The Broadcaster Trade Annual 1937

5/- net

The Broadcaster
RADIO & GRAMOPHONE
TRADE ANNUAL

1937

VIDOR H·T· BATTERIES

STANDARD RANGE

The range of batteries which set the standard for service, reliability and economical price.

LIST No.	VOLTS	RETAIL PRICE
13040	60	3/6
13067	100	5/9
13470	100 with G.B.	5/11
13080	120	6/6
13880	120 Square	6/6
13980	120 Sq. with G.B.	7/-
130103	150 with G.B.	8/3
13748	72 Dwarf	6/6
13006	9 Grid Bias	-/9
13011	16 Grid Bias	1/6

HEAVY-DUTY RANGE

The battery giving just that little extra power.

LIST No.	VOLTS	RETAIL PRICE
14040	60	3/9
14066	99	6/3
14067	100	6/3
14072	108	6/9
14080	120	7/6
14380	120 Square	7/6
14480	120 Sq. with G.B.	8/3
14006	9 Grid Bias	-/10
14011	16 Grid Bias	1/6

REPLACEMENT RANGE

There is a Vidor Replacement Battery for every popular make of battery receiver—state make and type when ordering.
Forty different types are available. A few of the more popular batteries are given below.

LIST No.	VOLTS	RETAIL PRICE
L5002	108	9/6
L5005	120	12/3
L5006	120 (with G.B.)	8/9
L5014	144 (with G.B.)	14/6
L5016	99	9/-
L5025	120	10/6

LIGHTING BATTERIES

There is a full range of Vidor lighting and bell batteries for every torch, hand-lamp and household purpose. Prices range from 2d. to 2/9.

Write for full details and liberal trade discounts.

VIDOR LIMITED, WEST STREET, ERITH, KENT.

The Broadcaster

RADIO AND GRAMOPHONE

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SIXTH EDITION

PRICE Post Free **5s.**

Published by
THE WIRELESS RETAILER & BROADCASTER
29, Bedford Street, London, W.C.2
Telephone: Temple Bar 2468. *Telegrams: Southernwood, Rand.*

CALENDAR for 1936

	JANUARY.	FEBRUARY.	MARCH.	APRIL.	MAY.	JUNE.
Sun.	. 5 12 19 26	. 2 9 16 23	1 8 15 22 29	. 5 12 19 26	. 3 10 17 24 31	. 7 14 21 28
Mon.	. 6 13 20 27	. 3 10 17 24	2 9 16 23 30	. 6 13 20 27	. 4 11 18 25 ..	1 8 15 22 29
Tues.	. 7 14 21 28	. 4 11 18 25	3 10 17 24 31	. 7 14 21 28	. 5 12 19 26 ..	2 9 16 23 30
Wed.	1 8 15 22 29	. 5 12 19 26	4 11 18 25 ..	1 8 15 22 29	. 6 13 20 27 ..	3 10 17 24 ..
Thurs	2 9 16 23 30	. 6 13 20 27	5 12 19 26 ..	2 9 16 23 30	. 7 14 21 28 ..	4 11 18 25 ..
Fri.	3 10 17 24 31	. 7 14 21 28	6 13 20 27 ..	3 10 17 24 ..	1 8 15 22 29 ..	5 12 19 26 ..
Sat.	4 11 18 25 ..	1 8 15 22 29	7 14 21 28 ..	4 11 18 25 ..	2 9 16 23 30 ..	6 13 20 27 ..

	JULY.	AUGUST.	SEPTEMBER.	OCTOBER.	NOVEMBER.	DECEMBER.
Sun.	. 5 12 19 26	. 2 9 16 23 30	. 6 13 20 27	. 4 11 18 25	1 8 15 22 29	. 6 13 20 27
Mon.	. 6 13 20 27	. 3 10 17 24 31	. 7 14 21 28	. 5 12 19 26	2 9 16 23 30	. 7 14 21 28
Tues.	. 7 14 21 28	. 4 11 18 25 ..	1 8 15 22 29	. 6 13 20 27	3 10 17 24 ..	1 8 15 22 29
Wed.	1 8 15 22 29	. 5 12 19 26 ..	2 9 16 23 30	. 7 14 21 28	4 11 18 25 ..	2 9 16 23 30
Thurs.	2 9 16 23 30	. 6 13 20 27 ..	3 10 17 24 ..	1 8 15 22 29	5 12 19 26 ..	3 10 17 24 31
Fri.	3 10 17 24 31	. 7 14 21 28 ..	4 11 18 25 ..	2 9 16 23 30	6 13 20 27 ..	4 11 18 25 ..
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Mon.	. 4 11 18 25 ..	1 8 15 22 ..	1 8 15 22 29	. 5 12 19 26	. 3 10 17 24 31	. 7 14 21 28
Tues.	. 5 12 19 26 ..	2 9 16 23 ..	2 9 16 23 30	. 6 13 20 27	. 4 11 18 25 ..	1 8 15 22 29
Wed.	. 6 13 20 27 ..	3 10 17 24 ..	3 10 17 24 31	. 7 14 21 28	. 5 12 19 26 ..	2 9 16 23 30
Thurs.	. 7 14 21 28 ..	4 11 18 25 ..	4 11 18 25 ..	1 8 15 22 29	. 6 13 20 27 ..	3 10 17 24 ..
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CONTENTS

For Detailed Subject Index, see page 154

THE B.B.C. YEAR REVIEWED

The first event of importance in 1936 was the opening in March of the new Lisnagarvey transmitting station. This replaced the old low-power transmitter at Belfast, which had been in service for nearly 12 years.

The new transmitter has made possible reliable reception of the Northern Ireland programmes throughout the whole of Northern Ireland, whereas this was previously limited to the area surrounding Belfast.

In October the new Burghead transmitter was put into service synchronised on the same wavelength as the Scottish Regional transmitter at Westerglen. A reliable service of the Scottish programme has thus been provided for listeners in the Highlands of the North of Scotland and also in the more densely populated districts round the shores of the Moray Firth. In this area listeners have previously had to depend upon reception from Droitwich, and upon indirect ray reception from distant medium-wave transmitters.

A low-power transmitter providing an excellent local service was put into operation at Beaumaris in Anglesey. This transmitter is synchronised on the same wavelength as the West Regional transmitter and radiates the same programme for the benefit of listeners in the Northern counties of Wales.

The B.B.C. has always had in mind the difficulties of listeners living in areas where reception is still comparatively weak. In addition to the areas named above, where reception conditions have already been greatly improved, another large area will benefit from the opening of a high-power transmitter at Stagshaw, near Hexham, construction of which is well advanced. This transmitter will replace the present low-power Newcastle transmitter, which provides only a local service, and will make possible satisfactory reception throughout the greater part of the four northern counties of England.

New studio premises were put into service at Bangor in North Wales, and building alterations were begun at the new Glasgow studio premises at Queen Margaret College. Plans are in preparation for the equipment of the studio centres at Aberdeen, Belfast and Swansea, where new premises have been purchased.

Continuing the development of the Empire Service, a third new transmitter has been ordered, and all three are in course of construction by their respective manufacturers. Construction of the new building at Daventry, for the transmitters, has been completed.

Eight additional masts are being erected to support a large number of new aerial arrays, and these, together with the new high-power transmitters, will mean a considerable increase in signal strength and improvement in quality of reception of the Empire programmes. It is anticipated that the new transmitters will be in service in time for the Coronation programmes.

A public service of high-definition television programmes was inaugurated at the beginning of November by the P.M.G., following a period of experimental transmissions which began on the opening day of Radiolympia. The television station, at Alexandra Palace, in North London, provides a service which covers the London area and extends into the home counties.

From the transmitters in Great Britain and Northern Ireland programmes are broadcast from 10.15 a.m. to midnight on Mondays to Saturdays, and (following a religious service from 9.30 to 10 a.m.) from 12.30 p.m. to 10.45 p.m. on Sundays.

The Empire station at Daventry transmits for approximately 17 hours a day, at times varying according to the period of the year.

B.B.C. ADDRESSES.

Below is given a list of addresses of the various B.B.C. offices:—

Headquarters.

Head Office and Principal London Studio Centre ...	Broadcasting House, London, W.1. Telegrams: Broadcasts, London. Phone: Welbeck 4468

Regional Centres.

Midland Region	282–5, Broad Street, Birmingham.
Welsh Region...	38–40, Park Place, Cardiff.
North Region ...	Broadcasting House, 33–7, Piccadilly, Manchester.
Scottish Region	5–6, Queen Street, Edinburgh.
N. Ireland Regn.	31, Linenhall Street, Belfast.
W. Eng. Region	21–25, Whiteladies Road, Bristol.

Other B.B.C. Offices.

Aberdeen ...	15, Belmont Street.
Glasgow ...	268, West George Street.
Leeds	Broadcasting House, Albrecht's Buildings, Woodhouse Lane, 2.
Newcastle ...	54, New Bridge Street.
Plymouth ...	Athenæum Chambers, Athenæum Arcade.
Swansea ...	Oxford Buildings, Oxford Street.
Bangor ...	Broadcasting House, Meirion Road.

THE RADIO MANUFACTURERS' ASSOCIATION

OFFICERS:

President:
The Rt. Hon. Lord Gainford, P.C.

Vice-Presidents:
W. W. Burnham, F.Inst.R.E., R. Milward Ellis, A.M.I.E.E., Capt. Sir Ian Fraser, C.B.E., M.P., The Right Hon. Lord Hirst, H.E. Marchese Marconi, G.C.V.O., C.M.G., Leslie McMichael, M.I.E.E., F.Inst.R.E., Lt.-Col. J. T. C. Moore-Brabazon, M.C., M.P., S. R. Mullard, M.B.E., M.I.E.E., Col. Sir Thomas Polson, K.B.E., C.M.G., E. E. Rosen, S. Wilding Cole, O.B.E., J. H. Williams.

Chairman:
M. M. Macqueen.

Vice-Chairman:
S. R. Mullard.

Hon. Treasurer:
J. Joseph, M.I.E.E.

Trustees:
W. W. Burnham, J. Joseph, Leslie McMichael.

Executive Council:
Belling Lee, Ltd., E. K. Cole, Ltd., A. C. Cossor, Ltd., Dubilier Condenser Co. (1925), Ltd., Edison Swan Electric Co., Ltd., Ferranti, Ltd., General Electric Co., Ltd., McMichael Radio, Ltd., Marconiphone Co., Ltd., Mullard Radio Valve Co., Ltd., Philips Lamps, Ltd., Pye Radio, Ltd., Ultra Electric Ltd., Westinghouse Brake & Signal Co., Ltd., Wingrove & Rogers, Ltd.

Director:
D. Grant Strachan.

Secretary:
R. P. Browne, B.Sc.

Exhibitions Organiser:
A. E. Moody.

Offices:
Astor House, Aldwych London, W.C.2 (Holborn 3346).

The membership of the Radio Manufacturers' Association at the end of October, 1936, was 100.

The policy of the Association in regard to exhibitions was changed during 1936, in that only one show, namely, Radiolympia, was organised, the Association discontinuing the promotion of the Scottish Radio Exhibition and withdrawing its support from the Manchester Radio Exhibition.

Radiolympia ran from August 26 to September 5, a period of 10 days, and the total paid attendance reached the figure of 202,517, compared with 192,202 in 1935.

The aim of the organisers being to impress upon the public the value of radio, both in entertainment and education, that it was not just a box of technical tricks to intrigue the amateur experimenter, the whole of the Exhibition publicity was designed to convince those who had not yet become listeners that they were missing something worth having.

A further point was to impress upon those who were using out-of-date sets that they were failing to derive the full measure of benefit and pleasure to be found in the broadcast service to-day.

To impress these facts upon the public visiting Radiolympia, a Souvenir brochure was prepared. One was given to each visitor, while a supply was also available for individual exhibitors to distribute from the stands.

This souvenir contained a brief outline of the history of radio from its early beginnings to its present influential position in the lives of the listening public.

It outlined the value of radio to-day as a force for the entertainment and education of the public; it sketched the possibilities of short wave listening; it looked into the future; and concluded by putting a series of questions designed to convince the reader of the desirability of purchasing a modern set.

Editorial publicity matter issued to the Press by the Association's Publicist was designed to convey the same message and further to emphasise another point hinted at in the brochure—the desirability of having more than one set in a home.

At Radiolympia a great deal of public attention was directed to the Television exhibit. Demonstrations of television reception were given twice daily from 12 to 1.30 p.m., and from 4.30 to 6 p.m., with very

little trouble apart from the control of the crowds which flocked to see them.

Radiolympia Theatre, 1936, was different from its predecessors in that the production and management were, this year, undertaken entirely by the Association and not by the B.B.C. as before.

The B.B.C. co-operated in the installation and operation of sound diffusion and broadcasting equipment, and also in the presentation of the Children's Hour from the theatre stage during the second week of the Show.

Special exhibits included a Radio Interference Bureau organised by the R.M.A. in co-operation with the G.P.O., B.B.C., and E.R.A.; and a Scotland Yard stand, illustrating the use of the Police Box.

The Association made an attempt this year to secure fuller co-operation and support from the retail side of the Industry, and arrangements were made to supply dealers with tickets at reduced rates, and to organise parties from the provinces at reduced rail fares.

The response of the retail trade was definitely disappointing. Little advantage was taken of the facilities offered, and it must surely follow that any future negotiations with the transport companies will be more difficult to conduct as a result of this year's experience.

The publication of the Ullswater Report was an outstanding event in the radio year. The proposals of the Report regarding the constitution. control and financing of the broadcasting service were in general approved by the R.M.A., and in line with the evidence given by the Association before the Government Committee.

The Association found itself opposed to the proposal that the G.P.O. take over relays and the suggestion that a low-priced standard set be produced.

Steps taken to counter these proposals included the submission of a memorandum to the P.M.G., the organisation of a press conference, an active campaign among

(*Continued at foot of opposite page.*)

RADIO EXHIBITIONS

PROMOTED BY THE R.M.A. OR ITS PREDECESSORS.

Year.	Promoter.	Venue.	Date.	No. of days.	No. of Exhibitors.	Stand area sq. ft.	Dem. Rm. area sq. ft.	Paid attendance.
1924	N.A.R.M.	Royal Albert Hall	Sept. 27 Oct. 8	10	56	11,700	—	46,000
1925	N.A.R.M. A.T.	Ditto	Sept. 12 Sept. 23	10	70	15,000	—	54,500
1926	N.A.R.M. A.T. & S.R.M.	Olympia New Hall	Sept. 4 Sept. 18	13	182	34,053	—	116,570
1927	R.M.A.	Ditto	Sept. 24 Oct. 1	7	184	34,642	—	99,315
1928	R.M.A.	Ditto	Sept. 22 Sept. 29	7	184	40,445	—	123,593
1929	R.M.A.	Ditto	Sept. 23 Oct. 3	10	185	42,177	7,006	140,627
1930	R.M.A.	Ditto and 1st floor, Empire Hall	Sept. 19 Sept. 27	8	186	54,464	8,769	161,128
1931	R.M.A.	Olympia, Nat. and Empire Halls	Sept. 18 Sept. 26	8	210	70,993	15,129	198,070
1932	R.M.A.	Olympia, Grand and Nat. Halls	Aug. 19 Aug. 27	8	241	74,154	19,368	180,750
1933	R.M.A,	Olympia, Grand and Nat. Halls	Aug. 15 Aug. 24	9	210	76,343	Offices, 7,803 Theatre, 14,000	209,463
1934	R.M.A.	Olympia, Grand and Nat. Halls	Aug. 16 Aug. 25	9	190	76,000	Offices, 8,320 Theatre, 20,000	238,285
1935	R.M.A.	Olympia, Grand and Nat. Halls	Aug. 14 Aug. 24	10	172	75,000	Offices, 9,744 Theatre, 26,000	192,202
1936	R.M.A.	Olympia, Grand and Nat. Halls	Aug. 26 Sept. 5	10	150	69,000	Offices, 12,050; Theatre, 37,600;	202,517

THE BRITISH RADIO VALVE MANUFACTURERS' ASSOCIATION

59, Russell Square, London, W.C.1.

Museum 1206 and 1207—Bradval, Westcent, London.

Members—

A. C. Cossor, Ltd.
Edison Swan Electric Co., Ltd.
Ever Ready Radio Valve Co., Ltd.
Ferranti, Ltd.
General Electric Co., Ltd.
Marconiphone Co., Ltd.
Mullard Wireless Service Co., Ltd.
Philips Lamps, Ltd.
Standard Telephones and Cables, Ltd.

Chairman : W. W. Burnham.

Secretary: D. P. Wheeldon.

Objects.—To promote, encourage, foster, develop and protect the interests of the public, the trade and the manufacturers of British-made thermionic valves and to impose such conditions on the conduct of the valve trade as in the opinion of the Association may be conducive to that object; to enter into agreements with and/or procure or promote agreements between members and wholesale and retail dealers in valves relating to the manufacture, supply and sale thereof, and particularly for the maintenance and protection of manufacturers' retail list prices and discounts and of the rules and by-laws of the Association for the time being in force.

General Regulations.—These cover the strict maintenance of established list prices; allowances; consignment stocks; contracts; invoices, etc. A "Stop List" is operated by the Association.

DEFINITIONS OF PURCHASERS AND TERMS.

Users.—Any private or trading individual, firm or company purchasing valves but not reselling them as bona-fide wireless dealers. The terms to users are list prices, nett with no cash discount. Wireless societies, staff associations and clubs are not entitled to any discounts.

Retailers—Any individual, firm or company having business premises, trading on their own account as dealers in wireless apparatus and/or valves who carry a reasonable stock appertaining to such industries, and who purchase such goods on their own order forms for resale to users.

Wholesale Distributors.—Certain individuals, firms or companies approved and specified by the Association, and whose business includes the distribution of valves and/or wireless apparatus to the trade and who carry and maintain on their own account for purposes of distribution a specified minimum stock of valves, who do not sell to the user, and who enter into specific obligations with the Association. The Association has a limited list of authorised Wholesale Distributors.

Set Makers.—Manufacturers of receiving sets, approved and specified by the Association.

Limited Licence.—All valves made by the Members are sold subject to a limited licence under the patents owned by the respective manufacturers.

(*Continued from opposite page.*)

M.P.s, and co-operation with the R.W.F., the W.R.A., and the Relay Service Association.

This action met with success in that the two proposals were rejected by the Government.

A specification for testing and expressing the performance of a set has been prepared by the Association and issued to members.

In an endeavour to counter the growing importations of radio equipment into this country, the Association has been engaged in the preparation of an application to the Import Duties Advisory Committee for an increased tariff on imported apparatus. Late in 1936 the application was almost complete but had not been lodged before the Committee.

The scheme for training radio engineers prepared by the Association during 1935 has been increasingly operated by technical institutions throughout the country during the past year. A number of students who have secured the National Certificate have been placed by the Association in manufacturers' works for a period of works training.

Further the Association has in preparation a Service Manual for service engineers.

RADIO WHOLESALE TRADING AGREEMENT

The Fair Trading Agreement, as the Radio Wholesale Trading Agreement was originally called, was first arranged in 1931.

The Agreement is between a group of receiver and radio-gramophone manufacturers and a second group of wholesalers. There are six "Original Subscribers," which was the name given to the manufacturers who launched the original scheme.

The Original Subscribers include :—

A. C. Cossor, Ltd.
Ever Ready Radio, Ltd.
Ferranti, Ltd.
General Electric Co., Ltd.
Philips Lamps, Ltd.
Ultra Electric, Ltd.

The Manufacturer Subscribers include :—

Aerodyne Radio, Ltd.
A. J. Balcombe, Ltd.
Beethoven Radio, Ltd.
Burndept, Ltd.
Climax Radio Electric, Ltd.
City Accumulator Co., Ltd.
Decca Gramophone Co., Ltd.
Invicta Radio, Ltd.
Lissen, Ltd.
Ormond Engineering Co., Ltd.
Radio Gramophone Development Co., Ltd.
Vidor, Ltd.

Approximately 163 wholesalers are subscribers to the Agreement.

The main object of the Agreement is to bind the Manufacturer Subscribers to supply their receivers, radiograms and kits only to wholesalers who are on the Second Schedule of the Agreement.

These wholesalers, in turn, agree that they will handle only the goods of the manufacturer subscribers as far as receivers, radiograms and kits are concerned, and will not deal in goods of this kind made by any firm of manufacturers not subscribing to the Agreement.

Wholesale subscribers are only allowed to supply dealers who conform to a definition worked out by the Original Subscribers to the Agreement in co-operation with the R.W.F. and the W.R.A. These dealers themselves agree not to resell at other than list prices.

The definition of a dealer now employed in the Agreement is :—

"A radio retailer shall mean any individual, firm or company having shop or showroom premises rated as business premises open to the public during ordinary local business hours of shopping, trading on his, their, or its own account as a dealer, or dealers, in wireless apparatus, who continuously maintains a reasonable stock of such apparatus and purchases the same for re-sale and resells the same to users at manufacturers' fixed retail prices, and who is prepared reasonably to service such apparatus.

"*Note :* (1) A bona-fide and whole-time electrical retailer or electrical contractor may be recognised as a radio retailer. (2) An individual who is mainly employed by other persons cannot be recognised as a radio retailer." (3) Wholesalers in other trades than radio cannot be accepted as radio retailers.

In connection with this definition, the Original Subscribers have instituted a Stop List which is now in operation.

The Agreement's year ends on July 31, and the annual subscription is payable in advance. This is 25, 10, and 5 guineas for Original, Manufacturer, and Wholesaler subscribers respectively.

Correspondence in connection with the R.W.T.A. should be sent to Blundell, Baker & Co., 16, Serjeant's Inn, London, E.C.4.

SET MAKERS' ASSOCIATION

The Set Makers' Association deals with a number of trade problems. During the past year it was instrumental in issuing a series of H.P. schedules for receivers and radiograms for dealer-financed transactions.

Correspondence for the S.M.A. should be addressed to Blundell, Baker and Co., at 16, Sergeants Inn, Fleet Street, London, E.C.4. The telephone number is Central 1778.

Radio and Gramophone Trades Guardian Association

Secretary and Accountant : Charles Latham, F.L.A.A., F.I.S.A., J.P.

Offices : 185–188, High Holborn, London, W.C.1. (Holborn 7858.)

The Radio and Gramophone Trades Guardian Association was incorporated in 1925 as a non-profit making concern. It provides members with commercial and financial information, collects accounts and deals with matters of liquidation. The annual subscription is 2 gns.

RADIO COMPONENT MANUFACTURERS' FEDERATION

President : Sir Percy Greenaway, Bt.
Vice-Presidents : Col. G. D. Ozanne, M.C., M.I.E.E. ; Major L. H. Peter, M.C., M.I.E.E., Mr. A. F. Bulgin, M.I.R.E. and Mr. E. M. Lee, B.Sc.
Chairman : Mr. F. H. McCrea.
Vice-Chairman : Mr. Guy R. Fountain.
Treasurer : Mr. A. Middleton.
Executive Council : Advance Components ; Bulgin & Co., Ltd. ; Belling & Lee, Ltd. ; Dubilier Condenser Co. (1925), Ltd. ; Ferranti, Ltd. ; Quadrant Carbon ; Reliance Manufacturing ; Reproducers and Amplifiers, Ltd. ; Standard Telephones and Cables, Ltd. ; Tannoy Products, Ltd. ; Westinghouse Brake & Signal Co., Ltd. ; and Wingrove & Rogers, Ltd.,
Secretary : Mr. C. Gordon Bonser, 83, Cannon Street, London, E.C.4 (City 7163).

The Radio Component Manufacturers' Federation was formed in 1932 to foster and protect the radio component and accessory industry, and to apply such conditions to the trade as in the opinion of the federation might be conducive to that object.

Its aims are :

To endeavour to maintain a high standard of quality, design and workmanship, to give advice on and otherwise deal with manufacturing problems, to promote standardisation of radio components and accessories.

To co-operate with other organisations in promoting or advancing movements for the betterment of the conditions of the whole radio components industry, and to join with them in negotiations with outside bodies.

Membership of the Federation is limited to individuals and firms approved by the Council, seventy-five per cent. of whose radio sales comprise components or accessories appearing on the federation schedule, which is revised by the council from time to time, and to such other component or accessory makers whose products are made in the British Isles and sold either singly or in kit form, as the council may approve.

The Federation entrance fee is three and the annual subscription seven guineas.

Standardisation groups have been formed dealing with potentiometers and variable resistances ; fixed resistances (not wire wound) ; fixed resistances (wire wound) ; tuning coils ; valveholders ; variable condensers ; loudspeakers ; transformers and chokes ; fixed condensers ; plugs, sockets and jacks ; pick-ups ; fuses and fuseholders ; switches ; screwed terminals ; interference suppressors ; rectifiers other than valves and meters in connection with radio receivers.

A Standardisation Report has been published and in loose-leaf form at 5s. Purchasers will be advised when further sheets are available.

Meetings are held frequently and valuable information circulated to members. Liaison committees have been formed to work in conjunction with the technical journals and the B.R.V.M.A.

By the invitation of the British Standards Institution the Federation has representatives serving on several of the Institution's committees dealing with radio components, and has also represented the component Industry in various discussions which have taken place with the defence services and the Postmaster General.

BRITISH RADIO CABINET MANUFACTURERS' ASSOCIATION

President : W. J. Salaman. *Chairman :* H. Holmes. *Vice-Chairman :* T. Stanton.

Hon. Secretary : E. Ellis, First Avenue House, High Holborn, London, W.C.1. (Larkswood 1086).

Members : The Aerograph Co., Ltd. ; Louis Bamberger & Sons ; Carrington Manufacturing Co., Ltd. ; R. Cruickshank (Cellulose), Ltd. ; Edward Doherty & Sons ; John J. Dunster & Sons, Ltd. ; Durex Abrasives, Ltd. ; Eburite Corrugated Containers, Ltd. ; Elwilply Veneers, Ltd. ; A. Ercolani & Sons, Ltd. ; S. Greeman, Ltd. ; Holmes Bros. (London), Ltd. ; Houghton Butcher Manufacturing Co., Ltd. ; J. B. Manufacturing Co. (Cabinets), Ltd. ; W. & T. Lock, Ltd. ; John Lovegrove & Co. ; Nobel Chemical Finishes, Ltd. ; Radio Silks, Ltd. ; E. Sherry, Ltd. ; T. Stanton ; Union Glue and Gelatine Co., Ltd. ; Frederick Waterhouse, Ltd. ; Watkins Sporne & Co. ; and John Wright & Sons (Veneers), Ltd.

The Association was founded in July 1932.

Its primary object is to promote mutual understanding and good will between those connected in the making of radio cabinets, thereby improving the standard of design and service to the radio manufacturers and to the whole of the Industry.

Every cabinet manufactured by a member of the B.R.C.M.A. is stamped with the Association symbol.

RELAY SERVICES ASSOCIATION

The Relay Services Association of Great Britain was incorporated on April 13, 1934, as a company limited by guarantee and operating under licence from the Board of Trade.

The Association is controlled by a Council of 20 members, with J. W. C. Robinson, Gwalia Radio Relay Services, Ltd., as its Chairman: H. Noble Selective Radio Relay Co., Ltd., Bradford), Deputy Chairman ; and E. A. Wyatt, 10, Queen's Road, Portsmouth, Hon. Treasurer.

The Council includes Messrs. D. G. Ball ; R. Blood ; H. Boocock ; H. J. Boon ; W. A. Brown ; W. Darwen ; A. J. Davies ; R. R. Goding ; Major H. MacCullum, B.Sc. (London) ; Messrs. J. Muscutt, P. L. Scarr, A. D. Thomas, A.S.A.A., A.C.I.S., C. W. Watson, J. D. Williams, J. G. Young, L. J. Donovan, M. R. Gill, J. C. Charles, J. W. Field and J. Lyn Davies.

The aims are to promote the consideration of questions affecting the Relay Service Industry, to give the Legislative Public Bodies facilities of conferring with persons engaged in the Industry, and to confer and co-operate with any Government Department, the British Broadcasting Corporation, County and Municipal Councils, etc.

Secretary : J. Russell Pickering, M.B.E., F.I.S.A., F.L.A.A. Registered Office : 23, Bedford Row, London, W.C.1. (Chancery 7516.)

SYNCHRONOUS CLOCK CONFERENCE

Negotiations between manufacturers of synchronous electric clocks for the purpose of forming an organisation to foster the interests of this new industry resulted in the formation of the Synchronous Clock Conference, at the end of 1932.

The Conference is composed of representatives of Synclocks, Ltd. (Everett, Edgcumbe and Co., Ltd.), Ferranti, Ltd., the General Electric Co., Ltd., Smith's English Clocks, Ltd., Synchronome Co., Ltd., and T. M. C. (Harwell) Sales, Ltd.

The objects of the Conference are to popularise the use of synchronous electric clocks, and to promote fair trading.

Synchronous electric clocks manufactured by members of the Conference are manufactured in this country to British standards of quality and to conform with the requirements of the British Standards Institution.

The Conference meets at 36 and 38, Kingsway, London, W.C. 2.

RADIO SERVICE ASSOCIATION

The Radio Service Association has as its objects " to co-operate with all firms genuinely engaged in the servicing of radio receivers and associated industries, primarily for the trade, and who do not carry on a separate retail business ; also to work for the benefit of all members of the Association."

It is governed by a committee of three members who resign annually.

The entrance fee is £1 1s. per member, and the annual subscription is £1 1s. per annum.

Election to membership is by the unanimous vote of the Committee, and any firm or person wishing to become a member must apply in writing to the secretary and must be proposed by one member of the association. The committee has full powers to adopt or reject the proposal for membership, and to ascertain the status of any prospective member by examination of his premises.

Chairman : H. Ford, 22, Howland Street, London, W.1.

Secretary : A. L. Michael, Aldwych House, Aldwych, London, W.C.2 (Holborn 9111).

Battery Association

The Association of Radio Battery Manufacturers was founded in May, 1935, with the object of encouraging and developing the sale of radio dry batteries, and of improving marketing conditions in the interests of the public, the trade, and the manufacturers.

The Director and Secretary is Mr. Herbert S. Mallalieu, 11, Tavistock Square, London, W.C.1. (Euston 1629.)

ULSTER WHOLESALERS' ASSOCIATION

The Ulster Radio Wholesalers' Association exists to further the interests of the wholesalers in Northern Ireland in relation to the retailers and manufacturers.

The *chairman* is Mr. V. Leonard, and the *hon. secretary* is Mr. Ralph S. Neilson, 53, Chichester Street, Belfast (Phone : 27196).

RADIO WHOLESALERS' FEDERATION

Bloomsbury Mansions, 26, Hart Street, London, W.C.1.
Telephone: Holborn 2488. Telegrams: Radmofac, Westcent, London.

The Officers and Council of the Federation for 1936–37 are as follows :—

President : C. H. G. Hobday (Hobday Brothers, Ltd.).
Vice-President : E. H. Burris (Fred. Burris & Sons, Ltd.).
Hon. Treasurer : A. J. Dew (A. J. Dew & Co., Ltd.).
Secretary : J. Macfarlane.

Council :

A. G. Beaver	...	Sun Electrical Co., Ltd.
E. S. Brown	...	Brown Brothers, Ltd.
A. A. Byne	...	L.E.S. Distributors, Ltd.
W. E. Collins	...	The Albion Electric Stores.
J. C. N. Eastick	...	J. J. Eastick & Sons.
E. M. Hillman	...	Hillman Bros., Ltd.
E. W. Houghton	...	Ensign, Ltd.
G. A. Litchfield	...	Nottingham Radio Supplies, Ltd.
J. W. Riddiough	...	Frank Riddiough & Son.
J. Robertson	...	James Robertson.
E. Smith ...	...	Midland Auto Components.
R. G. Willis	...	Dulcetto - Polyphon, Ltd.

Section Officials :

North Midland Section—
Chairman : G. P. Fearnside (Ellis & Mort, Ltd.).
Vice-Chairman : J. K. Green (Sun Electrical Co., Ltd.).
Hon. Secretary : G. P. Fearnside (Ellis & Mort), Ltd.
Hon. Treasurer : D. M. Fraser (Sun Electrical Co.).

Midlands Section—
Chairman : G. A. Litchfield (Nottingham Radio Supplies, Ltd.).
Vice-Chairman : W. Balmford (Walter Balmford, Ltd.).
Hon. Secretary : H. S. Poole (Gothic Electrical Supplies, Ltd.).

Scottish Section—
Chairman : R. Marriott (Dulcetto-Polyphon, Ltd.).
Vice-Chairman : E. C. H. Smith (Sloan Electrical Co., Ltd.).
Hon. Secretary : J. Robertson (James Robertson).

South Western Section—
Chairman : E. H. Burris (Fred. Burris & Sons, Ltd.).
Vice-Chairman : F. D. Newcombe (F. D. Newcombe & Co., Ltd.).
Hon. Secretary : F. A. R. Griffiths (Wire-Electric Wholesale, Ltd.).
Hon. Treasurer : A. J. Nicoll (Drake & Gorham (Wholesale), Ltd.

London and South Eastern Section—
Chairman : J. Diamond (Thompson, Diamond & Butcher).
Vice-Chairman : J. C. N. Eastick (J. J. Eastick & Sons).
Hon. Secretary : E. R. Harveyson (E. R. Harveyson & Co.).

Founded in 1928, the Radio Wholesalers' Federation was instituted to establish and preserve in the Radio Industry the best traditions of Wholesale trading. Primarily its objects are to secure that those engaged in this department of the business shall be "Wholesale only" and so not in conflict with the interests of their customers the Radio Retailers; the recognition by Manufacturers as Wholesalers only of those firms or companies equipped to provide that service to Radio Retailers, which is the *raison d'être* of their usefulness; and the prevention of breaches in Manufacturers' Terms and Conditions of Sale as applied to the Wholesale trade.

Operations.

The operations of the Federation are necessarily of a private character, but it may be said that in the eight years of its existence its work has resulted in the mitigation of many trade abuses, the engendering of a sound spirit of trust and good will among wholesalers themselves and many instances of assistance to manufacturers in the formulation of their policies and in the operation of these.

Questions such as members of the public dabbling in Retail selling have been substantially met by an intercommunication amongst members of the names of such endeavouring improperly to obtain trade terms on radio goods.

The Federation has steadily maintained cordial relations with other trade organisations.

The method of the Federation is to proceed by conference, and many valuable meetings of this character have been held which have produced both a practical outcome and an increased atmosphere of understanding on various aspects of the Trade.

Among the publications of the Federation is a List of Members alphabetically arranged under towns, which has proved of much value to manufacturers in arranging their schemes of wholesale distribution.

The members, with their branches, constitute a chain of wholesale establishments throughout the country numbering some 300.

WIRELESS RETAILERS' ASSOCIATION
OF GREAT BRITAIN AND NORTHERN IRELAND

Vice-Presidents : A. E. Betambeau (London), G. Williams (Darlington), C. W. Willmott (Norwich), and P. L. Harrison (Lincoln).

Chairman : W. Upton (Middlesbrough).

Vice-Chairman : L. Wilde (London).

Hon. Treasurer : J. W. Lightfoot (London).

General Secretary : M. E. Cavendish, 10, Ashley Place, Westminster, London, S.W.1. (Victoria 4504.)

Aims, Objects and Policy.

The Association was formed in 1923 at the special request of many retailers who felt that a live organisation was a necessity to their interests and the future good of the industry.

Since that date rapid strides have been made with the work of organisation throughout the country, and the membership of well over 2,000 is increasing daily.

The chief aim of the Association is to secure "Clean Trading" in industry, and towards this end a strong, sound and comprehensive policy is being pursued.

The subscription is two guineas per annum.

The Association has now 58 branches, and others are in the process of formation.

The Areas.

The following are the Associations' Areas. The first name given in each case is that of the Area delegate to the National Council. The second name is the name of the Area secretary, whose address is also given.

EAST ANGLIAN.—J. T. Harvey (Cambridge). C. C. Fisher, 27, St. Andrew's Street, Norwich.

EAST MIDLANDS.—L. Hall. L. Hall, 99, Derby Road, Nottingham.

LONDON & HOME COUNTIES.—L. Wilde (London). L. Wilde, 291, High Road, Ilford.

NORTH EASTERN.—W. Upton (Middlesbrough). W. Upton, 175, Linthorpe Road, Middlesbrough.

NORTH WESTERN.—H. Nightingale (Manchester). N. N. Lucas, 25, Northern Assurance Buildings, Albert Square, Manchester, 2.

SOUTHERN.—J. Fielding (Brighton). A. J. S. Russell, 138, London Road, Brighton.

SOUTH WESTERN.—A. Garraway (Taunton). F. J. Serle, 10, East Reach, Taunton.

WEST MIDLANDS.—H. F. Truman (Walsall). F. B. Jackman, 71, Birchfield Road, Birmingham, 19.

The names of the various Branches included in each Area are as follows :—

EAST ANGLIAN AREA.—Cambridge, Colchester, Norwich, Ipswich, Southend-on-Sea.

EAST MIDLANDS AREA.—Lincoln, Nottingham, Retford, Chesterfield, Grimsby, Sheffield, Peterborough, Derby.

LONDON AND HOME COUNTIES.—Beckenham, Croydon, South London, East London, North London, Harrow, Watford.

NORTH EASTERN AREA.—Darlington, Middlesbrough, Newcastle-on-Tyne, Scarborough, Sunderland, West Hartlepool, Carlisle.

NORTH WESTERN AREA.—Accrington, Blackpool, Bolton, Chester, Liverpool, Manchester, Preston, Rochdale, Southport, Wallasey, Wigan, Wrexham, Oldham, Bury, Blackburn.

SOUTHERN AREA.—Brighton, Canterbury, Tunbridge Wells.

SOUTH WESTERN AREA.—Bath, Bristol, Exeter, Exmouth, Plymouth, Taunton, Torbay.

WEST MIDLANDS AREA. — Birmingham, Mid. Northants, Walsall, Wolverhampton, Stoke-on-Trent, Burton-on-Trent.

ULSTER RADIO TRADERS' ASSOCIATION

The Ulster Radio Traders' Association, Ltd., membership comprises manufacturers, manufacturers' agents, wholesalers and retailers carrying on business in Northern Ireland.

The Registered Office of the Association is 53, Chichester Street, Belfast (Belfast 27196). The Secretary is Mr. Ralph S. Neilson and the Chairman Mr. W. Law.

The Council of the Association meets during the first week of every January, February, April, May, July, August, October and November, and at such other times as it considers necessary.

General meetings of the Association are held during the first week of every March, June, September and December. Special meetings of the Association are held whenever necessary.

The Association Council organise an annual exhibition. This exhibition is confined to manufacturers and members of the Association. Various social and educational activities are also undertaken.

SCOTTISH RADIO RETAILERS' ASSOCIATION

President : Mr. J. C. Cameron.

Past Presidents : Mr. James Plucknett, A.M.I.E.E. (1927-1931), Mr. Alexander Steuart (1931-1932). Mr. Robert Morrison (1932-1933). Mr. R. B. Donaldson (1933-1935). Mr. F. R. Forbes (1935–1936).

Vice-President : Mr. J. McMorland.

Secretary : Mr. W. Hood Stewart, C.A., 156, St. Vincent Street, Glasgow, C.2. (Central 6215.)

The objects of the Scottish Radio Retailers' Association are to promote and protect the interest of radio retailers in Scotland.

Membership is confined to persons or firms engaged in retailing radio from business premises in Scotland and maintaining a representative stock of radio. Associate membership is open to employees of persons or firms eligible for membership. Associate members may attend meetings but may not vote. They may be co-opted as members of the Council.

The annual subscription is one guinea, but members carrying on business at more than one address in Scotland pay according to a graduated scale. Associate members pay a subscription of 5s.

The sole control of the Association is vested in a Council consisting of not less than ten members. This includes one representative from each Branch, not more than six members elected at the Annual General Meeting, and the Council has the right to co-opt not more than six additional persons who may or may not be members of the Association. The Council meets monthly.

The branches are : Ayrshire, Edinburgh, Glasgow, Greenock and Motherwell.

National Association of Radio Retailers

President : R. H. M. Drake (Drake & Gorham, Ltd., London).

Vice-President : H. E. Walker (Walker Bros., Birmingham).

Director and Secretary : L. C. Penwill, Comp. I.E.E.

Assistant Secretary : H. A. Bain.

Offices : Africa House, Kingsway, London, W.C.2 (Holborn 7584).

The National Association of Radio Retailers, Ltd., was formed in 1936 to protect and further the interests of retailers and the well-being of the Industry generally.

Its parent body is N.E.C.T.A., Ltd., and the new organisation has been formed to give radio retailers a service equivalent to that which N.E.C.T.A. affords its own members.

In all its negotiations the N.A.R.R. will have the full support of N.E.C.T.A. behind it.

The N.A.R.R. annual subscription is 2 guineas, and there is an entrance fee of 3 guineas.

The Association is registered as a company limited by guarantee and having a share capital.

The council is for the time being a provisional one, with full powers of co-option, and it is intended, while limiting it in numbers, to make the council fully representative.

Organisation by branches and sections is included in the scheme of development, and all members will thus have a full voice in the conduct of the Association and close contact with its policy.

Under its Memorandum and Articles of Association, N.A.R.R., Ltd., has full powers to take any steps thought desirable to promote the well-being of its members, and in this connection several schemes of development are under consideration.

Applications for membership are carefully examined and only those with specific qualifications and a definite stake in the Industry are admitted to membership.

Fair trading and steady progressive development are the watchwords of N.A.R.R., Ltd.

Wales and Mon. Radio Retailers' Association

Chairman : A. E. Price.

Vice-Chairman : F. J. Paull.

Treasurer : H. Thane.

Secretary : A. J. Green, 137, Allensbank Road, Cardiff.

This Association was formed in 1935 as an independent organisation to represent Wales and Monmouthshire retailers. The subscription is £1 1s. a year, and the entrance fee 5s.

Branches are to be formed throughout Wales, and these are to elect one representative each to form county or area councils.

In addition, there is to be a Welsh National Council, composed of one representative each from the county or area councils.

The first branch was formed at Newport.

INDEPENDENT LOCAL ASSOCIATIONS

BURNLEY

The Burnley Gramophone and Wireless Retailers' Association was formed in November, 1933, after the local W.R.A. had become defunct. Its objects are the protection and development of trade interests.

Membership stands at 15. The officers are as follows :

President, Mr. J. E. Reynard ; *Hon. treasurer*, Mr. J. S. Ainscow ; *Hon. secretary*, Mr. William Bury, 119, Westgate, Burnley.

The Association meets at the Café Royal, Manchester Road, Burnley.

COVENTRY

The Coventry Musical and Radio Retailers' Association was formed in March, 1930. Its objects are to safeguard the interests of its members in the City of Coventry and towns within 10 miles.

The Association is always open to co-operate with other kindred organisations.

Meetings are held monthly, the committee on the second Monday, and the general meeting on the last Monday.

Other activities include an annual dinner in March, technical lectures and other social functions during the winter.

The officers are : *President*, A. Melville Sidley ; *Vice-President*, Mrs. I. Mackereth ; *Hon. Secretary*, Mr. G. H. Parsons, 201, Broad Lane, Coventry (office, 7, Warwick Row) : *Hon. Treasurer*, Mr. H. J. Cleaver ; *Committee*, Mrs. E. Clarke, Messrs. W. J. Fennell, H. Crane, H. Payne, J. C. Todman, F. A. Saxelby, W. Johnson, and R. H. Smith.

GRIMSBY

Grimsby and District Radio Dealers' Association has as its *Hon. Secretary*, Mr. H. Poole, of Gough and Davy, Ltd., 47, Victoria Street, Grimsby. (Grimsby 2913.)

The Chairman is Mr. F. W. Wood.

HANTS,, SOUTHERN

Hampshire Southern Wireless Dealers' Association was formed at a meeting of a few W.R.A. members held in March, 1934.

The officers of the Association are : *Chairman*, Mr. L. C. Latch ; *Vice-Chairman*, Mr. Clifford Lister ; *Hon. Treasurer*, Mr. H. French ; and *Secretary*: Mr. Martin Frankish, 45, Bridge Street, Andover.

The area covered by the Association includes Salisbury, Andover, Amesbury, Portsmouth, Bournemouth, Isle of Wight, Totton, Lyndhurst, Lymington, Bishop's Waltham, and Winchester. The membership are not against National affiliation or National unity.

LEICESTERSHIRE

The Leicestershire Radio Traders' Association was formed in March, 1925, and since that date has been represented in its membership by the principal radio retailers in Leicestershire.

The officers of the Association are elected annually and consist at present of the following : *Chairman :* Mr. S. May ; *Vice-chairman :* Mr. J. E. Creasey ; *Hon. Treasurer :* Mr. E. Griffin ; *Hon. Secretary :* Mr. F. J. Smith ; *Secretary :* Mr. O. Holmes, 14–16, Corridor Chambers, Market Place, Leicester.

The office and general meeting place of the Association is at Corridor Chambers, Market Place, Leicester.

The Association was originally formed for the purpose of combating the price-cutting firms in the City of Leicester, and has the honour of being the first local radio retailers' association in England. It has been successful in its efforts to prevent price-cutting.

About 11 meetings annually are usually held.

Membership comprises 35 firms. The entrance fee is 10s. 6d. and the annual subscription also 10s. 6d.

WEST HERTS

West Herts Radio Retailers' Association meets at the Carlton Tea Rooms, Queen's Road, Watford. Membership is open to radio dealers in Watford, Bushey, Rickmansworth, Radlett and Edgware.

The *Chairman* is Mr. H. D. White, the *Hon. Treasurer*, E. E. Sirett, and the *Hon. Secretary*, Mr. G. Alan Gray, of 57, Queen's Road, Watford.

NORTH LONDON

The Radio Traders' Association of North London is an organisation to assist radio dealers in that area commercially.

The *Chairman* is Mr. C. M. Goodchild, the *Vice-Chairman*, Mr. T. W. Smith, and the *Hon. Secretary*, Mr. T. H. S. Chick, of 553, Holloway Road, London, N. 19. (Archway 3283.)

Meetings are held quarterly at 553, Holloway Road, London, N.19.

REIGATE

The Borough of Reigate Radio Association is an organisation to further and protect the interests of local dealers.

Chairman : Mr. S. H. Rundle, of the Reigate Electrical Co.

Hon. Secretary and Treasurer : Mr. H. Jeal (Tamplin & Makovski, Ltd.), 57, Bell Street, Reigate (Reigate 2281).

Institute of Public Address Engineers

Chairman : D. B. H. Robinson (Ross and Robinson, Ltd., Acton, London, W.3.).

Vice-chairman : H. J. Fowlie (Maidenhead Radio).

Committee : W. F. Clemmey (Radiorite (Liverpool), Ltd.); E. G. Page (Edgar G. Page, St. Leonards-on-Sea); H. J. Fowlie; F. C. Capps (Sanson and Capps, Twickenham); A. McKay (Radiovox, Leeds); A. T. Moyle (A. J. Moyle, Uckfield); C. J. Bayley (Bayley's, Uxbridge).

Trustees : H. J. Fowlie, A. T. Moyle and F. C. Capps.

Hon. Auditors : F. W. Shearman (London) and Guy Warbrick (Liverpool).

Treasurer : F. C. Capps.

Secretary : L. B. Candfield, 266, Kingston Road, Teddington (Shepherd's Bush 3274).

Registered office : 83, Cannon Street, London, E.C.4 (City 7361).

The Institute was formed on October 12, 1936, to put the operating side of the P. A. industry on a firm footing, and to bring together all responsible people executing P. A. work.

Its objects include an endeavour to raise the prestige of members and to develop economic prices for all classes of P. A. work.

A special sub-committee has been appointed to consider present charges and to draw up a schedule of minimum prices.

Testing P. A. apparatus and the furnishing of reports to members is a further object.

The council meets monthly, as arranged, and the meeting place is not confined to any one town in the country.

National Radio Engineers' Association

The National Radio Engineers' Association has as its objects :—

(1) To promote the science and practice of radio engineering and to improve the knowledge and status of radio engineers.

(2) To provide educational facilities for all those engaged in the profession of radio engineering and in particular to provide examinations and certificates of qualification to act as radio engineers to those passing the said examinations.

(3) To enable radio engineers to meet and correspond and to facilitate the interchange of ideas respecting improvements in the various branches of radio engineering and the publication and communication of information on such subjects.

(4) To assist its members in finding suitable employment and employers in finding suitable radio engineers.

The Association will not support with its funds any object which, if an object of the Association, would make it a trade union.

It aims at the technical, industrial and social betterment of all radio engineers; and, in co-operation with other sections of the Trade, aspires to assist in the production of an efficient machine for the cleansing of the Industry.

The officers are as follows :—

Chairman : Mr. N. J. Gibson.

Hon. Secretary : Mr. H. W. King, 34, Bush Elm Road, Romford, Essex.

Asst. Secretary : Mr. F. Newton, 67, Minster Way, Hornchurch, Essex.

W. Area Secretary : Mr. G. E. Palmer, 3, Two Mile Hill, Kingswood, Bristol, 5.

Plymouth Area Chairman : Mr. W. L. Cornish, "East Moor View," Plympton, S. Devon.

Council : N. J. Gibson, H. W. King, H. Morgan, G. E. Palmer, W. L. Cornish, A. R. Twiss, M. Levitt, O. Swabey, F. W. Paine, F. A. Newton, T. F. Nicholson and J. Leech.

The various duties devolving upon the central organisation have been delegated to the following officers :—

Examination Officers : A. R. Twiss, F.T.S., A.M.I.R.E., A.I.W.T.; M. Levitt; and T. F. Nicholson, 33, Woodfield Crescent, London, W.5.

Lecture Officers : Howard Morgan, 172, Garratt Lane, London, S.W.18; and O. Swaby, 144, Edenbridge Road, Enfield.

Publicity : E. W. Paine, 106, Harwood Avenue, Ardleigh Green, Gidea Park, Essex.

Council Officer : John Leech, Kirkdale Road, Leytonstone, London, E.11.

Accounts.—W. Merrington, 20, Hanbury Road, London, N.17; and Mr. Levitt, 20, Queensdown Road, E.5.

Branch Liaison.—A. R. Twiss, 16, Lyndhurst Avenue, N.12, and T. F. Nicholson.

General Administration.—N. J. Gibson, "Landfall," Beach Avenue, Upminster, Essex.

General Correspondence will be handled by the central office at Royal London House, Finsbury Square, London, E.C.2.

Fees : Entrance fee, 5s.; annual subscription, 15s.; examination fees vary according to the number of entrants.

Music Trades Benevolent Society

President : Mr. Louis Sterling (1925).

Hon. Treasurer : Mr. F. B. Allen (1925).

Vice-Presidents : Messrs. F. B. Allen (1925), Louis Bamberger (1902), H. Billinghurst (1902), C. Wharton Collard, O.B.E. (1925), J. A. Murdoch (1902), R. W. Pentland (1902), and Wm. Rushworth (1920).

Board of Management : Messrs. F. O. W. Bamberger (1931), P. M. Booth (1931), H. J. Brinsmead (1903), Charles Brookes, (1936), H. Bryan (1936), D. Warnford Davis, W. Gaite (1936), Douglas Grover (1936), Arthur Harrison (1929), James Hillier (1902), L. C. W. Jenkins (1929), E. Machell (1936), Sir W. J. Mallinson, Bt., J.P., D.L. (1927), H. A. Mourant, F.C.A. (1925), W. Savile (1921), F. W. Shenstone (1928), Lionel Shenstone (1913), Herbert Sinclair (1930), H. V. Strong (1929), Robert Willis (1932), and E. A. Woods (1934).

Representatives of the Factory Employees : Messrs. C. W. Hanks (1918), W. Harrison (1930), and T. Webb (1928).

Relief Committee : Messrs. F. O. W. Bamberger, Louis Bamberger, James Hillier, F. W. Shenstone, Herbert Sinclair, and the three representatives of the factory employees.

Hon. Auditor : Mr. L. C. Webber, A.C.A.
Secretary : Mr. H. A. Bain, J.P., 64, Gresham Street, Bank, London, E.C.2. (Metropolitan 8888).

Management of the affairs of the Society is vested in the Board of Management and the annual meeting is held in March.

The object of the M.T.B.S. is to grant relief, either by way of annuity or otherwise and either directly or indirectly to deserving and necessitous members of the Music Trades in the United Kingdom or Irish Free State (not being members of the Society), and to widows and children of such members.

The Board may also from time to time make grants of money to relieve cases of temporary or urgent necessity.

Subject to certain provisions, all annuitants are elected by the votes of the members of the Society whose names appear in the register of Members, one month before the date of the election. All elections of annuitants take place on dates determined by the Board.

Funds are secured from the annual subscriptions of members, from special collections and donations, from collections made among employees in factories, and from collecting boxes retailers place on their counters.

There is no limit to the amount members can subscribe and subscribers and donors are entitled to a given number of votes according to the amount subscribed or donated.

A. G. M. I. M.

The Association of Gramophone, Radio and Musical Instrument Manufacturers and Wholesale Dealers was founded in 1918 to promote the interests of manufacturers of and wholesale dealers in gramophones, radio-gramophones, musical instruments and accessories.

President : Mr. Harry Bryan (Selecta Gramophones, Ltd.) ; *Vice-President :* Mr. Stanley Rose (Rose, Morris & Co., Ltd.) ; *Hon. Treasurer :* Mr. D. Warnford-Davis (Crystalate Gramo-Record Mfg. Co., Ltd.) ; *Secretary :* Mr. Chas. E. Timms, 17, St. John's Road, Golders Green, N.W.11.

The Association is registered as a Company Limited by Guarantee.

SCOTTISH MUSIC MERCHANTS ASSOCIATION

President, Mr. Edward Machell, 45, Great Western Road, Glasgow.

Vice-President, John M. Hay, 73, Murray Place, Stirling.

Secretary and Treasurer, Mr. James Bee, 22, Rutland Square, Edinburgh.

MUSIC AND RADIO DISTRIBUTORS' ASSOCIATION

The Music and Radio Distributors' Association is now the only association whose sole object is the protection and promotion of the interests of the dealers in the allied trades of music, radio and gramophones.

It is an amalgamation of the Music Trades' Association, founded about half a century ago ; the Gramophone and Radio Dealers' Association, established in 1920 ; and the Music Merchants' Association.

The new Association, which consists solely of dealers, has been certified under the Trade Union Acts.

It invites to membership every person or firm being the proprietor of a shop, or show room open to the general public and carrying a representative stock of music, radio or gramophone goods for sale retail.

The subscription is graded from half a guinea per annum for the small business, to a maximum of two guineas for the largest.

Applications should be addressed to Frank Ayliffe, Hon. Secretary, 9, Broadway Parade, London, N.8. (Mountview 1183.)

I.E.E. WIRELESS SECTION

The Wireless Section of the Institution of Electrical Engineers was formed in 1919, and at present has a total membership of approximately 800.

Meetings are on Wednesdays at 6 p.m.

Informal meetings are held on Tuesdays, at 6.30 p.m.

The Secretary is Mr. P. F. Rowell, and the address Savoy Place, Victoria Embankment, London, W.C.2. (Temple Bar 7676).

The proceedings of the Section are published separately from the Journal in a publication entitled "The Proceedings of the Wireless Section." This is issued two or three times annually, and is supplied, in addition to the main Journal, without extra charge, to members of the Section.

Dr. E. Mallett is the chairman of the Wireless Section Committee ; and Mr. E. B. Moullin, M.A., is the vice-chairman. The immediate past-chairman is Mr. R. A. Watson Watt, B.Sc. (Eng.).

Ordinary members of Committee are : Mr. H. Bishop, B.Sc. (Eng.) ; Mr. W. J. Brown, B.Sc. ; Mr. S. Brydon, D.Sc. ; Mr. W. T. Ditcham ; Mr. N. F. S. Hecht ; Mr. J. Joseph ; Mr. A. H. Mumford, B.Sc. (Eng.) ; Mr. R. L. Smith-Rose, Ph.D., D.Sc. ; Mr. Frederick Smith ; Mr. S. B. Smith ; Mr. C. E. Strong, B.A.I. ; and Mr. W. Ure, B.Sc.

Government departments are represented by Mr. F. S. Barton, M.A., B.Sc. (Air Ministry), Mr. A. J. Gill, B.Sc. (Eng.) (Post Office), Capt. W. T. Makeig-Jones, R.N. (Admiralty), and Col. J. P. G. Worlledge, O.B.E. (War Office) ; while the *ex-officio* members are Mr. H. T. Young (President) ; the Chairman, I.E.E. Papers Committee ; and a representative of I.E.E. Council.

Interference Committee

The I.E.E. Radio Interference Committee, having fulfilled its terms of reference from the I.E.E. Council, prepared a report which was unanimously agreed by the council. This report recommended, *inter alia* :—

> That the Electricity Commissioners should be given powers to issue regulations to suppress interference with radio reception caused both by new and existing electrical appliances, plant, or machinery.
>
> That the Post Office should have powers to enforce the application of the regulations, subject to appeal to the Commissioners.

Copies of the full report can be obtained from the Institution of Electrical Engineers, Savoy Place, Victoria Embankment, London, W.C.2, at 6d. a copy, post free.

RADIO SOCIETY OF GREAT BRITAIN

The Incorporated Radio Society of Great Britain exists to encourage interest in amateur radio with particular reference to short wave and ultra short wave work. The Society was founded in 1913.

The privileges of membership include a free subscription to the Society's journal, the *T. & R. Bulletin*.

Members interested in research and experimental problems are especially catered for, and over 600 such members are at present co-operating in 10 sections, each of which is studying a specific problem.

Standard frequency measuring apparatus capable of giving calibrations of an order of a few parts in a million is maintained for the purpose of calibrating members' meters and crystals.

Non-transmitting members receive a special identity number which enables them to send reports to transmitting amateurs *via* the Society's report card section. Approximately 400,000 cards are handled annually by the Society.

A "Guide to Amateur Radio" is now in its ourth edition. It is 8d. post free, and its 16 chapters running into 128 pages deal with every aspect of amateur radio.

The membership of the Society in 1936, was 3,050, representing an increase of over 1,800 members since 1930 ; Five hundred of these members are attached to the British Empire section.

The Society is privileged to represent the British radio amateur at Post Office discussions concerning licence matters, and is also permitted to recommend its members for higher power and other facilities.

Annual subscription fees for Corporate members are :—

Those resident within 25 miles of Charing Cross, £1 1s.

Those resident outside the above area, but within the British Isles, 15s.

Those resident abroad, 12s. 6d.

For Associate members resident at home the subscription is 10s.

The officers of the Society for the year 1937 are : *President :* Mr. E. Dawson Ostermeyer ; *Executive Vice-president :* Mr. H. Bevan Swift ; *Secretary :* Mr. John Clarricoats, 53, Victoria Street, London, S.W.1. (Victoria 4412.)

INSTITUTE OF WIRELESS TECHNOLOGY

The Institute of Wireless Technology, of 4, Vernon Place, Southampton Row, London, W.C.1 (Holborn 4879), was founded in 1925 and incorporated in 1932.

It exists to promote the general advancement of wireless technology in all its branches, to maintain the status of the profession of those engaged in the science and engineering of wireless technology, and all kindred subjects and their applications.

Examinations for admission to the class of Associate Members and Associates are held in May and November. For several years past special attention has been given to the requirements of service engineers. Television engineers are allowed to take a special examination.

The Institute is governed by a Council, consisting of the President, the Immediate Past President, the Vice-Presidents, the Honorary Treasurer, and not less than six and not more than twelve ordinary members.

Patrons : The Rt. Hon. Lord Gainford, P.C. ; the Rt. Hon. Lord Hirst of Witton ; and Mr. Charles E. Sebag Montefiore.

President : Sydney A. Hurren, M.C., M.I.W.T.

Immediate Past President : James Nelson, M.I.W.T., M.I.E.E., M.I.Struct.E.

Vice-Presidents : Commander The Lord Louis Mountbatten, K.C.V.O., M.I.W.T., A.M.I.E.E., R.N. ; Sir William Noble, M.I.W.T., M.I.E.E. ; H. J. Barton Chapple, B.Sc., M.I.W.T., A.M.I.E.E. ; Charles E. Garrard, Ph.D., M.I.W.T., M.I.E.E. ; and E. H. Turle, M.I.W.T., M.I.E.E., M.I.Mech.E.

Honorary Treasurer : George Lea, M.I.W.T.

Council : Horace A. Brooks, A.M.I.W.T. ; Stanley Brown, A.M.I.W.T. ; Y. M. D. Cooper, B.Sc., B. es L., M.I.W.T. ; Alfred T. Fleming, M.I.W.T. ; H. A. G. Howse, M.I.W.T., A.M.I.E.E. ; N. W. McLachlan, D.Sc. (Eng,), M.I.W.T., M.I.E.E. ; Leslie H. Paddle, M.I.W.T., A.M.I.E.E. ; B. Tunbridge Hogben, A.M.I.W.T., A.C.C.S., and T. F. Williams, M.I.W.T.

Secretary and Editor of Publications : Harrie J. King, M.I.W.T., F.C.C.S., F.R.Econ.S.

Student Membership.

This class of membership is of great value to those who intend to adopt wireless engineering as a profession, and also to those already in the profession or Industry who intend to qualify for advancement by taking the Institute examinations. At present there is no entrance examination for those who wish to become Student Members, but this regulation may be changed at any time.

Many valuable concessions are available to Student Members without charge, and other privileges are to be given from time to time.

Benevolent Fund.

The Institute of Wireless Technology Benevolent Fund exists to afford assistance to necessitous members of the Institute. The Fund is maintained by voluntary subscription and is managed by three trustees.

Honorary Secretary to the Fund : Harrie J. King.

INSTITUTE OF RADIO ENGINEERS

The Institute of Radio Engineers of the U.S.A. was formed in 1912 by the amalgamation of the Society of Wireless Telegraph Engineers and the Wireless Institute. The publication of its proceedings was started in 1913 and has been issued regularly since that time.

Its early membership of less than one hundred has grown to several thousand and its members may be found practically in every civilised country in the world where radio engineering is practised.

Its Medal of Honour in recognition of distinctive services in the field of communications is issued annually. So is the Morris Liebmann Memorial Prize, which is given for an important development in the communications field in the immediate past.

The headquarters of the Institute are at 330, West 42nd Street, New York City, and it maintains sections in eighteen cities in the United States of America and Canada. Membership is available in several grades, depending upon the qualifications and experience of the applicants. Secretary : Harold P. Westman.

BRITISH STANDARDS INSTITUTION

The British Standards Institution fixes a number of standards in connection with radio products.

The address is 28, Victoria Street, London, S.W.1. Telephone : Victoria 3127.

THE TELEVISION SOCIETY

The Television Society holds meetings at the University College, London, at 7 p.m., on the second Wednesday of each month from October to May.

Informal meetings and discussions are held at irregular intervals throughout the session usually on Wednesday evenings.

It has its own journal, which is published three times a year and circulates to all members.

There is an active Research Committee, and a loan lantern slide collection for the use of members and others.

The Society has a membership of about 450. The annual subscription is: Fellows, £1 (entrance, 10s. 6d.); associate members, 15s. (entrance, 5s.); student members, 10s. (entrance, 2s. 6d.).

The officers are as follows:—

President: Professor Sir Ambrose Fleming, M.A., D.Sc., F.R.S.

Vice-Presidents: Ll. B. Atkinson, Esq., M.I.E.E.; Professor Magnus Maclean, M.A., D.Sc., LL.D.; Professor J. T. MacGregor Morris, M.I.E.E.; W. T. Patrick, Esq., J.P.; Professor F. J. Cheshire, C.B.E., A.R.C.S.; and Clarence Tierney, Esq., D.Sc., F.R.M.S. (Chairman of Council).

Honorary Fellow: John Logie Baird, Esq.

Council: A. H. Bennett, Esq., M.I.E.E.; T. H. Bridgewater, Esq., R. W. Corkling, Esq., F.P.S.; J. J. Denton, Esq.; H. M. Dowsett, Esq., M.I.E.E.; E. L. Gardiner, Esq., B.Sc.; Wm. C. Keay, Esq.; Dr. W. N. Hindley; H. H. Hope, Esq.; T. M. C. Lance, Esq., A.M.I.R.E.; E. M. Lee, Esq., B.Sc.; L. McMichael, Esq., M.I.E.E.; W. G. W. Mitchell, Esq., B.Sc.; G. Parr, Esq.; E. Phillips, Esq.; R. R. Poole, Esq., B.Sc.; J. C. Rennie, Esq., B.Sc., M.I.E.E.; C. Tierney, Esq., D.Sc., F.R.M.S.; E. H. Traub, Esq.; and H. Wolfson, Esq., B.Sc.

Honorary Treasurer: Wm. C. Keay, Esq.

Hon. General Secretary: J. J. Denton, Esq., 25, Lisburne Road, Hampstead, London, N.W.3.

Hon. Editorial Secretary: W. G. W. Mitchell, Esq., B.Sc., "Lynton," Newbury, Berks, England.

Foreign Secretary: E. H. Traub, Esq.

Lecture Secretary: G. Parr, Esq.

Institution of Electronics

The Institution of Electronics was registered on August 28, 1935, as a company limited by guarantee, without share capital, with 1,000 members each liable for £1 in the event of winding-up. The word "Limited" is omitted from the title by licence of the Board of Trade.

The Institution was formerly the British Radio Institution founded in 1930, which aimed at raising the standard of technical knowledge of all members of the radio-electrical profession, and set periodical examinations for the granting of diplomas.

Under the new title the above aims are continued, but also embrace all those whose work and interests bring them into contact with principles and applications of an electronic character.

President: Dr. J. S. Bridges, M.A., B.Sc., LL.D.

Vice-President: A. T. K. Moir, A.M.I.E.E.

Assistant Secretary: A. H. Hayes, F.C.S., Hazlitt House, Southampton Buildings, London, W.C.2. (Holborn 1068.)

Council Offices: 75, Gloucester Place, Portman Square, London, W.1.

Council: J. J. Denton (Chairman), D. A. Bell, B.Sc., Caradoc Williams, T. W. E. Towers, H. Moyse Bartlett, M. W. G. Russell, M.I.R.E., H. V. Fowler-Wallis, L. E. C. Hughes, Ph.D., J. C. G. Gilbert, H. F. Stone, W. Skirving Rutherford, D.O., A. H. Bateman, B.Sc. (Treasurer).

Solicitors: D. Edgar Rodwell & Co., 4, Half Moon Street, London, W.1.

Listeners' League

The Listeners' League has been formed out of a merger of the Wireless League, the Wireless Association of Great Britain, the Radio Association, and the Listeners' Association.

Its objects include the bringing together of listeners for the defence of broadcasting freedom and the progressive improvement of programmes.

There will be two classes of members.

Members paying 2s. 6d. a year will receive free technical and legal advice, copies of League literature, and free insurance covering the member's receiver against a large variety of risks, including damage or loss to sets by storm, lightning, fire and theft, against damage to aerials by storms, and against third party risks.

Associates pay 1s. a year and receive free technical and legal advice and the right to vote in any plebiscite.

A provisional committee, under the chairmanship of Sir Patrick Hannon, M.P., has been formed to organise the League. The offices of the organisation are at 12, Grosvenor Crescent, London, S.W.1.

THE TRADE'S LUNCHEON CLUBS

LEEDS

The headquarters of the Leeds Radio Trades' Luncheon Club are the Guildford Hotel, The Headrow, Leeds. The Club meets the first Thursday of the month, excluding July and August. The membership is over 100.

The officers are as follows: *Chairman:* L. J. Smith; *Vice-Chairmen,* Robson Elliff and J. H. Rogerson; *Hon. Treasurer,* H. W. Harris; *Secretary,* R. Broadbent; *Committee,* H. W. Sellers (past chairman), E. Mercer, and J. H. Smithson.

The Club has a strong golf section, which promotes a number of tournaments during the spring and summer. In the winter the Leeds Radio Ball and one or two dinner dances are held.

MANCHESTER

The Manchester and District Radio Trades Luncheon Club holds meetings on the first Monday in each month.

Membership is open to directors or departmental managers of any *bona fide* manufacturing or wholesale firm, and to any radio retailer or individual of standing in that industry.

The Club invites applications for membership.

The officers are: *President:* Mr. H. Nightingale, A.M.I.R.E.; *Past-Presidents:* Messrs. J. H. Farthing and J. W. Needham; *Vice-Presidents:* Messrs. H. A. Pryor, Y. W. P. Evans, V. Z. de Ferranti and S. J. Wrigglesworth; *Hon. Secretary:* Mr. R. H. Ellis, 7, Gartside Street, Manchester, 3 (Blackfriars 3871); *Hon. Treasurer:* Mr. R. Richardson; and *Committee;* Messrs. C. E. Leak, W. F. Litherland, C. S. Warde, V. H. C. Moore, M. H. Quarmby and J. Hirst.

MIDLANDS

The Midlands Radio Luncheon Club holds luncheon meetings every third Wednesday in the month at the Imperial Hotel, Temple Street, Birmingham. Its membership is about 100.

The club's officers are as follows:—

President: Mr. S. Wilding Cole.

Vice-President: Mr. Percy Edgar, O.B.E., (Midland Regional Director).

Chairman: Mr. John Priestley.

Vice-Chairman: Mr. W. H. Miller.

Hon. Secretary: Mr. F. C. Richardson, 85, Station Street, Birmingham, 5. (Midland 0102).

Hon. Treasurer: Mr. F. H. Barlow.

NEWCASTLE

The Newcastle and District Radio Trade Social Club had another successful year.

Membership is higher than ever and the Club's varied activities such as motor rallies, dances, outings, tournaments and swimming matches have been well attended.

The A. E. Dees silver challenge cup for golf, which is played for annually, and is presented to the winner by the donor who is Newcastle manager for Dulcetto-Polyphon, was this year won by Mr. Jack Roddy.

The tennis tournament for the John Watson silver challenge cup was this year won by Mr. J. Ramsbottom, service engineer to "Poly."

A big programme of social events has been arranged for the coming months.

The Club officers are as follows:—

President: Mr. W. Horsfal, Manager of the G.E.C. Newcastle Branch.

Chairman: J. A. Roddy, Manager of Cossor Newcastle branch.

Vice-Chairman: Mr. Harry Bradley (retailer).

Hon. Secretary: Mr. J. Mitchel Hill, 36, Carliol Street, Newcastle-upon-Tyne, 1. (Newcastle 21083).

Asst. Hon. Secretary: Mr. S. A. Reid.

Hon. Treasurer: Mr. W. A. Swan.

Committee: Messrs. R. E. Fabian, J. W. Skurr, J. S. Wood, E. C. Ridsdale, E. C. Robinson, I. R. Callaghan, W. G. Craig, R. Winnard, A. F. Guitard, S. Gale, H. Dodds and R. Ford.

NORTH STAFFS

North Staffs Radio Luncheon Club, Percy Street, Hanley, Staffs (Hanley 5526), has the following officers:—

President, J. Ridgway; *Chairman,* F. Bew; *Vice-Chairman,* R. Johnson; *Hon. Treasurer,* J. Bould; *Hon. Secretary,* J. Templeman.

NOTTINGHAMSHIRE

Each section of the industry is equally represented among the officers and committee of the Nottinghamshire Radio Luncheon Club.

The *chairman,* Mr. A. H. Whiteley, is a manufacturer; the *honorary secretary,* Mr. G. A. Litchfield, of Sherwood Buildings, South Sherwood Street, Nottingham, is a wholesaler; and the *treasurer,* Mr. J. Thornton, is a retailer. The nine committee members are three retailers, wholesalers and manufacturers respectively.

The club meets monthly for lunch at the

Black Boy Hotel, Long Row, Nottingham. The speaker for the occasion addresses the members on a matter of general interest. The radio industry is not discussed at the luncheons.

The annual subscription of 2s. 6d. is a nominal one to cover postage, and the membership is 90. The average attendance at the monthly luncheon is 45 members. Anyone connected with the radio industry in any of its branches is eligible for membership.

It is felt that the meetings are conducive to good feeling among members of the trade, and make for good fellowship and healthier conditions.

RADIO INDUSTRY CLUB

The Radio Industry Luncheon Club exists "to promote mutual understanding and good will in the Radio Industry by the holding of periodical luncheon meetings."

The officers are ;—

Chairman : Mr. G. G. Kent.

Vice-Chairman : Mr. H. R. Harris (H. Hacker & Sons).

Hon. Secretary : Mr. F. Brewerton (Ecco Radio, Ltd.), Ecco House, Princess Street, St. John's Wood, London, N.W.8 (Paddington 6735).

On the Committee are Messrs. H. de A. Donisthorpe (General Electric Co., Ltd.); J. C. N. Eastick (J. J. Eastick & Sons); E. R. Harveyson (E. R. Harveyson & Co.); C. H. G. Hobday (Hobday Brothers, Ltd.); A. Middleton (Ferranti, Ltd.); Col. G. D. Ozanne (Wingrove & Rogers, Ltd.); and Col. T. W. Vigers.

Meetings are generally held on the last Wednesday of the month, and a subject for discussion relating to the general benefit and advancement of the Industry is tabled for each meeting.

Subjects discussed during the past year have been varied and interesting. These, together with the speakers were :—

"Television at the Berlin Exhibition," Mr. T. Wadsworth ; "Growth of Radio in the Air Services," Lt.-Col. W. J. Polyblank, O.B.E., M.I.E.E. ; "How can the B.B.C. and the Radio Industry be of mutual assistance to one another ? " Mr. G. G. Kent and Sir Stephen Tallents ; "Co-operative advertising," Mr. G. J. Freshwater ; "Wireless and the Police," Lt. Cndr. Best, R.N., Retd. ; "The Luncheon Club," Col. T. W. Vigers ; "Trade connections in other countries," Major R. Gildea Robertson ; "Ideas for Radio publicity for 1936," Mr. Gray Sinclair ; "Impressions of the Radio Exhibition, 1936," Mr. Campbell Smith ; "The People's Set," Capt. R. Gambier Parry ; and "Are Trade Associations worth while," Mr. E. J. Power.

The meeting place is the Connaught Rooms, Gt. Queen Street, London, W.C.2.

The annual subscription is 10s. 6d., and there is an entrance fee for new members of 10s. 6d. Directors or managers of bona-fide manufacturer or wholesaler firms or companies, or any person of standing in the Industry considered eligible by the Committee, may become members of the Club.

Members may invite as guests to the luncheons individuals of responsible standing in the Industry.

The number of members continues to increase and the attendance at the luncheons also shows a steady advance.

SHEFFIELD

The Sheffield Radio Trades Luncheon Club meets on the third Wednesday of the month at the Grand Hotel.

President of the Club is Mr. A. J. Cheyne ; *Treasurer*, Mr. W. Marshall ; and *Secretary*, Mr. G. W. Bagshaw, J. G. Graves, Ltd., Radio Factory, Hallam Gate, Sheffield 10.

British "Wireless for the Blind" Fund

The British "Wireless for the Blind" Fund was started on Christmas Day, 1929, under the Presidency of The Prince of Wales, by a broadcast appeal by Mr. Winston Churchill, and, thanks to the generosity of the public, the assistance given by the B.B.C. (in arranging facilities for broadcast appeals) and the R.M.A. (by giving the use of a stand at each Radio Exhibition), it has been able up to date to distribute over 28,000 wireless sets to the blind in Great Britain and Northern Ireland. A thousand of these sets were provided by the R.M.A. free of charge.

During the past year, 1,000 sets with speakers have been supplied in replacement of obsolete and worn-out sets. Meanwhile fresh cases of blindness are continuously occurring, while the need for new sets of replacement inevitably increases as time goes on. The support and interest of the public and all sections of the Trade will always be needed for the work of this Fund to prosper.

The Chairman of the Fund is Capt. Sir Beachcroft Towse, V.C. ; and the Hon. Treasurer, the Rt. Hon. Reginald McKenna.

Secretary : Mr. W. McG. Eagar, 226, Great Portland Street, London, W.1. (Euston 5251.)

THE RADIO INDUSTRY'S GOLFING SOCIETIES

LANCASHIRE AND CHESHIRE

The Lancashire and Cheshire Radio Industry Golfing Society was formed in February, 1934, to encourage playing golf among members, and give support to benevolent funds connected with the Radio Industry.

All persons directly or closely connected with the radio industry are eligible for election to the society.

Ordinary membership is open to persons residing in the counties of Lancashire and Cheshire and adjoining districts, and only such members are entitled to attend the annual general meeting of the society.

Country membership is open to persons residing more than 10 miles from the borders of Lancashire and Cheshire. Such members have the same playing and social rights as ordinary members.

The membership year commences on January 1. The annual subscription for ordinary and country members is 10s., and non-playing members 5s.

The officers of the society are as follow :—

President : V. Z. De Ferranti ; *Captain :* C. P. Beardsall ; *Vice-Captain :* C. S. Warde.

Hon. Secretary : R. Hollingdrake, 65, Prince's Street, Stockport.

Hon. Treasurer : Y. W. P. Evans, " Nairana," St. Annes Road, Blackpool.

The Committee includes : M. H. Carr, G. Cooper, J. E. Kemp, J. Hall, C. Gadd, J. Duxbury, H. Hackett, J. D. Morrison, and J. Riding.

MIDLANDS

The Midlands Radio Golfing Society has as members persons in the Midlands associated with the Radio Industry.

The officers are as follow; *President*, F. Boyes; *Chairman*, T. H. Varcoe; *Captain*, H. E. Cox; *Vice-Captain*, H. W. Miller; *Hon. Treasurer*, L. H. Farmiloe; *Hon. Secretary*, F. H. Barlow, 27, Hazel Oak Road, Shirley, Birmingham (Shirley 1442); *Committee*, H. E. Adams, Gordon Baynton, F. Belfield, F. Coley, L. E. Page, J. Thomas, L. G. Watts, and E. A. Wood.

RIGS

President : J. H. Williams.

Vice-Presidents : H. Howitt and J. G. G. Noble, M.C.

Captain : F. H. Robinson.

Vice-Captain and Hon. Treasurer : S. R. Mullard.

Hon. Secretary : F. H. Robinson, 29, Bedford Street, London, W.C.2. (Temple Bar 2468).

Committee : H. Boon, H. Bryan, S. Wilding Cole, W. T. Forse, S. Grey, E. M. Lee, F. H. McCrea, S. R. Mullard, M.B.E., J. G.G. Noble, M.C., G. R. Osborne, Lt.-Col. G. D. Ozanne, M.C., F. H. Robinson, E. E. Rosen, Gray Sinclair, J. H. Williams.

The Society has 178 members. Membership is open to directorate, principals and executives of all radio manufacturers, wholesalers and retailers in Great Britain and Northern Ireland and such other persons closely associated with the radio industry as the Committee approves.

The annual subscription is 10s.

The society was formed early in 1933 and held its first meeting on March 22 of that year.

SCOTTISH

For many years a " Radio Golf Outing " was held in Scotland on the first Tuesday of each summer month.

When the Radio Industry Golfing Society was formed in England a number of Scottish players joined. Then a meeting was held in Scotland in April, 1933, at which it was agreed that the difficulty of distance from London could not be overcome.

There was also the further difficulty that if, to conform to R.I.G.S. rules, assistants were excluded, a large number of good friends and good golfers in Scotland would be excluded from membership. In these circumstances the " Scottish Radio Golf Society " was formed.

Mr. Edward Machell is now President; Mr. G. H. Stevenson, Vice-President; and Mr. Garry Black, Captain.

The Committee of the Society is elected by the votes of Retailers, Wholesalers and Manufacturers' representatives. As it is representative of all sections of the trade, it has been found spheres of usefulness beyond golf—organising dances, " smokers," and the outings held during the Scottish Radio Exhibition.

The membership of the society is about 60. They have two cups for competition, and prizes are given at all meetings, which are generally held on the first Tuesday of every month from April to October.

Mr. J. R. Paterson, of 29, Cadogan Street, Glasgow, C.2 (Central 2497.), has acted as secretary since the inception of the Society.

WHO'S WHO IN RADIO

ALLEN, Charles Gilbert, Fellow R.E.S., A.M.I.R.E.—Sales Manager, McMichael Radio, Ltd., Danes Inn House, 265, Strand, London, W.C.2. Joined Callenders Cable Co., Ltd., 1914; Marconi International Marine Communication Co., Ltd., 1917; one of first employees of McMichael, Ltd., 1923, traveller 1924, London sales manager 1927. Sales manager 1930. Born August 17th, 1900. Recreations: motoring, tennis. Private address: Home Lea, Nightingale Lane, Bromley, Kent. (Ravensbourne 3807.)

ALLIGHAN, Garry.—Journalist, 310-312, Regent Street, London, W.1. Official publicist to the Radio Manufacturers' Association since 1929; Press manager of Radio Exhibition, 1929 to 1936. Born 1895. Recreation: motoring. Address: 9, New Cavendish Street, W.1. (Langham 1085.)

ALLSTON, Reginald Oscar.—General Sales Manager, Hellesens Ltd., 260-268, Gray's Inn Road, London, W.C.1, since British company was formed 1932. Six years previously selling Hellesen with A. H. Hunt, Ltd. Radio trade since its inception. Born June 15th, 1896. Recreations: golf, bridge, motoring. Private address: "Linga Longa," West View, Letchworth, Herts. Phone: 476.

ARBIB, Richard.—Advertising Manager and Manager of Press Department, "His Master's Voice," 98–108, Clerkenwell Road, London, E.C. Joined The Gramophone Co., Ltd., in 1928, Electrical Reproducer Dept.; became Press Manager 1932, took up present position in February, 1935. Recreations: motoring, swimming, golf, darts. Private address: 35, Farm Avenue, London, N.W.2. (Gladstone 4114.) Club: Royal Automobile.

ASHBRIDGE, Sir Noel.—Chief Engineer, B.B.C., Broadcasting House, London, W.1. B.Sc., M.I.E.E. Fellow of King's College. Engineering training with Yarrow & Co., Ltd., and British Thomson-Houston Co., Ltd. Served European War 1914–1919, Royal Fusiliers and Royal Engineers. Six years Marconi's, at Writtle Experimental Station. Joined B.B.C. 1926 as assistant chief engineer. Became chief engineer B.B.C. 1929. Member of Council of I.E.E. Member of Radio Research Board, Television Committee (1924) and Television Advisory Committee (1935). Born December 10th, 1889.

ASHE, S. Macdonald.—Chief of Sales Division, E.M.I. Service, Ltd., Sheraton Works, Hayes, Mdx. Previously in motor trade, London; and in Australia as Sales Representative and Instructor. 1933, Lecturer on Salesmanship, Institute of Motor Salesmanship, London. 1934, Chief of Sales Training School, H.M.V. Household Appliances, Ltd. Born December 31st, 1900. Private address: 8, Haven Green, Ealing, London, W.5.

BAGGS, John.—Radio Publicity Manager, Ferranti, Ltd., Radio Works, Moston, Manchester 10; Metropolitan-Vickers Electrical Co., Ltd., 1914-21, serving apprenticeship; Ferranti, Ltd., Meter Sales Dept., 1923; since then from commencement attached to Radio and Clock Sales Dept. Now in charge of Radio Publicity. Born November 30th, 1898. Recreations: literature, boating, fishing, motoring. Private address: 2, Ash Walk, Alkrington, nr. Middleton, Manchester.

BAGSHAW, George William, Assoc. I.E.E., M.I.W.T.—Chief Engineer and Manager J. G. Graves, Ltd., Radio Factory, Sheffield. Chairman, Yorkshire Section, I.W.T., 1933 to date. 1914, Post Office Telephone Dept., 1914-19, R.E. Wireless B.E.F., 1922–26, Bagshaw, Tyas & Co., Radio set manufacturers, 1926–35, Graves Radio. Born: October 2, 1897. Recreations: yachting and sea fishing, tennis, motoring. Private address: "Roseneath," Baslow Road, Totley, nr. Sheffield. ('Phone: 71886.)

BAIN, Herbert Alexander, J.P.—The National Association of Radio Retailers, Ltd. Army, 1914; Ministry of Labour, 1919; The Federation of British Music Industries, 1925–30; Secretary, The Pianoforte Manufacturers Association, Ltd. 1926–1931; Secretary The Music Trades Benevolent Society, 1930; Secretary The Music Trades School Advisory Committee, 1929–31. General Secretary, W.R.A., 1931–36. Recreations: golf, music, Private address: Deepdene, Snaresbrook, London, E.11.

WHO'S WHO IN RADIO

BAIRD, John Logie.—Managing Director, Baird Television, Ltd., 58, Victoria Street. London, S.W.1. Born August, 1888, Private address : 3, Crescent Wood Road, Sydenham, London, S.E.26.

BAKER, Arthur.—Managing Director, Bakers Selhurst Radio, Ltd., 75–77, Sussex Road, South Croydon. Made the first electro-magnet moving coil speaker with floating cone, January, 1925 ; manufactured the first cross type permanent magnet speaker with floating cone, March 1926. Born January 25th, 1895. Private address : 89, Selhurst Road, South Norwood, London, S.E.25.

BAKER, Harold.—Radio Journalist, Wireless Correspondent and Broadcast Critic, "The Daily Mirror," Geraldine House, Fetter Lane, London, E.C.4. From 1918–9, O.C. Exhibitions, Photographic Section of Ministry of Information, and Imperial War Museum. 1926–7, Manager of Publicity and Trade Section of the Wireless Association of Great Britain. Joined "Daily Mirror" 1927. Clubs : Press and Vaudeville Golfing Society. Recreations : Motoring, golf, photography.

BAKER, Percy William—Director, Climax Radio Electric, Ltd., Haverstock Works, Parkhill Road, Hampstead, London, N.W.3. Member of Council R.M.A. Was with Cambridge Instrument Co. 1908-14 ; Charge of Testing Dept., R. W. Paul, until end of War. Proprietor of Scientific Electrical Co. prior to amalgamating with Climax. Holds many international electrical patents. Born October, 1891. Recreations : gardening, fishing, badminton, swimming, walking. Private address : The Thatched House, Wroxham, Norfolk.

BAKER, T. E. (Blundell, Baker & Co., 16, Serjeant's Inn, London, E.C.4).—Solicitors for the R.M.A., B.R.V.M.A., S.M.A., and R.W.T.A.

BAKER-BEALL, Alfred.—Managing Director The Lithanode Co., Ltd., 190, Queen's Road, Battersea, London, S.W.8 ; 40 years' connection with mechanical and electrical engineering, with the manufacture of accumulators and primary batteries. Born, March 22, 1875. Private address : "Homeland," Shoreham Beach, Sussex.

BALCOMBE, Edwin Kesteven.—Managing Director, A. J. Balcombe, Ltd., 52–58, Tabernacle Street, London, E.C.2.

BALL, Arthur Leslie.—Accountant, The Marconiphone Co., Ltd., 210, Tottenham Court Road, London, W.1. Joined present company 1923 ; assistant accountant 1924 ; accountant 1930. Born May 24th, 1901, Private address : 36, Lloyd Park Avenue, Croydon, Surrey.

BARKER, Eric Albert.—Sales Manager, Aerodyne Radio, Ltd., Aerodyne Works, Tottenham, London, N.17. Recreations : golf, swimming, motoring. Private address : 125, Abbott's Gardens, East Finchley, London, N.2 (Tudor 1597).

BARRETT, Ferberd Sessions.—Advertisement Manager "The Broadcaster and Wireless Retailer," "Electrical Trading," "Hotel and Catering Management," Odhams Press Ltd., 29, Bedford St., Strand, W.C.2. Born February 27th, 1896. Recreation : golf. Private address : 59a, Abbey Road, St. John's Wood, London, N.W.8.

BARRIE, Douglas Gordon Everard.—Director, Henderson Wholesale Electrical & Radio Ltd., Electric House, Queen's Road, Brighton, and at Worthing, Tunbridge Wells, Eastbourne and London. 28 years in electrical trade. Born : October 5th, 1894. Recreations : deep sea fishing. Private address : "Avoca," Middleton Avenue, Hove.

BARRINGTON, Jonah, A.R.C.M.—"Daily Express" radio critic. Recreation : riding. Born August 20th, 1904. Private address : The Old Barracks, Westcott, Surrey (Westcott 134).

BEARDSALL, Charles Poynter.—Radio Sales Manager, Ferranti, Ltd., Radio Works, Moston, Manchester ; member of council R.M.A. from January, 1929 ; R.W.T.A. and S.M.A. from formation, and Board of Management B.V.A., 1933–35 ; trained for journalism, which forsook for engineering ; joined Ferranti, Ltd., 1907 ; sales dept., 1910 ; sales manager, meter dept., 1926 ; associated with radio from commencement and appointed sales manager, radio dept., 1929. Born January 19th, 1886. Recreations : various, chiefly golf. Private address : Alton, Sheepfoot Lane, Heaton Park, Manchester. (Cheetham Hill 1019.)

BEAVER, Eric, A.C.G.I.—Director, Sun Electrical Co., Ltd., 118, Charing Cross Road, London, W.C.2. 1922–1927 with Siemens, from 1927 with Sun Electrical Co. Born, September 14th, 1900. Recreations: golf, swimming. Private address : 21, St. Leonards Road, Ealing, W.13.

BETAMBEAU, Albert Edward.—Proprietor A. E. Betambeau & Co., 101a, High Street, Penge, London, S.E.20, and 20–22, Anerley Station Road, S.E.20. Member of Council W.R.A. since August, 1923 ; Chairman W.R.A. 1929–31 ; Vice-President, 1932–36 ; after 17 years'

practical experience, including apprenticeship, opened present business 1920. Rotarian, Penge Rotary Club; member of Penge Chamber of Commerce. Born August 30th, 1887. Private address: Anerley Lodge, Anerley Road, London, S.E.20.

BLACK, Donald Harrison, M.Sc (N.Z.), Ph. D. (Cantab.), F. Inst.P.—Head of Valve Laboratory, Standard Telephones & Cables, Ltd., North Woolwich, London, E.16. Joined Standard Telephones in 1925, engaged for number of years on dielectric research. Took over present position in 1933. Born June 18th, 1899. Recreation: motoring. Private address: "Tawahi," 7, Copt Hall Drive, Mill Hill, London, N.W.7.

BLACK, Michael.—Managing Director, Michael Black, Ltd., 138, West George Street, Glasgow, C.2, 57–59, Elder Street, Edinburgh, and 30–32, Chapel Street, Aberdeen; Leafield Road, Dumfries. Director of Hi-Pur Services, Ltd., Glasgow. Born, August 11th, 1893. Recreations: golf, swimming, motoring. Private address: "The Whins," 106, Haggs Road, Glasgow, S.1.

BOON, H.—Advertising Manager, Chloride Electric Storage Co., Ltd., 137, Victoria Street, London, S.W.1. On Advertising Committees of S.M.M.T. & A.M.A. In film industry 1920–26; with Mullard's 1926–30; Exide 1930 to date. Born January 3rd, 1898. Recreations: golf. Private address: Oakbank, Hampton Grove, Ewell, Surrey.

BOWERS, Ernest Victor.—Director, Henderson's Wholesale Electrical and Radio, Ltd., 1, Soho Square, London, W.1. Telsen, Ltd., 1927; Lotus Radio, Ltd., 1930. Director of Cameron's Surgical Specialities, Ltd. Born December 17, 1904. Recreations: riding, tennis, fishing, shooting. Private address: Chapel Fields, Addlestone, Surrey.

BOWYER - LOWE, Albert Edwin, M.Inst.C.E. — Director, Self-Changing Gramophones, Ltd. Vice-chairman, R.M.A., 1926; Chairman, R.M.A., 1927; Vice-president, R.M.A., 1928-30; Trustee, R.M.A., 1927-30; Corresponding Chamber of Council, Junior Institution of Engineers. Designed cycles, motors, etc., 1900-22. Born February 27th, 1883. Recreations: motoring, photography, clock-making. Private address: "Veloce," South View, Letchworth, Herts. (Letchworth 34).

BRIDGEN, Charles William.—General Sales Manager, Ferranti, Ltd., Hollinwood, Lancs. Born: October 26, 1895. Recreations: golf, swimming. Private address: 188, Wilmslow Road, Withington, Manchester.

BROWN, Alice S. G.—Secretary and Director, S. G. Brown, Ltd., Victoria Road, N. Acton, London, W.3. Director, Telegraph Condenser Co., Ltd.; Chairman, S. G. Brown (Radio Relay Products), Ltd.; Secretary and Director of S. G. Brown, Ltd., since 1912 and of T. C. C. since 1922. President of Y.W.C.A., East Acton Centre, Vice-President, Acton Hospital. Recreations: zoology, botany, swimming, writing, dancing, travelling. Private address: 41, Elsworthy Road, London, N.W.3.

BROWN, Harold Ernest.—Contracts Manager, Radio, Gram. & Television, Ltd., December, 1935; previously Sales Manager, Halcyon Radio, Ltd.; Sales Dept., Pell, Cahill & Co., 1924; Assistant to Works Manager, M.P.A. Wireless, Ltd., 1926; Assistant to Sales Manager, A. J. Dew & Co., 1927; F. A. Hughes & Co., Ltd.; later developed into the British Blue Spot Co., Ltd., 1929. Born January 5th, 1905. Recreation: photography. Private address: 14, Tudor Gardens, Upminster, Essex.

BROWN, Sidney George, F.R.S., M.I.E.E., Fellow of London University.—Managing Director, S. G. Brown, Ltd., Victoria Road, N. Acton, London, W.3; Chairman, Telegraph Condenser Co., Ltd. Has many important electrical, telegraphic and wireless inventions to his credit. Served on Admiralty Ordnance Council during the War, and Royal Commission on Awards to Inventors. Member of Athenæum Club, under special recommendation for his achievements. Born: July 6th, 1873. Recreations: inventing, travelling. Private address: 41, Elsworthy Road, London, N.W.3.

BROWNE, Rupert Pollard.—Secretary R.M.A.; Assistant Secretary, R.M.A., from inception 1926 to 1936, Astor House, Aldwych, London, W.C.2. B.Sc.; Assistant Secretary, N.A.R.M.A.T., from its inception, 1924. Born, December 18th, 1897. Private address: 11, Riverdale Gardens, Twickenham Park, Middlesex.

BRYAN, Harry, B.Sc.—Managing Director, Selecta Gramophones, Ltd., 81, Southwark Street, London, S.E.1. President of A.G.M.I.M., Captain of M.I.G.S. Has had 30 years' association with gramophone and music trades. Born: March 21st, 1893. Recreations: golf, swimming, tennis. Private address: 17, Leigham Hall, Streatham Hill, London, S.W.2.

BRYCE, N. Dundas.—Sales Manager, Belling & Lee, Ltd., Cambridge Arterial Road, Enfield, Middlesex. Served in the R.F.C. and R.A.F., 1914-19; Lever Bros., Ltd., 1919; Advertising manager,

WHO'S WHO IN RADIO

Burndept, Ltd., 1921; Advertising manager, A.J.S. Radio, 1925; Joint manager, Hugh Paton & Sons, Ltd., Printers, 1928. Born 1897.

BULGIN, Arthur Frederick, M.I.R.E., F.R.S.A.—Governing Director, A. F. Bulgin & Co., Ltd., Abbey Road, Barking, Essex. Member R.M.A. Council, 1934–35. Vice-President, R.C.M.F. Engaged in experimental spark transmission and reception 1913; R.F.C. and R.A.F., 1919; entered radio industry 1921; founded A. F. Bulgin & Co., 1924; converted to Limited Company, 1930. Has invented many radio patents. Born January 23rd, 1899. Recreations: motoring, tennis, kinematography. Private address: "The Oaks," 5, Holly Bush Hill, Wanstead.

BURNE-JONES, David.—Managing Director, Burne-Jones & Co., Ltd., 309–317, Borough High Street, London, S.E.1. Apprenticed to Westminster Engineering Co., Ltd.; worked 9 years in India, 1905-6 engineer-in-chief of H.M. The King and Queen's fleet of cars, during their Indian Tour; worked in kinematograph industry 1913-20; since manufactured radio apparatus. Recreations: motoring, fishing. Private address: Holly croft, Brunswick Road, Sutton, Surrey.

BURNHAM, Walter Witt. Comp. I.E.E., Fell.I.R.E.—Manager, Radio Division, Edison Swan Electric Co., Ltd. (Associated Electrical Industries, Ltd.); for three years was Chairman, N.A.R.M.A.T., Vice-President and Trustee, R.M.A., Chairman, B.V.A. Board of Management; formerly Director, British Broadcasting Co., Ltd. Born April 12th, 1880. Private address: The Plateau, Sundridge, near Sevenoaks, Kent. 'Phone: Ide Hill 241.

BUSWELL, Gordon.—Director, Whiteley Electrical Radio Co., Ltd., Radio Works, Mansfield, Notts. Born: February 27th, 1885. Private address: 19, Stella Street, Mansfield, Notts.

CADISCH, Ernest Edward.—Partner, R. Cadisch & Sons, Red Lion Square, London, W.C.1. Member of Council, Accessory Committee and Stop List Committee of M.F.A., 1933-36. Born August 11th, 1897. Recreations: golf, tennis, motoring. Private address: "Normandy," Broad Walk, London, N.21.

CALKIN, Alan Bernard, M.A., A.M.I.E.E.—Radio Technical Adviser, Phillips Lamps, Ltd., 145, Charing Cross Road, London, W.C.2. Born, March 6, 1905.

CAMPBELL, Guy.—Chairman and Managing Director, Benjamin Electric, Ltd., Brantwood Works, Tariff Road, Tottenham, N.17; Chairman, Magnavox (Great Britain), Ltd. Director, Hazelpat, Ltd. and Imperic (Service) Co., Ltd. Private address: 16, Abbey Lodge, Regent's Park, London, N.W.

CARRINGTON, Frederick Douglas.—Managing Director, Carrington Mfg. Co., Ltd., "Camco" Works, Sanderstead Road, S. Croydon. Engaged in production of precision woodwork since late 'nineties. Supplied Marconi's with radio casework many years before the war. Born May 26, 1883. Recreations: tennis, bowls. Private address: Carlton House, Fairdene Road, Coulsdon, Surrey.

CLARK, Alfred.—Chairman, Electric & Musical Industries, Ltd., the Gramophone Co., Ltd.; Director, Columbia Graphophone Co., Ltd., Cie. Francaise du Gramophone, Marconiphone Co., Ltd., Skandinavisk Grammophon Aktieselskab, Marconi-E.M.I. Television Co., Ltd., Radio Pictures, Ltd., Gramophone Buildings, Hayes, Middlesex. President, International Federation of the Phonographic Industry. Born: December 19th, 1873. Recreation: golf. Private address: Warren House, Iver Heath, Bucks.

CLARKE, Arthur.—H. Clarke & Co. (Manchester), Ltd., Atlas Works, Patricroft, Manchester. Recreations: tennis, football, golf. Private address: "Gogarth," Monton Green, Eccles, Lancs.

CLARKE, H. — Managing Director, H. Clarke & Co. (Manchester), Ltd., Atlas Works, Patricroft, Manchester. Private address: "Gogarth," Monton Green, Eccles, Lancs.

CLARKE, R. C. W.—Sales Engineer, A. H. Hunt, Ltd., Bendon Valley, Garratt Lane, London, S.W.18.

COBB, Frederick Arthur, A.I.E.E., M.I.R.E.—Manager, Broadcast Receiving Valve Division, Standard Telephones and Cables, Ltd., Footscray, Sidcup, Kent. Standard Telephones' Representative to B.V.A. Senior Maintenance Engineer, 2LO, 1924; Assistant Chief Engineer, Indian Broadcasting Co., from inception, 1927; Manager, Valve and Amplifier Dept., Philips, 1932. Born February 11, 1901. Private address: 28, Manor Gardens, Purley, Surrey.

COHNREICH, Alfred.—Director, Loewe Radio Co., Ltd., 3-4, Clement's Inn, London, W.C.2. Born February 26th, 1893. Private address: 23, Exeter Road, Southgate, London, N.14.

COLE, Eric Kirkham.—Deputy Managing Director, E. K. Cole, Ltd., Ekco Works, Southend-on-Sea. Private address: "Hampton," Beehive Lane, Chelmsford, Essex.

COLE, Stanton Wilding, O.B.E.—Chairman of S. Wilding Cole, Ltd., 62, Moor Street, Birmingham. Deputy-Chairman, Kolster-Brandes, Ltd., Cray Works, Sidcup, Kent; Vice-President, R.M.A. Executive Council, N.U.M.; Managing Director, Burney Blackburn, Ltd., 1915–1921; Chairman, S. Wilding Cole, Ltd., 1921 onwards; Director, Kolster-Brandes, Ltd., 1927 onwards. Chairman, Heating Installations, Ltd., and Smart and Brown (Toolmakers), Ltd. Born, February 14th, 1880. Recreations: golf, tennis. Private address: The Turret, Footscray Lane, Sidcup, Kent.

VAN COLLE, Victor George.—Executive Technical Sales and Chief of Designs Staff, Ward and Goldstone, Ltd., Pendleton, Manchester. Six years on "Popular Wireless" technical staff, in which period built about 1,000 different set designs, including those for Mr. Ramsay MacDonald, Mr. Edgar Wallace, Sir George Sutton and other well-known people. Later chief engineer to Wright and Weaire, Ltd. Born: July 29, 1907. Recreations: golf, photography, gardening, journalism. Private address: "Strathmore," Overbrook Drive, Prestwich, Lancs. (Prestwich 1751.)

COLLINSON, Richard Francis—Managing Director, Colvern Ltd., Mawneys Road, Romford, Essex. Born July 26, 1901. Private address: 23, Kings Avenue, Woodford Green, Essex.

COURSEY, Philip Ray, B.Sc. (Eng.).—M.I.E.E.—Technical Director, Dubilier Condenser Co. (1925), Ltd., Ducon Works, Victoria Road, N. Acton, London, W.3. Chairman of Committee on Mains Radio Apparatus of British Standards Institution. Member of Technical Committee of R.M.A.; past Member of Committee of Wireless Section of the Institution of Electrical Engineers; Secretary, Radio Society of Great Britain, 1923–4. Research Physicist, H.M. Signal School, 1918–9. Editor, "Radio Review," 1920–1. From 1922 with present company. Born May 7, 1892. Recreation: authorship. Private address: 67, Queens Road, Richmond, Surrey.

DARBY, Lawson Alfred.—London Manager, The Chloride Electrical Storage Co., Ltd., 211-229, Shaftesbury Avenue, London, W.C.2. Member of Research and Standardisation Committee, Institute of Automobile Engineers. Private address: 37, Gunnersbury Avenue, Ealing Common, London, W.5.

DAVIS, Leslie Waring Westacott Captain.—Chairman and Director, Burlington Radio, Ltd., 50, Sion Road, Bristol, 3. Proprietor of L. Westacott Davis, Wholesale Distributor, Clifton Terrace, Sion Road, Bedminster, Bristol, 3. Bristol Works Manager, Colston Works, Bristol, 1912–1915. Director of Automobile Accessories, 1921–1936. Partner, Vickers Automobile Co., Bristol. Officer, R.A.S.C., M.T., during War; afterwards Road Transport Officer, Board of Trade. Also interested in automobile engineering. Born April 18th, 1893. Recreations: speedboating, yachting, swimming, badminton. Private address: 14, Cransley Crescent, Henleaze, Bristol.

DIAMOND, Joseph.—Partner, Thompson, Diamond & Butcher, 34, Farringdon Road, London, E.C.1. Chairman, London and South Eastern Section, R.W.F. Born March 5th, 1894. Private address: 63, Wynchgate, Old Southgate, N.14.

DIBBEN, Horace Ronald.—Managing Director, Horace Dibben, Ltd., 34, Carlton Crescent, Southampton, and 17, Commercial Road, Portsmouth. Served five years' apprenticeship with Wm. Dibben & Sons, Ltd., Builders' Merchants; then founded and became Manager of the radio factory business of this firm. In 1930 formed company of Cromwell (Southampton), Ltd., radio manufacturers, and became General Manager in addition to above. In 1934 severed connection with both companies and purchased factoring business from Wm. Dibben & Sons, forming a limited company and becoming Managing Director. Later became Director also of Chilworth Estates, Ltd., architects and builders. Born April 15th, 1905. Recreations: golf, hockey, squash rackets. Private address: "Wentworth," Bassett, Southampton.

DICKINSON, Reginald Gordon.—Export Manager, Kolster-Brandes, Ltd., Cray Works, Sidcup, Kent. Corporate Member of Institute of Export. Recreations: tennis, badminton. Private address: "Kathera," 68, Madeira Avenue, Bromley, Kent.

DOBIE, Arthur John Douglas.—Area Sales Manager, South of Thames & South Wales, Wingrove & Rogers, Ltd., 188/9, Strand, London, W.C.2. Marine work with Siemens Bros., & Co. Ltd., 1915; R.F.C. and R.A.F., 1918; The Marconi International Marine Co., Ltd., 1918; Marine work with Radio Communication Co., Ltd., 1920, and transferred to the "Polar" Broadcasting Dept. in 1923. Born February 18, 1897.

WHO'S WHO IN RADIO

DOHERTY, Harold Alfred.—Director, Edward Doherty & Sons, 718/728, Seven Sisters Road, London, N.15. Honorary Treasurer of British Radio Cabinet Manufacturers' Association. Director of Wincycle Company, makers of Invalid Furniture. Born February 27th, 1902. Recreations: Swimming, gardening. Private address: "Stoke Gabriel," Townsend Avenue, London, N.14.

DOIG, Thomas Watson, A.M.I.W.T.—Principal, Bossons & Doig, 27, Victoria Street, Crewe. Director, Crewe Economic Building Society. Theatre, cinema and other orchestral appointments, 1890–1920. Entered radio, music and electrical business 1920, and pioneer radio retail business in Crewe. Born March 10, 1881. Recreations: motor-boating, motoring. Private address: "Beechwood," 98, Gainsborough Road, Crewe.

DONISTHORPE, Horace St. John de Aulâ.—Valve Sales, General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2. Member B.V.A. General Purposes Committee and Radio Industry Luncheon Club Committee. Wireless operator, Marconi International Marine Communications Co., Ltd., 1912–13. During war Wireless Intelligence Service, Captain, Royal Engineers, and Inspector of Royal Engineer Stores (Wireless). Director and engineer, R. M. Radio, Ltd., 1919–21; American Representative, Marconi International Marine Communication Co., Ltd., 1921 to 1925; Broadcast work in New York, U.S.A., B.B.C., London, Oslo, and contributions to radio press in Britain and America, 1930. Author of several radio handbooks. Born December 18th, 1896. Recreations: tennis, riding, swimming. Private address: 16, Douglas Mansions, London, S.W.17. (Western 1675.)

DUNN, William Henry, M.A.—Chairman, City Accumulator Co., Ltd., and C.A.C. Cabinets, Ltd., 18-20, Normans Bldgs., Central Street, London, E.C.1. Born: August 20th, 1907. Recreations: riding, rowing (Captain of Magdalen College Boat Club, Cambs., 1928-9). Private address: 24, Montagu Street, London, W.1.

DUNNE, Daniel Patrick.—Managing Director, The Chloride Electrical Storage Co., Ltd., 137, Victoria Street, London, S.W.1. Born November 26th, 1875.

DYER, Carleton L.—Managing Director, Philco Radio and Television Corporation of Great Britain, Ltd., Aintree Road, Perivale, Middlesex. Born August 12, 1901. Recreation: sailing. Private address: "Yew Ridge," Cedars Close, Hendon, London, N.W.

DYER, John.—Sales Promotion Manager, Philco Radio and Television Corpn. of Gt. Britain, Ltd. Editor "Wireless Trader," 1933–36. Press Representative, the Marconiphone Co., Ltd., 1929–1933. Editorial Staff "Wireless Trader" 1925-29, Born, July 19th, 1897. Private address: Rectory Cottage, Hanwell, London, W.7.

EASTICK, John Clare Newlands.—Manager J. J. Eastick & Sons, Eelex House, 118, Bunhill Row, London, E.C.1.

ECKERSLEY, Peter Pendleton.—Consulting Engineer. M.I.E.E., F.I.R.E. Chief Engineer, B.B.C., 1923–1929; publications and technical papers in the I.E.E. and I.R.E. proceedings. Designs Sect., Marconi's Wireless Telegraph Co., 1920–23. Born January 6, 1892. Private address: 82, Swan Court, Chelsea, London, S.W.3.

Van EENDENBURG, Daam Carel Frederik.—Managing Director, Philips Lamps, Ltd., 145, Charing Cross Road, W.C.2. Born July 27th, 1885. Recreations: tennis, swimming. Private address: Hindounid, Gloucester Road, Kingston-on-Thames.

ELLIS, Richard Milward, M.I.E.E.—Joint Managing Director, Pye Radio, Ltd., Africa House, Kingsway, London, W.C.2, and Vice-President R.M.A., 1932; Chairman, 1931; Vice-chairman, 1930; previously Member of Council, R.M.A.; Director, Cathodeon, Ltd.; has occupied executive positions on N.A.R.M.A.T.; served with Everett, Edgcombe & Co.; R. W. Paul; Edison Swan; Engineering Publicity, Ltd.; Chellis, Ltd., City and Guilds College (Electrical Engineering Dept.); was a Drapers' Company scholar and research student at East London College. Private address: Tall Trees, Quarry Woods, Marlow, Bucks.

EMERY, Ernest John.—Managing Director, E.M.I Service, Ltd., Sheraton Works, Hayes, Middlesex. Joined Marconi International Marine Communication Co., Ltd., 1915; Marconi's Wireless Telegraph Co., Ltd., 1919; The Marconiphone Co., Ltd., 1922; Electrical and Musical Industries, 1932; E.M.I Service, Ltd., 1933. Born October 24, 1897. Private address: 28, Hillcroft Crescent, Ealing, London, W.5.

EVANS, Selborne.—General Manager Ward & Goldstone, Ltd., 5, Percy Street, London, W.1. Gold medallist, City and Guilds. Born September 11, 1890. Recreations: cricket, football, tennis, swimming, gardening. Private address: Havenfield Cottage, Great Missenden, Bucks.

FARRER, Alan W.—Director and General Manager, Ultra Electric Ltd.; Director and Secretary, Ultra Electric (Holdings), Ltd., Western Avenue, Acton, London, W.3. Accountant, 1918-1923; Cinema Circuit Manager, 1923–26; joined Ultra Electric Ltd., 1926, as Company Secretary. Born: July 27, 1898. Recreations: photography, motoring. Private address 1, Craignish Avenue, London, S.W.16.

FAWCETT, Francis Thomas, M.A., Ph.D., D.Sc., M.I.W.T.—Chief Examiner Electrical Engineering Subjects, International Correspondence Schools, International Buildings, 71, Kingsway London, W.C.2. Past President, Institute of Wireless Technology. Member, Mathematical Association. Technical Editor, Journal and Proceedings of the Institute of Wireless Technology from their inception; articled with Edison & Swan, subsequently with W. T. Henley's Telegraph Works Co., Ltd.; sometime demonstrator in Electrical Engineering in the University of London; contributor to technical journals and author of scientific textbooks. Born May 17th, 1880. Recreation: photography. Private address: 53, Snakes Lane, Woodford Green, Essex. (Buckhurst 2140.)

FELTON, Lionel Bernard.—Joint Managing Director, Lectro Linx, Ltd., 79A, Rochester Row, London, S.W.1. B.A. (Cantab). Director, Autoveyors, Ltd., 1925-27. Recreations: tennis, motoring, riding. Private address: 9, Kensington Hall Gardens, London, W.14.

FERRANTI, Vincent Ziani de.—Chairman and Managing Director, Ferranti, Ltd., Ferranti Electric, Ltd. (Canada), Ferranti Electric Inc. (U.S.A.). Hollinwood, Lancs. Member of Council B.E.A.M.A. and I.E.E. Born February 16, 1893.

FORD, Cyril Herbert.—Chief Engineer, E.M.I. Service, Ltd., Sheraton Works, Hayes, Middlesex. Joined Marconi's Wireless Telegraph Co., Ltd., 1914; The Marconiphone Co., Ltd., 1922; Electrical and Musical Industries, 1932. Born May 4, 1896. Private address: 366, Uxbridge Road, Acton, London, W.3.

FOUNTAIN, Guy Rupert.—Founder and Governing Director, Tannoy Products (Proprietors: Guy R. Fountain, Ltd.), Canterbury Grove, West Norwood, London, S.E.27. Born November 26th, 1899. Recreations: yachting, motoring. Private address: 25, Lancaster Road, West Norwood, London, S.E.27.

FREEMAN, A. H. Desmond.—Philco Radio & Television Corporation, Ltd.; previously General Manager, British Belmont Radio, Ltd. Was deputy member to R.M.A. Council, while Sales Supervisor to Kolster-Brandes. Formerly Sales Director to Clarke's Atlas. During war Lieutenant 13th London Regt. (Kensington's). Born January 14th, 1897. Recreations: bridge, golf, tennis. Private address: "Silchester," Wembley Hill Road, Wembley, Middlesex (Wembley 4785).

FREEMAN, Horace.—Managing Director, Parrs Advertising, Ltd., Craven House, Kingsway, London, W.C.2. Telephone, Holborn 2494. Was assistant organiser and manager of the first All-British Wireless Exhibition and Convention, Horticultural Hall, London, 1922. Was advertisement manager for John Scott-Taggart's publications. Established his own advertising agency in 1925 at above address. Specialises in Radio, Television, Electrical and Mechanical engineering publicity. Recreations: swimming, motoring.

FRENCH, Cyril.—Sole Distributor and Service Agent for Celestion loudspeakers to the wholesale and retail trades in Great Britain and Northern Ireland. Director of Electrical Mfg. and Plating Co., A.B. Metal Products, Ltd., Rexicon, Ltd., Kingston and Staines Press, Ltd. Apprenticed to Scientific Instrument Co., Cambridge, 1903-10. G. Kent & Co., 1914. Walters Electrical Mfg. Co., 1918. J. E. Jaccard, 1919. Founded Celestion, 1926. Recreations: motoring, flying, golf. Private address: 64, Lingfield Avenue, Kingston-on-Thames.

FRESHWATER, George John.—Publicity and Sales Promotion Manager, The Marconiphone Co., Ltd., 210-212, Tottenham Court Road, London, W.1. Born August 2nd, 1898. Recreations: golf, cricket, tennis. Private address: 25, West End Road, Ruislip, Middlesex. (Ruislip 2604.)

GAMBRELL, Horace William.—Radio Publicist and Exhibitions Organiser. The Edison Swan Electric Co., Ltd., 155, Charing Cross Road, London, W.C.2. M.I.W.T., M.I.R.E., 1st Class C.G.I. Served with the British Thomson-Houston Co., Ltd., until 1929. Born November 18, 1898. Recreations: yachting, fishing. Private address: "Stanford," Lincoln Close, Pinner, Middlesex.

GARDNER, Victor George Edward, M.S.M.A.—Publicity and Asst. Sales Manager, S. Smith & Sons (Motor Accessories), Ltd., Central Works, Cricklewood, London, N.W.2. Joined S. Smith & Sons, Ltd., 1926 as Asst. Engineer, made Publicity and Asst. Sales Manager, 1933.

WHO'S WHO IN RADIO

Previously with Messrs. Clement Talbot. Born October 31, 1902. Recreations : ice hockey (Captain British Ice Hockey Team, 1932), tennis, squash rackets, winter sports, Private address : 21, Oxgate Court, Oxgate Lane, London, N.W.2.

GIBSON, William Thomas, O.B.E., M.A. (Cantab), B.Sc. (London).—Chief Valve Engineer, Standard Telephones & Cables Ltd., North Woolwich, London, E.16. Head of Valve Development Labs., I.T. & T. Labs., Paris, 1928–31. Chief Valve Engineer, Federal Telegraph Co., Newark, U.S.A., 1931–32. Born January 21, 1899. Private address : The Firs, St. George's Road, Bickley, Kent.

GILBERT, Ernest Richard.—Advertising Consultant. Gilbert Advertising Ltd., Hastings House, Norfolk Street, Strand, London, W.C.2.

GILBERT, Josiah William, A.I.P.A.—Departmental Director, Willing & Co., Ltd., 356-364, Gray's Inn Road, London, W.C.1 ; Advertising Consultant to Ekco, Eastick, etc. ; with "Broadcaster," 1923–27 ; Woburn Advertising, 1928–33. Born February 10, 1902. Recreations : golf, tennis. Private address : 55, Chadwick Road, Westcliff-on-Sea, Essex.

GOLDSTONE, Sampson. — Director, Ward & Goldstone, Ltd., Pendleton, Manchester. Private address : 80, Promenade, Southport.

GOODFELLOW, Magnus.—Chairman and Managing Director, The Ever Ready Co. (Gt. Britain), Ltd., Hercules Place, Holloway, London, N.7, and The Ever Ready Trust Co., Ltd. Chairman, Lissen, Ltd.

GOODMAN, William Henry.—Managing Director, Dubilier Condenser Co. (1925), Ltd., Mansbridge Condenser Co., Ltd., High Frequency Engineering Co., Ltd., Ducon Works, North Acton, London, W.3. Also Director of Isenthal & Co., Ltd. Founded Dubilier & Co., in 1912. Born April 23rd, 1884. Recreations : rowing and tennis. Private address : "The Haven," Camden Place, Bourne End, Bucks.

GOOTNICK, Samuel, M.I.R.E., Fellow Television Society.—Chairman and Managing Director, Burgoyne Wireless (1930), Ltd., Great West Road, Brentford, Middlesex. Has been commercially connected with radio since its inception. Recreations : motoring, photography. Private address : 47, Highfield Gardens, London, N.W.11.

GREY, Sidney.—Managing Director, S. Grey & Co., Ltd., 360, Upper Street, Islington, London, N.1. Member of Committee of Radio Industry Golfing Society. Interested in radio industry since broadcasting started. Born June 29th, 1903. Recreation : golf. Private address : 45, Blake Hall Road, Wanstead, Essex.

HAIGH, Richard.—British General Manager, "His Master's Voice," The Gramophone Co., Ltd., 98–108, Clerkenwell Road, E.C.1. Born February 4, 1895. Recreations : tennis, photography. Private address : Crossways, Farnham Common, Bucks.

HAMBLING, Arthur William.—Managing Director, A. W. Hambling & Co., 26, Charing Cross Road, London, W.C.2. Member (1922) Institute Radio Engineers, New York. After serving in the war, was with F. O. Read & Co., Ltd., 1919-20 ; Hambling Clapp, Ltd., 1921-29. Owned and operated station G.2.M.K. since 1919. Served on R.S.G.B. Council ; was Assistant Secretary, 1921. Born March 1st, 1898. Recreation : aviation. Private address : 80, Brondesbury Road, London, N.W.6.

HANCHARD GOODWIN, John Martin, M.A. Cantab., Junior Optime 1st Class Mech. Sciences Tripos. General Manager, Britannia Batteries, Ltd., Redditch, Worcs. Educated Highgate School, Royal Military Academy, Woolwich, and Pembroke College, Cambridge. Late Royal Engineers. Joined Kodak, Ltd., 1923, and made Asst. Sales Manager 1927. Born April 8, 1897. Recreations : writing, rowing. Private address : Studley Manor, Warwickshire. Club : Oxford and Cambridge.

HARRIS, Charles Lynton. — Manager, Press Section (Publicity Dept.), Marconiphone Co., Ltd., 210, Tottenham Court Road, London, W.1. 1920-24, in Merchant Service as Apprentice and Third Officer in steam ; 1925-29, Showroom Salesman for Marconiphone ; 1929-31, Travelling Representative ; 1931-32, with Stagecraft. Press Representative, Easter, 1933. Born September 12th, 1903. Recreation : golf, short wave radio transmitting and receiving. (Member Royal Naval Wireless Auxiliary Reserve.) Call sign NM6. Private address : 26, Carlton Avenue East, Wembley Park, Middlesex. (Arnold 1616.)

HARRIS, Herbert Reginald.—H. Hacker and Sons, Ray Lea Road, Maidenhead. With A.E.I. (British Thomson-Houston Co. and Ediswan, 1922–1936). Member of Council, R.C.M.F., since formation, Chairman, Commercial Committee B.R.V.M.A., 1932–1933. Vice-Chairman Radio Industries Luncheon Club. Born, November, 1889. Recreation : motoring, Private address : 44, Woodside Park Road, North Finchley, London, N.12.

HARRISON, Donald Frederick.—Sales Manager, The Mullard Wireless Service Co., Ltd., 225, Tottenham Court Road, London, W.1. Born November 27, 1899. Private address : 40, Gyllyngdune Gardens, Seven Kings, Essex.

HART, David.—General Sales Manager, E. K. Cole, Ltd., Southend-on-Sea.

HARVEY, Grinnell Strong.—Manager, Exide Service, The Chloride Electric Storage Co., Ltd., Clifton Junction, nr. Manchester. Born July 16, 1893. Private address : 16, Westgate Avenue, Bury Lancs.

HAYNES, Frederick Henry.—Managing Director, Haynes Radio, Ltd., Queensway, Enfield, Middlesex. Formerly Assistant Editor to " Wireless World " and " Wireless Engineer." Born October 1, 1893. Private address : 38, Sittingbourne Avenue, Enfield, Middlesex.

HEAVER, Ernest Frank.—Sales Manager and Publicity Manager of R.A. Rothermel, Ltd. Director, British Centralab, Ltd., Canterbury Road, Kilburn, London, N.W.6. Connected with importation of American hardware and tools, 1912–1915 ; R.F.C. and R.A.F. wireless operator and observer, 1916–1919 ; hardware and tool trades, 1919–1923. Joined Rothermel Corporation, Ltd., as Sales Manager in 1923. Born July 19, 1897. Private address : 37, Circle Gardens, Merton Park, London, S.W.19. (Liberty 1530.)

HENDERSON, Frederick Ewart, A.M.I.E.E.—Gold Medallist and Honours Diploma, Faraday House. Head of Osram Valve Technical Sales Dept., General Electric Co., Ltd., Magnet House, Kingsway, W.C.2. Joined G.E.C. Research Labs., 1921, and Osram Valve Sales Dept., 1924. Born August, 1898. Recreations : tennis, photography. Private address : 21, Lansdowne Road, Muswell Hill, N.10.

HERCZEG, Akos, Dipl. Ing., Dr. pol.—Liaison Engineer, E. K. Cole, Ltd., Ekco Works, Southend-on-Sea. Born July 19, 1902. Private address : " Cintra," Winsford Gardens, Westcliff-on-Sea, Essex.

HESTER, Jack Sydney Clement.—Managing Director, Truphonic Radio (Putney), Ltd., Truphonic Works, Aboyne Road, Garratt Lane, London, S.W.17. Recreations : golf, cricket. Private address : " Southlawn," Bickley, Kent. (Chislehurst 1023.)

HIGGINSON, Kingsley.—Dubilier Condenser Co. (1925) Ltd., Ducon Works, Victoria Road, N. Acton, W.3. Private address : 322, Richmond Road, Kingston-on-Thames.

HILLMAN, Charles.—Director, Hillman Bros., Ltd., 123–5, Albion Street, Leeds, and 64–66, West Bar, Sheffield, 3.

HILLMAN, Edgar Martin.—Director, Hillman Bros., Ltd., 123–5, Albion Street, Leeds, and 64–66, West Bar, Sheffield, 3. A.C.G.I., Int. B.Sc. (Engineering).

HIRST, John, B.A. (Cantab), M.I.E.E.—Managing Director, Hirst, Ibbetson & Taylor, Ltd., 9, Blackfriars Street, Manchester, and at Blackpool, Liverpool, Lancaster, Colwyn Bay, and Burnley. With A.E.G., 1910–1914 ; Willans & Robinson, Ltd., 1915–1916 ; Manager, Harland Engineering Co., 1916–1920. Founded Hirst, Ibbetson & Taylor, 1920. Born January 23, 1884. Recreations : mountaineering, golf, amateur theatricals. Private address : " Grivola," Bowden Lane, Marple, Cheshire.

HITCHCOCK, Alan Flinders.—Managing Director, Flinders (Wholesale), Ltd., East Stockwell Street, Colchester. Born January 2, 1888.

HOBDAY, Clifford Henry George.—Managing Director, Hobday Brothers, Ltd., Great Eastern Street, London, E.C.2 ; also at Manchester, Wolverhampton and Sheffield. President, R.W.F. Chairman, Joan Dancer, Ltd. Born September 18, 1899. Private address : Forest House, Chigwell, Essex.

HODSON, John Curran.—Sales Manager, Ever Ready Radio Co., Ltd., and Ever Ready Radio Valve Co., Ltd., Fonthill Works, Clifton Terrace, London, N.4., Valve sales manager of Mullard Wireless Service Co., Ltd. 1924–1931 ; sales manager, Audiovisor, Ltd., 1931–32. Born June 1, 1900. Recreations : golf, cricket, swimming. Private address : Haycot, 46, Ducks Hill Road, Northwood, Middlesex.

HOGBEN, Bernard Tunbridge, A.C.C.S., A.M.I.W.T.—Hon. Treasurer, Institute of Wireless Technology. Editor, Technical Publications, and Secretary of Radio-Manufacturers' Service, Philco Radio and Television Corpn. (Gt. Britain), Ltd., Perivale, Greenford, Middlx. Since 1917 has been doing private secretarial and courier work, followed by electro-therapeutic and television research work. Born August 13, 1901. Recreations : television research, psychology. Private address : 53, Lulworth Drive, Pinner, Middlx.

HOLMES, Herbert.—Managing Director, Holmes Bros. (London), Ltd., Holbro Works, Billet Road, Walthamstow, London, E.17. President, British Radio Cabinet Manufacturers' Association. President, Walthamstow Rotary Club, 1931–2. Originally camera manufacturer

WHO'S WHO IN RADIO

and patentee of many important inventions in that industry. Born September 12, 1875. Recreations: motoring, gardening. Private address: "Heathcote," Chelmsford Road, Woodford, London, E.18.

HOLMES, Ronald Herbert.—Director and Sales Manager, Holmes Bros. (London), Ltd., Holbro Works, Billet Road, Walthamstow, London, E.17. Born March 17, 1903. Recreations: motoring, walking, shooting, fishing. Private address: 2, Fitzroy Lodge, The Grove, Highgate Village, London, N.6.

HOUGHTON, Edgar William.—Chairman Ensign, Ltd., 88–89, High Holborn, London, W.C.1. Chairman and subsequently President of the Radio Wholesalers' Federation, 1928–34.

HUMPHRIES, Sydney John.—Head of International Copyright Dept., Electric & Musical Industries, Ltd., Hayes, Mdx. Chairman, British Phonographic Industry and Associated Copyrights, Ltd. Member of Executive Committee, International Federation of Phonographic Industry. Private address: "Homeleigh," Harlington, Middlesex.

HUNT, Cyril Harvey.—Managing Director, A. H. Hunt, Ltd., Garratt Lane, Wandsworth, London, S.W.18, also Director, A. H. Hunt, Ltd., from 1919, and of A. H. Safetisigns, Ltd., 1927–1935. Managing Director of Hellesens, Ltd., 1932–1935. Born 1897. Recreations: hunting, golf, squash. Private address: "Brightleigh," Outwood, near Redhill, Surrey.

ILIFFE, Alfred Eldred.—Director and General Sales Manager, The Benjamin Electric, Ltd., Brantwood Works, Tariff Road, Tottenham, London, N.17.

JONES, Bernard Edward.—Managing Director, Bernard Jones Publications, Ltd., 37–38, Chancery Lane, London, W.C.2. Chief Editor, "Radio Pictorial," "Television and Short-wave World"; 1909–26, technical editor, Cassell & Co., Ltd.; founded "Amateur Wireless" and "Wireless Magazine" for Cassell's. In 1926 acquired these publications for his own company; sold them to Messrs. Newnes, 1935. Founded "Radio Pictorial" in 1934, and acquired "Television" in 1933.

JONES, Frank. — London manager, Marconiphone Co., Ltd., 210, Tottenham Court Road, London, W.1. Joined Sterling Telephone Co., 1921, became Belfast Branch manager, 1923. Representative, Marconiphone Co., 1925–30. Dublin Branch Manager (Marconiphone), 1930. London Manager, 1933. Born: April 6, 1897. Recreations: golf. Private address: "Tamar," 188, The Avenue, West Wickham, Kent.

JONES, Wilfred Lawrence.—Director and Works Manager, E. K. Cole, Ltd., Ekco Works, Southend-on-Sea. Born November 15, 1902. Private address: "Long Vistas," Benfleet Road, Hadleigh, Essex.

de JONG, Anthonie.—Joint Managing Director, Philips Lamps, Ltd., 145, Charing Cross Road, London, W.C.2. Director, Mullard Wireless Co., Ltd. Born April 6th, 1891. Recreations: golf, chess. Private address: "The Hawthorns," Heath Drive, Walton-on-the-Hill, Surrey.

JOSEPH, Henry.—Representative, W.T. Lock, Ltd., and H. Vesshoff and Co., 33, Percy Street, London, W.1. After serving apprenticeship in electrical engineering 1911–14 did journeyman work until 1925, when present organisation was founded. Born October 27, 1895. Recreation: bowls. Private address: 76, Highlever Road, North Kensington, London, W.10.

JOSEPH, Joseph, M.I.E.E., M.I.R.E.—Managing Director, Aeronautical and General Instruments, Ltd., Purley Way, Croydon. Member of Council, R.C.F. Honorary Treasurer, Trustee, Member of Finance Committee, R.M.A. Member Council I.E.E., Wireless Section. Private address: The Beacon, Purley, Surrey.

KAY, Barry.—Sales Promotion Manager, E. K. Cole, Ltd., Ekco Works, Southend-on-Sea. Born May 21, 1904. Private address: 9, Leigh Heath Court, London Road, Leigh-on-Sea. (Hadleigh 58160.)

KAY, Henry Graeme Aytoun.—Manager, Radio Dept., Benjamin Electric Ltd., and Director, Magnavox (Gt. Britain), Ltd., Brantwood Works, Tariff Road, Tottenham, London, N.17. Member of Council of N.A.R.M.A.T. and R.M.A. 1924–28 and various committees of these associations; was manager radio department, Metropolitan-Vickers Electrical Co., Ltd., 1924; Sales Manager Wireless Pictures (1928) Ltd., 1928; Secretary, the Twenty Six Trust, Ltd., 1929-1931.

KING, Harrie John, F.C.C.S., F.R. Econ.S., M.I.W.T.—Secretary and Editor, Institute of Wireless Technology, 4, Vernon Place, London, W.C.1; Founder-Member of the Institute of Wireless Technology; Assistant Secretary, 1925; Secretary, 1927, to date; Editor of Institute's publications, 1926 to date. Interested in research and investigation of sound reproduction and acoustics from

1908 to date, which has included lecturing, writing, examining and organising work furthering the interests of wireless. During war service with R.N.A.S. ; later R.A.F. Spare-time interests : music, psychology, economics, motoring. Private address : 48, Mount View Road, N. Chingford, London, E.4.

KIRBY-JOHNSON, Harry Linscott.—Managing Director, Martindale Electric Co., Ltd., The Hyde, Hendon, London, N.W.9. Member London Chamber of Commerce, Member Arbitration Board American Chamber of Commerce in London. Life Member ex-British Westinghouse Association. Born May 16, 1884. Recreations : golf, camping. Private address : 23, Hillside Drive, Edgware, Middlesex.

KLEIN, Rene Henri.—Joint Managing Director, McMichael Radio, Ltd., 265, Strand, London, W.C.2 ; M.I.R.E., Vice-President Radio Society of Great Britain ; Founded Wireless Society of Great Britain. Private address : 18, Crediton Hill, West Hampstead, London, N.W.6.

KNOX, Collie.—Radio Editor, "The Daily Mail," Northcliffe House, E.C.4. During war was on active service with the R.F.C., and seriously injured in aeroplane crash ; later A.D.C. to Lord Lloyd in India and afterwards the Governor-General of the the Sudan and was on staff of the Adjutant-General at War Office. For six years on "The Daily Express" as sub-editor, special writer, radio critic and feature editor. Recreations : tennis, golf, song writing. Private address : 9, Eccleston Court, S.W.1.

KOHN, Louis.—Manager of Leeds Branch, Ward & Goldstone, Ltd., 45, Woodhouse Lane, Leeds.

LATHAM, Charles, F.L.A.A., F.I.S.A.—Secretary and Accountant of The Radio & Gramophone Trades Guardian Association, Ltd., 78, New Oxford Street, London, W.C.1. Member of The London County Council ; Member of The Public Works Loan Board ; Member London and Home Counties Traffic Advisory Committee appointed under London Passenger Transport Act, 1933. Member of London Passenger Transport Board. Justice of the Peace for County of London. Director and Accountant of The Automobile Trades Guardian Association, Ltd., Director, S. Symons & Co., Ltd., and H. Yager (London), Ltd. Chairman, Singer & Co., Ltd., Coventry. Born 1889. Private address : 30, Sunny Gardens, Hendon, N.W.4.

LEE, Arthur.—Director and Secretary, Portadyne Radio (Gorst Electrical Co., Ltd.), Gorst Road, N. Acton, London, N.W.10. Has intimate knowledge of business and commerce in the Near East due to many years' residence in Persia, Egypt, and the Balkan States. Born May 5, 1887. Recreations : golf, bowls. Private address : "Oaklands," Waterfall Road, London, N.14.

LEE, Edgar Morton, B.Sc., London, Assoc. I.E.E.—Director and General Manager, Belling & Lee, Ltd., Cambridge Arterial Road, Enfield, Middlx. Director, Insulators, Ltd., Vice-Chairman Radio Component Mfrs. Federation. Council Member, R.M.A. and I.E.E. Interested in Bakelite Moulding Component specialisation and interference suppression ; prior to jointly founding Belling & Lee, Ltd., 1922, was Physics and Physical Chemistry research worker and student demonstrator Born March 31, 1902. Recreation : slimming.

LEICESTER, Edward Frederick.—Service Manager, Philips Lamps, Ltd., New Road, Mitcham Junction, Surrey. National Joint Committee (Treasurer) P.O. Organisations, 1913–16. National Whitley Council 1920–25. A.G.D. Whitley Council, 1920–25. Executive National Industrial Alliance, 1930 to date. Born : June 18, 1887. Recreations : swimming, tennis, music. Private address : Warren Wood, Hayes, Kent.

LEVER, Edward Anthony, B.Sc., B. Com.—General Sales Manager, Pye Radio, Ltd., Africa House, Kingsway, London, W.C.2. Born February 25th, 1900. Recreations : films and filming. Private address : 75, Chiltern Road, Sutton, Surrey.

LEWIS, Edwin John Godfrey.—Head of Technical Information Division, E.M.I. Service, Ltd., Hayes, Mdx. Private radio and journalistic work, 1920-28. Joined H.M.V. as Service Engineer and Editor of Technical Information. Retained by E.M.I. Service, Ltd., on formation of that company. Made head of division, 1934. Author of "Radio Receiver Servicing and Maintenance," 1934 ; "Television—Technical Terms and Definitions," 1936. Born September 13th, 1903. Recreations : reading, writing. Private address : 1, Somerset Road, Southall, Mdx.

LITCHFIELD, Gordon Arthur, A.M.I.B.E., A.M.I.R.E., Managing Director, Nottingham Radio Supplies, Ltd., Sherwood Buildings, South Sherwood Street, Nottingham. Chairman, Midlands Section, R.W.F., 1936–7 ; Hon. Sec., Notts Radio Luncheon Club since inception in May, 1933 ; 1909–14, Building trade ; 1914–19, served with B.E.F. in France ; 1919–22, Building trade ; 1922 to date, Nottingham Radio Supplies, Ltd. Born :

WHO'S WHO IN RADIO

December 29, 1890. Recreations : aviation, engineering, golf, cinematography. Private address : Radcliffe - on - Trent, Notts.

LLOYD, Sidney.—Sales Manager in Southern Counties, Ward & Goldstone, Ltd., 40, Ashton Road, Moordown, Bournemouth.

LONGMIRE, Albert.—Manager for Sales Enquiries, Ward & Goldstone, Ltd., Frederick Road, Pendleton, Manchester. Born May 25th, 1894. Private address : 163, Fairfield Street, Ardwick, Manchester.

LYONS, Claude Lipman.—Joint Managing Director, Claude Lyons, Ltd., 40, Buckingham Gate, Westminster, London, S.W.1. B.Sc., M.I.R.E., Fellow Physical Society (London), R.S.G.B., F.R.S.A. Born September 21, 1896. Recreations : reading, photography, motoring, philately. Private address : 12, Beechcroft Avenue, Golders Green, London, N.W.11.

McCREA, Frederick Harold.—Deputy Managing Director, Dubilier Condenser Co. (1925), Ltd. ; Ducon Works, Victoria Road, North Acton, London, W.3 ; Director, Mansbridge Condenser Co., Ltd., and Isenthal, Ltd. Member of R.M.A. Council and Component Makers Federation Council. In 1922 formed Manchester Radio Co., Ltd. ; joined Dubilier 1929 as sales manager. Born October 5, 1895. Recreation : golf. Private address, "Charnwood," Ricksmansworth Road, Northwood, Middlesex.

McKENZIE, James Patrick, M.C., A.M.I.E.E., M.I.R.E.—Managing Director, Sifam Electrical Instrument Co., Ltd., Hollydale Road, Queen's Road, London, S.E.15. Director, Radioformer, Ltd. ; Works Manager, C. F. Elwell, Ltd., 1921 ; Standard Telephone & Cables, Ltd., 1923 ; founded Sifam Co., 1925. Born January 14th, 1889. Recreation : shooting. Private address : 77a, Eltham Road, Lee, London, S.E.12.

McMICHAEL, Leslie.—Chairman and Joint Managing Director, McMichael Radio Ltd., Slough, Bucks., M.I.E.E., F.I.R.E., Vice-President Radio Society of Great Britain ; Vice-President R.M.A. Apprenticed to electrical engineering, 1900 ; held transmitting and receiving licence for 1911 ; call sign 2F.G. ; helped form the Wireless Society of London, since extended to Radio Society of Great Britain ; during the war served in the Wireless Experimental Section of the R.A.F. ; for several years Secretary of the Radio Society of Great Britain ; founded present firm in conjunction with Messrs. R. H. Klein and B. Hesketh in 1920 ; a founder member of the National Association of Radio Manufacturers, serving on the Council until R.M.A. formed, and has been on Council of R.M.A. since inception. Chairman R.M.A., 1932. Born November 17th, 1884. Private address : Everest, Ashley Lane, Hendon, N.W.4.

MACFARLANE, James.—Secretary, Radio Wholesalers Federation, 26, Hart Street, London, W.C.1. From 1898-1928 connected with motor trade press ; Appointed to present position 1928. Recreations : golf, literature. Private address : Guildford Lodge, Clarendon Road, Watford, Herts.

MACQUEEN, Montague M.—Manager, Wireless Dept., General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2. Vice-Chairman, R.M.A., Chairman, R.W.T.A. Born February 18, 1898.

MAHONEY, Henry Charles.—Sales and General Manager, Beethoven Radio, Ltd., Chase Road, N. Acton, London, N.W.10. Joined Edison Bell, Ltd., in 1924 after varied scientific career in many parts of Europe. During War was sentenced to death as spy in Germany ; in 1926 was made Wireless Sales Manager and promoted in 1928 to General Wireless Manager. Lectures and writes on wireless and allied sciences. Lecturer on Salesmanship and Systems. Chief Inspector Met. Spec. Constab. (Camberwell). Born March 17th, 1887. Recreations : motoring, photography, carving, gardening. Private address : The "Oddun," Silverleigh Road, Thornton Heath, Surrey.

MALLALIEU, Herbert S.—Director, Association of Radio Battery Manufacturers, 11, Tavistock Square, London, W.C.1.

MARCONI, Marchese Guglielmo.—A Senator of Italy, Knight Grand Cross of Order of St. Maurice and Lazarus of Italy, Hon.G.C.V.O., Hon.Don., Oxford, Hon.Sc.D. Cambridge, H.Sc., LL.D. Glasgow, etc.—Marconi House, Strand, London, W.C.2. Educated at Bologna, where he was born 1874 of Italian and Irish parents and where first experiments in wireless were conducted. In 1899 established wireless between France and England. In 1901 sent messages from Cornwall to Newfoundland, 1902 extended to America. His system practically in universal use. Among honours Nobel Prize, 1909 ; Albert Medal, Royal Society of Arts, etc. Recreations : hunting, motoring, yachting. Private address : 11, Via Condotti, Rome, Italy.

MARKS, Lord, George Croydon, C.B.E., J.P.—Chairman Columbia Graphophone Co., Ltd., Director Electrical and Musical Industries, Ltd., 58, Lincoln's Inn Fields, London, W.C.2. M.I.M.E., A.M.I.C.E. Senior partner and founder of Marks & Clerk, Patent Agents and Consulting Engineers, practising in London, Birmingham, Manchester, Glasgow, New York, Washington, Chicago, Ottawa, Toronto, San Francisco. Private address : Cerne Abbas, The Avenue, Bournemouth, W.

MARKS, Maurice, A.M.I.B.E.—Managing Director of Camel Accumulators, Ltd., 9, Newington Causeway, London, S.E.1. Trained Northampton Polytechnic. Held several positions abroad and in 1927 started Camel Accumulators. Born May 15th, 1899. Recreation : yachting.

MARRIOTT, George Armstrong, B.A. (Cantab):—Manager Osram Valve Dept., The General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2. Joined G.E.C. Osram Lamp Dept., 1921 ; took over valves 1922 in addition to lamps and sole charge of valves, 1927. Born 1892. Recreations : tennis, shooting, rock climbing. Private address : 5, Pitt Street, Kensington, London, W.8.

MARTIN, Anthony Wyard.—Assistant Chief Engineer, E. K. Cole, Ltd., Southend-on-Sea. Wireless manager, Bexhill Motors, Bexhill, 1926-28. Born September 26th 1907. Recreations : yachting, football, tennis. Private address : Clun, Thames Close, Leigh-on-Sea.

MAY, John.—Editor, " Wireless Retailer and Broadcaster," 29, Bedford Street, Strand, London, W.C.2. Joined editorial staff of " Wireless Trader," " Wireless Export Trader," and " Experimental Wireless " in February, 1925. Left to go to " Industrial Daily News " and " Modern Transport " in August, 1928. Joined " Broadcaster " August, 1929. Born September 27, 1908. Recreations : writing and riding. Private address : 112, St. Leonard's Road, East Sheen, London, S.W.14. (Prospect 1998.)

MIDDLETON, Arthur.—London Sales Manager, Ferranti, Ltd., Bush House, Aldwych, London, W.C.2. A.M.I.E.E.

MILLER, Nora Evelyn.—Manager, Publicity Dept., The Edison-Swan Electric Co., Ltd., 123-5, Queen Victoria Street, London, E.C.4. Started in Edison-Swan Drawing Office 1916. Took over present work 1927. Born March 11th, 1899. Recreation : motoring. Private address : 10, Manorway, Bush Hill Park, Enfield.

MILLER, William Edward, B.A. (Cantab). M.I.W.T.—Technical Editor, " The Wireless Trader," Dorset House, Stamford Street, London, S.E.1. With the Cambridge Instrument Co., Ltd., 1924, Joined " Wireless Trader," 1925. Born June 5, 1902. Private address : 42, Hunters Grove, Kenton, Middlesex. (Wordsworth 2803.)

MONTAGUE, David.—Director and Technical and Research Adviser, Beethoven Radio, Ltd., Chase Road, N. Acton, London, N.W.10. Joint Managing Director of S. & D. Montague, Ltd., Furniture Manufacturers, Chase Road, N. Acton, N.W.10.

MONTAGUE, Sidney.—Director, Beethoven Radio, Ltd., Chase Road, N. Acton, London, N.W.10. Joint Managing Director of S. & D. Montague, Ltd., Furniture Manufacturers, Chase Road, N. Acton, N.W.10.

MOODY, Alexander Edmund. Exhibitions Organiser to the R.M.A., Astor House, Aldwych, W.C.2. Born April 12, 1886. 1906-1914 Chief Engineer, Jury's Imperial Pictures and Imperial Playhouses, Ltd. Shortly after war, Managing Director Moody's Ltd., electrical engineers. 1922-1928 joint radio sales manager, British Thomson-Houston Co., Ltd. Joined R.M.A. in 1928. War Service. Paravane Section R.N.V.R. 14th Destroyer Flotilla. Private address : 86, Augustines Avenue, Wembley, Middlesex.

MOODY, Richard Henry Cyril.—Commercial Manager, Special Products Division, E.M.I. Service, Ltd., 15–16, Alfred Place, London, W.C.1. 1918–20 with R. M. Moody, Ltd., Manufacturers ; 1920–29, Grindlay & Co., Ltd. ; 1929–32, Gramophone Co., Ltd. ; 1932 to date, Marconiphone Co., Ltd. Born : July 16, 1901. Recreations : golf. Private address : 62a, Upper Mulgrave Road, Cheam, Surrey.

MOORE-BRABAZON, Lt.-Col. J. T. C., M.C., M.P.—Ex-President R.M.A., 38, Eaton Square, London, S.W.1. Educated at Harrow and Cambridge ; early pioneer in motoring, aviation and radio ; held a transmitting licence on the spark system before the war ; Conservative M.P. for Rochester, 1918–29 ; Wallasey, 1931 ; was Parliamentary Secretary to the Ministry of Transport, 1923–7, during which time was largely responsible for passing the Electricity Act ; is a director of Associated Equipment Co., Ltd., Kodak, Ltd., and Ultra Electric (Holdings), Ltd. Born February 8th, 1884. Recreations : yachting, golf, Swiss ice sports. Clubs : White's, Carlton, R.Y.S.

MORRISON, L. Claude.—Director and Sales Manager, Kolster-Brandes, Ltd., Cray Works, Sidcup, Kent. Born August 10th,

WHO'S WHO IN RADIO

1895. Recreations: tennis, football, golf. Private address: "Furzefield," Lye Lane, Brickett Wood, St. Albans.

MULLARD, Stanley Robert, M.B.E., M.I.E.E.—Chairman, The Mullard Wireless Service Co., Ltd.; Director, The Mullard Radio Valve Co., Ltd., Mullard House, 225, Tottenham Court Road, London, W.1; Director, Radio Transmission Equipment, Ltd.; Vice-President, R.M.A. from 1928 to date. Chairman, B.R.V.M.A., 1933-34; Chairman, Wireless Section, I.E.E., 1934–35; from 1910–15 head of Research Dept., Ediswan; during war, Lieut., R.N.V.R. and Capt., R.A.F.; after war founded Mullard Companies. Recreations: hunting, golf.

MULVEY, Richard G.—Advertisement Manager, "The Wireless Trader," Dorset House, Stamford Street, London, S.E.1.

MURPHY, Frank, B.Sc., M.I.E.E., Assoc. I.R.E., M.B.E.—Chairman, Murphy Radio, Ltd., Welwyn Garden City, Herts. Founded present company 1929, after service in Engineering Dept. P.O.; Wireless Officer R.A.F. during war and later O.C. Officers Wireless School, R.A.F. Born June 16, 1889. Recreations: tennis, walking. Private address: Ludwick Corner House, Welwyn Garden City, Herts.

NEUMAN, Adalbert.—Managing Director, Tungsram Electric Lamp Works (G.B.), Ltd., Tungsram House, 82–84, Theobalds Road, London, W.C.1, and British Tungsram Radio Works, Ltd., West Road, Tottenham, N.17. Born September 17, 1900. Recreations: swimming, rowing. Private address: 59, Queensborough Terrace, London, W.2.

NEWELL, Frederick Arthur, B.Sc.—Director, Eirco (Wholesale) Limited, 29, Wellington Place, and 28-30, College Street, Belfast. Director, Eirco Services, Ltd., 19, Ormeau Avenue, Belfast. Connected with radio since 1921. Born October 11, 1894. Recreations: golf, bridge, radio. Private address: 9, Slievemoyne Park, Belfast.

NICOLL, George Jack McCracken.—Showroom Manager, Marconiphone Co., Ltd., 210, Tottenham Court Road, London, W.1. Joined company 1923. Became representative for Eastern and Southern Counties and later took charge of Marconi House showrooms. Ultimately transferred to Radio House as Showroom Manager. Born October 25, 1897. Recreations: gardening, swimming, stage. Private address: 61, Connaught Street, Hyde Park W.2.

NOBLE, James George Gillbard, M.C.—Director, Dulcetto-Polyphon, Ltd., 2–3, Newman Street, W.1. Freeman Music Industries Council. Vice-President, R.I.G.S. Born April 16, 1890. Recreation: golf. Private address: 18, Green Moor Link, Winchmore Hill, N.21.

NUNN, Robert Henry.—Managing Director, Regentone Products, Ltd., Worton Road, Isleworth, Middlesex. Founded Regent Radio Supply Co., 1924—absorbed by present company 1935. Partner in Equity Contracts, Financiers. Born March 26, 1901. Recreation: yachting. Private address: Tetherdown, Courtlands Avenue, Hampton, Middlesex.

OLIVER, Charles.—Chairman and Managing Director, Oliver Pell Control Ltd. (Varley), Cambridge Place, Burrage Road, Woolwich, London, S.E.18. A.I.E.E. Founded company in 1898.

OSBORNE, Gerald Robert.—Sales Manager, Marconiphone Co., Ltd., 210-212. Tottenham Court Road, London, W.1, Wireless operator M.I.M.Co., Ltd., 1917. From 1922 with present company. Born November 4, 1900. Recreation: golf. Private address: "Heathfield," 26, Briar Road, Kenton, Middlesex.

OTTEN, J. H.—Publicity Manager, Philips Lamps, Ltd., 145, Charing Cross Road, London, W.C.2. Born March 17, 1904. Recreations: tennis, swimming, Private address: 1, Thurlow Court, 20, Thurlow Road, London, N.W.3.

OZANNE, Guy Durand, M.C.—Manager, Wingrove & Rogers, Ltd., 188-9, Strand, London, W.C.2. Director, Wright & Weaire, Ltd., 740, High Road, Tottenham, N.17. M.I.E.E. in 1928. Educated Elizabeth College, Guernsey. Entered Sandhurst, 1908. Joined Indian Army, 1909. Captain, 1915; Major, 1917. Member of Council, R.M.A., 1932–36; First Chairman, Radio Component Manufacturers Federation, 1933, Vice-President, 1935; served during the war in East Africa, twice mentioned in despatches; retired 1923 with major's rank; since November, 1930, Lt.-Col. Commanding (City of London) Divisional Signals, T.A., Brevet-Colonel 1934; joined Radio Communication Co., Ltd., 1924; manager, Broadcasting Dept., 1925; joined Wingrove & Rogers, Ltd., 1926. Director, Wright & Weaire, Ltd., 1936. Born April 2, 1889. Recreations: golf, riding. Private address, 127, Latymer Court, London, W.6. (Riverside 5891.) Club: Junior United Service.

PAGE, Reginald Brougham.—Managing Director, Celestion, Ltd., Kingston-on-Thames. Born, May 27, 1897. Private address: "Kenilworth," Woodlands Road, Surbiton, Surrey.

PAGE, William Ivan Gregory, B.Sc. (Honours, London).—Radio Consultant. Chief Radio Engineer, C.A.C., 1934–36. 1922–27, Joint Managing Director British and Colonial Industries Assoc., Ltd.; 1927-33, on Technical Editorial Staff of "The Wireless World." Born: September 11, 1891. Recreation: squash racquets. Private address: Mayfield, Oxshott, Surrey.

PARTRIDGE, Clifford Arthur Frank S.—Managing Director, Partridge & Mee, Ltd., Parmeko Works, Aylestone, Leicester. Born February 21st, 1900. Private address: Newlands, Chorley Wood Road, Rickmansworth, Herts.

PATERSON, John Russell.—Chartered Accountant. Partner, "Ulster and Scottish Radio Dealer," 29, Cadogan Street, Glasgow, C.2. Secretary, Scottish Radio Golf Society. Publisher of "The Scottish Nurse," "The Scottish Electrical Engineer." Organiser, "Glasgow Weekly Herald" Radio Exhibition, 1931–32–36. Born April 20, 1894. Recreation: golf. Private address: 84, Stewarton Drive, Cambuslang.

PAYNE-GALLWEY, Reginald Frankland.—23, Denmark Street, London, W.C.2. (Temple Bar 6870). B.R.V.M.A. With Mullard's 1922-32, now acting as agent. Born April 15, 1889. Recreation: Golf. Private address: 31, Earls Court Gardens, London, S.W.5.

PENWILL, Leslie Charles, Companion I.E.E., Africa House, Kingsway, London, W.C.2. Director and Secretary, Electrical Constructors Association, Incorp., N.E.C.T.A., Ltd.; National Federated Electrical Association; National Association of Radio Retailers, Ltd. Private address: "Greenside," Woodlands Road, Surbiton, Surrey.

PERKS, Frederick William.—Sales Manager, The Gramophone Company, Ltd., 98–108, Clerkenwell Road, London, E.C.1. Born November 22, 1891. Recreation: golf. Private address: 81, Greencroft Gardens, Hampstead, London, N.W.6.

PHELP, Arthur Frederick.—Chairman and Director, Henderson's Wholesale Electrical & Radio, Ltd., Electric House, Queen's Road, Brighton; Vale Road, Tunbridge Wells; 109, Chapel Road, Worthing; 1, Soho Square, London, W. Seven years' apprenticeship in printing and publishing trades. Three years' experience in Boston, U.S.A. Started in same business on own account in England in 1883. After three years as auctioneer and valuer, returned to printing and publishing until 1920. Joined Board of Associated Electrical, Ltd., until 1923; then founded Henderson business. Treasurer of Guild of Freemen Lodge; Past Master with London Rank Honours. Born August 31st, 1862. Recreations: work, golf. Private address: Calthorpe House, Lewes Crescent, Brighton.

PHILIPS, Dr. Anton Frederik.—President, N. V. Philips' Radio, 29, Emmasingel, Eindhoven, Holland. Doctor L.C. Handelshoogeschool, Rotterdam. Born March 14th, 1874. Private address: Huize de Laak, Eindhoven, Holland.

PINKHAM, Charles, M.A. (Cantab).—Publicity Manager, The General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.

POCOCK, Hugh Shellshear.—Editor "The Wireless World," Dorset House, Stamford Street, London, S.E.1. Born 1894.

PRIESTLY, John.—Proprietor, Priestly & Ford, 3-11, Carr's Lane, Birmingham,4; also at Manchester and Nottingham. Chairman, Midland Radio Luncheon Club; past Chairman, R.W.F., Midlands Section. Born March 24th, 1883. Recreations: reading, writing, travel. Private address: "Shawms," Barnt Green, Worcs.

PRINCE, Herbert Stanley, M.B.E., M.C., A.M.I.R.E.—Chairman, Anti Static Installation, Ltd., St. Stephen's House, Cannon Row, London, S.W.1, and "Natrasco" Works, Cobbold Estate, Willesden, N.W.10. Director, Telephone Installing Service Co., St. Stephen's House, S.W.1. Served in France 1914–18, and was attached to R.E. Signals, awarded M.B.E., M.C., Ordre de l'Couronne, Croix de Guerre and '14 Star. Entered radio 1922. Service manager, Philips Lamps, Ltd., 1928–9. Founded N.R.S., Ltd., 1932, and Anti Static Installation, Ltd., 1936. Captain, Queen Victoria's Rifles. Born December 26, 1895. Recreations: tennis, motoring. Private address: Constitutional Club, Northumberland Avenue, London, W.C.2. Also member British Wireless Dinner Club and R.I.L. Club.

QUARRINGTON, C. A. G.—Publicity Manager, A. C. Cossor, Ltd., Cossor House, Highbury Grove, London, N.5.

REITH, Sir John Charles Walsham.—Director General, B.B.C. Broadcasting House, London, W.1. G.B.E., D.C.L., LL.D. Served five years' engineering apprenticeship in Glasgow; engineer, S. Pearson & Son, Ltd., London, 1913; during war, Major R.E. 1914–15, wounded; munition contracts for Gt. Britain in America, 1917; Admiralty 1918; Ministry of Munitions, 1919. General Manager, Wm. Beardmore & Co., Ltd., Coatbridge,

WHO'S WHO IN RADIO

1920; General Manager, B.B. Co., Ltd., 1922; Managing Director, 1923. Director General, British Broadcasting Corporation, 1927. Clubs: Athenaeum, Royal Automobile. Born 1889.

RELPH, Douglas Sisson.—Editor, "The Wireless Trader," Dorset House, Stamford Street, London, S.E.1. Editorial Assistant "Amateur Wireless" and "Work," 1923; Assistant Editor, "Wireless Magazine," 1925; Editor, "Amateur Wireless" and "Wireless Magazine," 1933; Editor, "Aero and Airways," 1935. Joined "The Wireless Trader," 1936. Born May 15 1905. Recreations: studying the theory and practice of weekly and monthly periodical production, and the science of public relations. Private address: 204, Sutton Court Road, London, W.4. (Chiswick 5045.)

RICHMOND, Frank S. — Electrolytic Condenser Sales, Plessey Co., Ltd., Vicarage Lane, Ilford, Essex. Radio trade since its inception. Born February 28, 1898. Recreations: swimming, motoring.

RIDDIOUGH, John William, Assoc. Inst. R.E.—Proprietor Frank Riddiough & Son, Lee Street, Thornton Road, Bradford. Councillor Radio Wholesalers' Federation 1928 to date. Chairman, North Midland Section R.W.F., 1934–35. Born February 12, 1889. Recreations: motoring, shooting, short wave transmission and reception, experimental station G.5SZ. Private address: Rosse-Lyn, Frizinghall, Bradford.

RIDGEWAY, John Whinfrey.—Assistant Manager, Radio Division, Edison Swan Electric Co., Ltd., 155, Charing Cross Road, London, W.C.2. A.M.I.R.E. Engaged in electrical research work, 1918-24; joined Metro-Vick Supplies, Ltd., 1924; sales manager Radio Dept., 1928, since 1929 with present company. Born February 13, 1903. Recreations: yachting, photography. Private address: Threeways, Ockley, Surrey.

RIDLEY, John Harry Dunn, Grad. I.E.E. —Chief Radio Engineer (Setmakers' Section), Edison Swan Electric Co., Ltd., 155, Charing Cross Road, London, W.C.2. Previously with Burndept, as Chief Engineer. Owner of radio station G.5NN, first to communicate with Australia (18 metres), Mosul (Iraq) and S. America. First in Europe to receive American broadcasting. Recreations: shooting, cinematography.

RIDOUT, Herbert C. —Advertising Manager, Columbia Graphophone Co., Ltd., 98-108, Clerkenwell Road, London, E.C.1. Founder Member and Hon. Publicity Officer to Advertising Managers' Assoc. since 1933. Recreation: motoring.

ROBB, Robert James.—Service Development Division, E.M.I Service, Ltd., Hayes, Mdx. Vice-President, Province of Quebec Radio Trade Association, Montreal, Canada. Was for five years with Canadian Marconi Wireless Telegraph Co., Montreal; 18 months Royal Canadian Naval Air Service; and eight years President of Radio, Ltd., of Montreal. British-born Canadian. Born September 12th, 1898. Recreations: swimming, golf. Private address: 8, North Hyde Road, Hayes, Middlesex.

ROBERTS, Harry Charles.—Northern Area Manager, Mullard Wireless Service Co., Ltd., 47a, Fountain Street, Manchester. Marine Wireless Operator, R.N.R., and Mercantile Marine for Marconi International Co., Ltd. Joined Marconiphone staff on inception of broadcasting and joined Mullard's in 1926. Born November 5, 1899. Private address: "The Chalet," Bramhall Park Road, Bramhall, near Stockport, Cheshire.

ROBERTSON, Arthur Albert George.—Manager and Buyer, Radio, Electrical and General Merchandise Depts., Dulcetto Polyphon, Ltd., 2–3, Newman Street, London, W.1. Born November 1, 1900. Recreations: tennis, swimming. Private address: 4, Bean Road, Bexleyheath. (Tel.: No. 1563.)

ROBERTSON, James.—Sole proprietor, James Robertson, radio, motor and cycle factor, 95, West Nile Street, Glasgow, 56-58, Rose Street, Edinburgh. President, Scottish Motor Trade Association, 1935-6. Started business 1908 in grandfather's firm, the North British Machine Co., Ltd., Glasgow. Joined Army, 1915; and started own business in 1919 after demobilisation. Born March 1st, 1892. Recreations: fishing, golf. Private address: 17, Sherbrooke Avenue, Glasgow, S.1.

ROBINSON, Frederick Henry, A.M.I.R.E., Supervising Editor and Manager, "The Broadcaster" and associated trade publications, Odhams Press Ltd., 29, Bedford Street, Strand, London, W.C.2. Hon. Sec., Radio Industry Golfing Society. Formerly with Marconi's Wireless Telegraph Co., Ltd. Born May 6, 1901. Recreation: golf. Private address: 28, Vernon Road, Leigh-on-Sea, Essex.

ROBINSON, Thomas Allen White.—Bush House, Aldwych, London, W.C.2, Director, Pye Radio, Ltd., Lissen Ltd., Ever Ready Radio Valve Co., Ltd., and United Rentals, Ltd. Member of Council

R.M.A. Born August 28th, 1886. Private address: Brambledown, Tower Road, Hindhead.

ROGERS, Maurice Roger.—Founder and proprietor of M.R. Supplies, 11, New Oxford Street, London, W.C.1. In radio business since 1924 in technical and managerial capacities and first introduced fidelity microphones at popular prices. Born June 24th, 1894. Much too busy for recreations. Private address: "Shaldon," Chorley Wood, Herts.

ROSEN, Edward E.—Chairman and Managing Director Ultra Electric, Ltd., and Chairman, Ultra Electric (Holdings), Ltd., Western Avenue, Acton, London, W.3. Member R.M.A. Council, 1930–34, Chairman, R.M.A., 1936–37. Entered Marconi's Wireless Telegraph Co., Ltd., before the war; served in Flying Corps, Radio Section, 1915–18; founded firm of Edward E. Rosen & Co. in 1919; converted to limited company 1925; has invented and patented many improvements in radio and gramophone amplifiers. Born July 22, 1896. Recreations: golf, cinematography.

ROTHERMEL, Royden Albert.—Managing Director, The Rothermel Corporation, Ltd., and British Centralab, Ltd., Rothermel House, Canterbury Road, London, N.W.6. With various American manufacturing companies as export sales manager and manager until 1913; organised exporting business to Europe 1913; opened office in London 1914; engaged in sale of motor-car accessories and components until the beginning of the radio industry in Great Britain and has been part of it since, trading as R. A. Rothermel, Ltd. Born May 13, 1879. Recreations: golf, tennis, motoring. Private addresses: 23, Orchard Court, Portman Square, London, W.1. (Welbeck 7025) and The White House, Amberley, Sussex.

ROWE, Bertrand Ernest.—Northern Area Manager, Marconiphone Co., Ltd., 210, Tottenham Court Road, W.1. On B.R.V.M.A. Committee, 1928–32. Born March 29th, 1892. Recreations: golf, motoring. Private address: 35, Broad Lawn, New Eltham, S.E.9. (Eltham 2810.)

ROYDS, George Dawson, B.Sc., A.I.P.A.—Managing Director, E. Walter George, Ltd., Advertising Consultants. Director Arks Publicity, Ltd., 1923; Sales Development Manager, Phillips Rubber Soles, Ltd., 1929. Present company, 1931. Born June 2nd, 1899. Recreation: helping others. Private address: Crossways, Haywards Heath, Sussex.

SAEMANN, Hans Josef.—Managing Director, British N.S.F. Co., Ltd., Waddon Factory Estate, Croydon, Surrey. Born July 3, 1898. Private address: "Glenrosa," Whitgift Avenue, South Croydon.

SALAMAN, Walter John.—Cabinet Sales Manager, Houghton-Butcher Manufacturing Co., Ltd., Ensign Works, Walthamstow, London, E.17. Staff Capt., R.A.F., during war. Connected with radio since 1911. President, British Radio Cabinet Manufacturers' Association. Born February 18, 1890. Recreation: motoring. Private address: "The Brackens," Heather Walk, Edgware, Middlesex.

SCOP, Leo, A.M.I.E.E. — Managing Director, Eirco (Wholesale), Ltd., 29, Wellington Place and 28–30, College Street, Belfast. Director, Eirco Services, 19, Ormeau Avenue, Belfast. Started Eirco (Wholesale), Ltd., who are also electrical factors, in 1921. Born November 18, 1893. Recreations: golf, bridge. Private address: 17, Downview Avenue, Belfast.

SELLERS, Harold Wadsworth.—Managing Director, Sellers of Leeds, Standard Buildings, Leeds. General Manager, Collaro, Ltd., Culmore Works, Peckham, London, S.E. Immediate Past Chairman, Leeds Radio Luncheon Club; Chairman of Directors, Neil Larsen & Son, Ltd., Leeds; Chairman, George Casperson, Ltd., Leeds. Member of Leeds City Council; Apprentice engineer, 1903–8; Manager of engineering works in Leeds, 1908–11. Managing Director, Machine Tool Works, Keighley, 1911–22. Formed Sellers of Leeds, 1922. Born March 25, 1887. Recreations: yachting, golf, politics. Private address: "Moorcroft," Sandmoor Drive, Alwoodley, Leeds.

SHORE, George Charles.—Sales Manager, Reproducers and Amplifiers Ltd., Frederick Street, Wolverhampton. A.M.I.R.E. Member of Council of N.A.R.M. and N.A.R.M.A.T., 1928-27; sales manager, Burndept, Ltd., 1921. General sales manager, Symphony Gramophone, Co., Ltd., and National Electric Co., Ltd., 1929–30. Was Sales Managers of Flinders (Wholesale), Ltd., 1930–32. War service R.F.C. and R.A.F., France, Egypt and N.W.F. India. Born August 26th, 1899. Private address: Broad Lane, Bradmore, Wolverhampton. (Wolverhampton Penn 36875).

SINCLAIR, Herbert Gray.—Director and Radio Editor, "The Pianomaker and Music Seller," 204, Gt. Portland Street, London, W.1. Born April 2, 1914. Private address: 2, Moss Hall Crescent, N. Finchley, London, N.12.

SINCLAIR, William Herbert.—Director and Editor, "The Pianomaker and Music Seller," 204, Gt. Portland Street, London,

WHO'S WHO IN RADIO

W.1. Private address: 2, Moss Hall Crescent, London, N.12.

SLATER, Harry G.—General Sales Manager, Philips Lamps, Ltd., 145, Charing Cross Road, London, W.C.2.

SMITH, Edward Charles Scott.—Managing Director, Portadyne Radio, and Gorst Electrical Co., Ltd., 18, Gorst Road, London, N.W.10. Interested in radio since 1925. Recreation: motoring. Private address: End House, Coombe Rise, Kingston-on-Thames, London, W.7. (Kingston 1937.)

SMITH, M.—Service Station Manager, Oldham & Son, Ltd., Hyde Road, Denton, Manchester. Foreman in accumulator assembly, Oldham & Son, Ltd., 1921. Designs Dept., 1924; Sales Section, 1926; charge of Radio Sales Section, 1928. Born June 16th, 1890. Private address: 28, Haughton Green Road, Denton, Manchester.

STANLEY, Charles Orr.—Director, Pye Radio, Ltd., Cambridge. Private address: Lisselane, Clonakilty, co. Cork.

STANLEY, Edward James Walker, M.A., B.Sc.—Area Manager of Pye Radio for London and surrounding counties. Prior to joining Climax was five years Managing Director, E. Walter George, Ltd., Radio Advertising Specialists. Born, April 6th, 1896. Recreations; tennis, golf, yachting, swimming. Private address: Devonshire Club, St. James Street, London, S.W.1.

STEWART, Alastair Campbell.—Drydex Sales and Production Manager, Exide Batteries, Exide House, 205–31, Shaftesbury Avenue, London, W.C.2. With Exide since 1920. Two years' Service Manager; 1923–4, Sales Engineer, South-West area; 1924–31, Manager, Bristol and West of England Depot; 1931 to date, as above. Born: June 7th, 1892. Recreations: shooting, golf, fishing. Private address: Little Orchard, Holly Lane, Banstead, Surrey. (Burgh Heath 1966).

STRACHAN, David Grant.—Director, Radio Manufacturers Association, Astor House, Aldwych, W.C.2. Secretary, National Association of Radio Manufacturers, 1923-1924, and of National Association Radio Manufacturers and Traders, 1924 to 1926. Born, July 26th, 1866. Recreation: gardening.

SUDLOW, Edmund William, F.C.I.S., F.C.W.A., F.S.A.A.—Managing Director, Block Batteries, Ltd., By-Pass Road, Barking, Essex. Chartered Secretary and Accountant. 1918, private secretary to Sir Thomas Lipton; 1919, Secretary, Fullers United Electrical Works, Ltd., 1926, Director and Secretary, Fuller Accumulator Co. (1926), Ltd.; 1931, Managing Director, Fuller Accumulator Co. (1926), Ltd. Private address: 39, Holcombe Road, Ilford, Essex.

SWINEY, Douglas Herbert William.—Area Sales Manager, Wingrove & Rogers, Ltd., 188, Strand, London, W.C.2. Radio Communication Co., Ltd., 1922-27. Born April 23rd, 1898. Recreations: golf. Private address: 88, Thames Drive, Leigh-on-Sea. (Phone: Leigh-on-Sea 7358).

TALLENTS, Sir Stephen George, K.C.M.G., C.B., C.B.E.—British Broadcasting Corporation, Broadcasting House, London, W.1. Born October 20th, 1884. Private address: St. John's Jerusalem, Sutton-at-Hone, Dartford, Kent.

TAYLOR, George Stanley.—Advertising and Sales Manager, Whiteley Electrical Radio Co., Ltd., Victoria Street, Mansfield, Notts, and 109, Kingsway, London, W.C.2. Born: June 10th, 1903. Recreations: swimming, boating. Private address: 4, Park Croft, Park Road, Wallington, Surrey.

TEBB, Charles William, F.C.L.—Southern Area Manager, The Marconiphone Co., Ltd., 210-212, Tottenham Court Road, London, W.1. During War, Lieutenant R.F.A. Born November 18th, 1892. Recreation: golf, Private address: 790, Sidcup Road, New Eltham.

THOMAS, John Henry.—General Manager, A. C. Cossor, Ltd., Cossor House, Highbury Grove, London, N.5. M.C., M.I.E.E.

TIMMS, Charles Edward.—Managing Director, Besson and Co., Ltd., Stanhope Place, Marble Arch, London, W.2. Secretary, Association of Gramophone, Radio and Musical Instrument Manufacturers and Wholesale Dealers. 1898, left school and joined Besson and Co., Ltd. 1902–1910, Secretary, 1910–1925, Director, 1925 to date, Managing Director of Besson and Co., Ltd. Born May 1, 1880. Private address: 17, St. John's Road, Golders Green, London, N.W.11.

TOBIN, J. Raymond, Mus. B., Dunelm.—Editor "The Music Teacher" and "The Piano Student." Private address: "Alpha," Moss Lane, Pinner, Middlesex.

TURLE, Edgar Harold.—Chief Electrical Engineer, H. J. Cash & Co., Caxton House, Westminster, London, S.W.1, M.I.E.E., M.I.R.E., A.M.I.Mech.E.; Vice-Chairman I.W.T. 1926; Vice-President, 1932 onwards; pupil to G. F. Ratcliff 1903; Chief Assistant Engineer 1909; Resident Elec-

trical Engineer new works (E.H.T.) Billingham, 1918; Chief Electrical Engineer since 1919; Lecturer in Electrical Engineering, Tottenham Polytechnic, 1924-31; Special Lecturer in Mechanical Power Equipment, Croydon Polytechnic, 1930–36, now Head of Dept. in Electrical Engineering, Croydon Polytechnic, 1932–36. Lecturer in Electrical Engineering Practice, Borough Polytechnic. Author of many articles on radio and allied subjects. Born December, 1887. Recreation: camping. Private address: Deerhurst, Beckenham.

TYERS, Paul Douglas.—Consulting Radio Engineer, 28, Victoria Street, London, S.W.1. Commercial radio telegraphy and telephony with Radio Communication Co., Ltd., up to 1922; founded and edited "The Wireless Engineer and Experimental Wireless," 1923; commenced present consulting practice 1925; owns laboratory equipped for design and measurement work extensively used by the industry. Recreations: golf, ice skating, music, scientific literature. Private address: Devereux House, Devereux Drive, Watford.

UPTON, Walter.—Joint Governing Director, E. Upton & Sons, Ltd., 175–9, Linthorpe Road, Middlesbrough, and Stockton, Darlington, Redcar, South Bank, and Billingham. National Chairman, W.R.A., Secretary N.E. Area, W.R.A., and Delegate to W.R.A. Council, London; 1929-32, secretary Tees-side Wireless Retailers' Association (independent); 1928-29 secretary, Tees-side Gramophone Dealers' Association. Joined Uptons in 1921, became partner with Edward Upton in 1929; business established in 1869, and started to sell radio with commencement of broadcasting. Born May 18th, 1904. Recreations: golf, badminton, bridge and motoring. Private address: "Windy Ridge," Coast Road, Redcar.

VERRELLS, Henry Victor.—Export Manager, E. K. Cole, Ltd., Ekco Works, Southend-on-Sea. Recreations: golf, motoring.

VERRELLS, William Streatfield.—Chairman and Managing Director, E. K. Cole, Ltd., Ekco Works, Southend-on-Sea.

VIGERS, Thomas Whitehair, Colonel, O.B.E., M.C., T.D.—German Diplomas in Chemistry and Physics. General Manager British Blue Spot Co., Ltd., Rosoman Street, London, E.C.1, 1933-35. Deputy Chief Signal Officer (T.A.) of London District. Member Royal Engineers Board (War Office). Born: March 28th, 1887. Recreations: golf, sailing. Private address: 3, Clareville Grove, South Kensington, S.W.7. Club: Junior Army and Navy.

VOIGT, Paul Gustavus Adolphus Helmuth, B.Sc., A.M.I.E.E.—Director, Voigt Patents, Ltd., The Courts, Silverdale, London, S.E.26. With Edison Bell, Ltd., from 1922 until May, 1933, when he bought their stock of his patented parts (speakers and microphones) and set up in business on his own account. Born December 9th, 1901. Recreations: motoring, tennis. Private address: 53, Church Road, London, S.E.19.

WALKER, George Leonard.—Peto and Radford, 50, Grosvenor Gardens, London, S.W.1; trained at Edmundson's Electricity Corpn., Ltd.; has served Siemens, Armstrong Whitworth, Chloride Electrical Storage, and Pritchett & Gold, whose portable accumulators are marketed by Peto & Radford under the name "Dagenite." Born December 4th, 1890. Recreation: golf, tennis. Private address: Lawnswood, Grimwade Avenue, Addiscombe, Surrey.

WARD, Gordon Ebden.—Managing Director, City Accumulator Co., Ltd., and C.A.C. Cabinets, Ltd., 18, Norman's Buildings, E.C.1. Founded City Accumulator Co., 1921. Active service Royal Engineers. Born December 24th, 1891. Private address: "Bengairn," Mayland, Essex. (Latchingdon 331.)

WARRILOW, William Edward, A.M.I.E.E., M.J.I.—Odhams Press Ltd., Long Acre, W.C.2. Special Electrical Commissioner "John Bull," "Passing Show," "Ideal Home," "Picturegoer." Vice-President Electrical Commercial Travellers' Association. 1894-99, Municipal Electricity Supply at Cheltenham, Torquay, Huddersfield and Manchester; 1900-2, Electrical manufacturing with Westinghouse and Ferranti; 1903-6, Editor "The Electrical Magazine;" 1907-21, advertising manager "The Electrician;" 1922-24, Advertising Agent for "Broadcaster," and "Modern Wireless" and "Wireless Weekly" for J. Scott-Taggart; 1925-29 Special Electrical Commissioner for Odhams Press, Ltd.; 1929-31 Assistant Manager, Edison Storage Battery Co.; 1931, returned to original post at Odhams Press, Ltd. Born January 15th, 1877. Recreations: golf. Private address: Amber Way, Nancy Down, Oxhey, Herts.

WATKINS, A. E.—Managing Director, Watmel Wireless Co.,Ltd., Imperial Works, High Street, Edgware, Middlesex.

WEBSTER, Russell.—Director, New London Electron Works, Ltd., East Ham, London, E.6. Started with W. J. Webster (Parent), completioners of advertising. 1912-14, with Rembrandt Intaglio Printing Co., Ltd. (Advertising Section). 1914–17 War service. 1917-20, with metal merchants. 1920 to date, with New London

WHO'S WHO IN RADIO

Electron Works, Ltd. Born: March 25, 1888. Recreations: golf, swimming. Private address: 29, Morpeth Mansions, London, S.W.1, and Mammina, Pevensey Bay.

WEESE, George Rodolph, B.Sc., M.I.R.E.—Managing Director, Quadrant Carbon and Metal Products, Ltd., Cumberland Road, Stanmore, Middlesex. 1924–31, Chief Engineer, Victor Talking Machine Co., Montreal; 1922–24, Manager, Radio Sales and Special Engineering, Northern Electric Co., Canada. Prior to that, Sales Manager, John Milne & Sons, Canada's first radio factors. Born June 27, 1899. Recreations: golf and motor yachting. Private address: 1, Vincent Court, Green Lane, Hendon, N.W.4. (Hendon 8395.)

WELHAM, Laurence. — Assistant Sales Manager, The Gramophone Co., Ltd., 98–108, Clerkenwell Road, London, E.C.1. With Gave, Jackson & Co., chartered accountants, 1918-22. Joined Columbia Co. as Manager, Dealers' Accounts Dept., 1922. Appointed representative for South London, 1927; and for West End, 1929. Made Southern Sales Supervisor, 1931. Similar position for Gramophone Co., 1933 (after amalgamation). Appointed Instrument Sales Manager (Columbia), 1935. Born July 6th, 1900. Recreation: golf. Private address: 491, Great West Road, Hounslow, Middlesex.

WHEELDON, Douglas Parker.—Secretary, British Radio Valve Manufacturers' Assocn., 59, Russell Square, London, W.C.1. Previously Manager, Six-Sixty Radio Co., Ltd. Private address: 23, Woodend, Sutton, Surrey.

WHITELEY, Alfred Harold.—Managing Director, Whiteley Electrical Radio Co., Ltd., Radio Works, Mansfield, Notts. Chairman, Notts Radio Luncheon Club. Born June 15th, 1893. Recreations: golf. Private address: 19, Alexandra Avenue, Mansfield, Notts.

WHITTINGHAM, Robert Buxton.—Chairman and Managing Director, Portadyne Radio, Gorst Road, North Acton, London, N.W.10. Founder of Whittingham, Smith & Co.; pioneer of portable radio receivers, and claims to be producer of first radio portable incorporating a loudspeaker. Born 1900. Recreation: flying. Private address: Oakdene, Manor Road, Hinchley Wood, Esher, Surrey.

WILLBY, Stanley George.—In charge of advertising, retail publicity and publications, Murphy Radio, Ltd., Broadwater Road, Welwyn Garden City. Formerly Editor "Wireless and Gramophone Trader" and associated publications. Lifelong association with journalism. Born November 22, 1900. Private address: 7, High Oaks Road, Welwyn Garden City. (Welwyn Garden 470.)

WILLIAMS, John Harold.—Managing Director, Marconiphone Co., Ltd., 210, Tottenham Court Road, London, W.1. Director, E.M.I. Service, Ltd. Vice-President, R.M.A. Management Committee, B.R.V.M.A. Has served with Marconiphone Co., Ltd., since 1922, as Sales Representative, Assistant Branch Manager, Assistant Sales Manager, Sales Manager. Born May 4th, 1896. Recreations: golf, motoring. Private address: 10, Forty Lane, Wembley Park, Middlesex.

WILLIS, Robert.—Chairman and Joint Managing Director of Dulcetto Polyphon, Ltd., 2 & 3, Newman Street, London, W.1.

WILLMOTT, Charles William.—Managing Director, East Anglian Distributors, Britannia Road, Norwich; Willmott's Stores, Ltd., 48-51, Prince of Wales Road, Norwich. Vice-President, W.R.A., 1935–36. Chairman, Norwich City Sports Club, Ltd.; Councillor, Norwich Rotary Club. Apprenticed to boot trade, 1893; cycle engineering, 1896; secretary and sales manager, 1898; manager, advertising and billposting company, 1899; manager cycle depot, 1903, in Bedfordshire; manager cycle depot in Lancs, 1906; bought present business 1910. Born May 24th, 1880. Recreations: tennis, badminton, motoring. Chairman, Harvey Lane Sports Club, Ltd., Norwich. Private address: 2, Britannia Road, Norwich.

WINGROVE, Major Charles William, M.C.—Managing Director, Wingrove & Rogers, Ltd., Mill Lane, Old Swan, Liverpool. Founded in 1919, with Mr. W. Rogers and Mr. G. S. Wingrove, present firm. In 1926, incorporated British Electric Vehicles, Ltd. In 1927 acquired the broadcasting business of Radio Communication Co. Acquired Wright & Weaire, Ltd., 1936. Born January 28, 1889. Private address: St. Ives, Sandfield Park, West Derby, Liverpool.

WYBORN, Edward John, B.Sc., A.C.G.I., A.M.I.E.E.—Chief Engineer, E. K. Cole, Ltd., Ekco Works, Southend-on-Sea. Essex. Director, Scophony, Ltd. Private address: "Ray View," Undercliff Gardens, Leigh-on-Sea.

YOULE, Frederick.—Valve and Battery Sales, Marconiphone Co., Ltd., 210, Tottenham Court Road, London, W.1. B.Sc. (Eng.), A.C.G.I., A.M.I.E.E. With Marconiphone since 1922.

TELEVISION'S 1937 SALES PROSPECTS

Television definitely starts to sell in 1937 on a large scale, backed by a number of manufacturers of complete television receivers and by a real entertainment service of programmes from the B.B.C. It is not usual in a publication such as BROADCASTER ANNUAL to deal with the year's selling prospects, but here is a new Industry on the threshold of its career—so an exception has been made. This and following pages survey the 1937 position and probable progress.

Actual reception proves that the B.B.C. estimate that television would be available only within 25 miles radius of Alexandra Palace (shown by inner circle) is a conservative one. Sets are working satisfactorily in a wide area (shaded on the map) outside this circle. Reception on the outer edge of this "extra" area depends on local conditions and whether or not there are intervening hills. What this means in the number of radio homes which could receive television is outlined on the next page. Long distance "freak" reception outside the area shown has been obtained at Margate and Brighton.

Television's 1937 Sales Prospects

Two Million Radio Homes are

Will television affect my business in 1937 ? Many dealers must be asking themselves this question. Already it is a big factor for many of them, and this survey sets out to suggest what will probably happen during the year. Unlike most material in the ANNUAL, this article is necessarily topical. But if it is borne in mind that it is written as at January this will not detract from it.

Over a quarter of the licensed listeners of Britain reside in the area served by the Alexandra Palace television transmissions—2,000,000 radio homes. This is one surprising and thought-provoking fact disclosed by the BROADCASTER map given on page 43.

Television is no longer a matter of concern to an insignificant minority of retailers. To approximately a quarter of the Industry's dealers it is at this moment a big factor which definitely concerns their businesses.

Watch London

Other dealers—especially those in the Midlands, for which the next television transmitter is scheduled—must watch closely all developments in the London area.

From the manufacturers' point of view television is shown to have an enormous market, which contains a large proportion of Britain's wealthiest people.

Television in all its aspects, commercial, technical and programme, is admittedly in a formative stage. There is still a smack of the experimental about it.

To appreciate the present position let us see what television has achieved since its inception last autumn.

Statistics Wanted

No statistics of total receiver sales are available even to R.M.A. members, although they are being collected. Official bodies and manufacturers alike are silent on this question.

BROADCASTER'S investigations, confirmed by an official's "unofficial" statement, suggest that the number of receivers in use at the end of 1936 was near the 1,000 mark. Remembering that television sets sell at over £100 each, and that only half a dozen firms have been in production, that figure, even if hypothetical, indicates that to date television has resulted in a worthwhile turnover.

During 1937 manufacturers can be expected to make real efforts to speed production and develop sales.

Sales can be said to have been created by the initial novelty appeal of television. They do not enable one to state that television has proved capable of *earning* sales. Even any current sales figures would be largely spurious, because a proportion of sets produced must be going into use, not as domestic instruments, but for publicity.

Sales, not Novelty

A sales manager's opinion is that now retailers are showing signs of getting down to *selling* television. Previously they were too busy to interest themselves beyond, perhaps, getting a receiver and using it to draw people into their shops. Now they seem to be relegating the publicity aspect to the background, and concentrating on selling a profitable line.

During the coming year retailers will probably increasingly appreciate this aspect of television—that is, in fact, providing a definite opportunity for "big" sales. A hundred odd pounds is a good deal of money for a person to spend on home entertainment. But there are tens of thousands who will do so.

Price Reductions

Will prices be reduced this year ? There is a prospect of what amounts to the same thing—that is, the introduction of less expensive models. Makers will be ill-advised if they seek to maintain a high price-level. The enormous production increase which would result from the introduction of 50-60 gns. instruments would increase their profits. When 5-valve all-wave mains superhet sound receivers are being sold at under £10, the 50-60 gns. television set is not impossible.

It is not suggested that prices will fall to such a level this year. Makers are accumulating technical and production experience, and experience has to be paid for.

in Range of Alexandra Palace

Retailers can look forward to considerable assistance in their efforts to sell television. The B.B.C. are clearly determined to make television "go." They publicise it through their ordinary programmes and, yet more valuable, they are now issuing an excellent illustrated weekly television supplement in the *Radio Times*.

Good Publicity

This supplement is contained in all issues sold in counties any part of which comes within 30 miles of Charing Cross. Every *Radio Times* reader in that large area will read about the television programmes every week, and a wish to look-in must be created.

The possibility of receiving the Alexandra Palace broadcasts extends even further than the circulation of the Television Section of *The Radio Times*. The map on page 43 shows that it covers such outlying towns as Cambridge, Colchester, Southend, Whitstable, Maidstone, Tunbridge Wells, Horsham, Farnham, Reading, Aylesbury, Leighton Buzzard and Bedford. Reception has also been obtained as far afield as Brighton and Margate, though at this distance car ignition and other interference makes itself very unpleasant.

For their part, manufacturers will continue to help dealers by taking over installation and service.

The factor on which sales will depend, however, is programmes. The B.B.C. are the first to admit that on the whole programmes have not been too good. They are working strenuously to improve them, and a number of recent broadcasts have shown that big strides are being made.

The difficulties in providing two hours' original entertainment daily can easily be understood. A theatrical producer has several weeks to create an evening's entertainment; a film studio works all day to "shoot" a few minutes' film. At Alexandra Palace, the producers, starting from scratch with a new medium, have had to rehearse and produce all in one day.

Big Use of O.B.s

Probably of all television "departments" programmes will show the biggest progress during the year. The B.B.C. think that outside broadcasts will become the mainstay of television, and are hastening forward the provision of technical means whereby O.B.s can be picked up and conveyed to Alexandra Palace for transmission.

A van is now being made so that scenes can be relayed from all kinds of outside localities. Connection with the transmitter will be obtained either by co-axial cable or micro-wave relays.

Co-axial Cable

A co-axial cable is being laid between Alexandra Palace and Broadcasting House, and this will probably be extended to various vantage points throughout London. A third "floating" hour of programme time will be provided for these O.B. broadcasts.

Many of these developments for O.B.s will have occurred prior to the Coronation. There can be no doubt whatever that the Coronation will give a great impetus to television and prove highly valuable to the Industry by "forcing" both sales and technical progress.

Technical matters generally, however, need have little effect on sales. At the same time, makers and retailers would act with greater confidence if the position regarding the dual systems were settled.

Patent Pool Wanted

Most people will agree that, no doubt, technical progress will best be made through simplification of transmission and reception by the adoption of one system. Both the Baird and Marconi-E.M.I. systems contain valuable features. These should be welded into one system.

Little progress at the time of writing is being made with the patent "pool" urged by the Television Committee. It is to be hoped that both the B.B.C. and R.M.A. will press for at least sufficient "give and take" to enable a single system to be operated.

Summarising briefly, it can be said that 1937 will certainly see television established as a permanent public service parallel to, but not so highly developed as, the B.B.C.'s sound transmissions.

Better Programmes

Programmes will improve enormously and achieve a high percentage of topical interest content. Some technical simplification is to be hoped for, with, of course, detail improvements of apparatus.

Most important from the Industry's point of view: makers and retailers alike will settle down to the view that television is not a nine-days' wonder, but just another radio "line" to be sold and developed side by side with better-class receivers.

WHO MAKES VISION SETS?

Below is a brief survey of the manufacturers of television receivers, with tabloid specifications of their models as at January.

BUSH-BAIRD "TELEVISORS"
Bush Radio, Ltd., Power Road, Chiswick, London W. 4.

MODELS.—T5, 20-valve sound-and-vision superhet. Vertical tube; 12 by 9 in. picture viewed *via* a mirror. PRICE: 85 gns. SUPPLIES: Available. T7, as above but inc. all-wave radiogram chassis. T6, 14-valve sound-and-vision and broadcast receiver; 10 by 7½ in. picture.

MARKETING.—Through Bush dealers, who are given areas to cover.

COSSOR
A. C. Cossor, Ltd., Highbury Grove, London, N.5.

MODELS.—137T, sound-and-vision and all-wave superhet. 237T, as above, but with auto-radiogram equipment. Both give a 10 by 8 in. picture viewed direct on the tube. PRICES: 137T, 105 gns.; 237T, 120 gns. SUPPLIES: Available.

MARKETING.—Through dealers. Cossor instal.

EKCO-SCOPHONY
E. K. Cole, Ltd., Ekco Works, Southend-on-Sea.

MODELS will be available at about £100: 201, vision and broadcast receiver; 202, vision and all-wave receiver. Optical-mechanical system employed; pictures 16 by 12 in. on flat screen.

FERRANTI
Ferranti, Ltd., Moston, near Manchester.

MODELS.—One sound-and-vision only, one with all-wave receiver.

MARKETING.—To distribute through existing dealer organisation.

G.E.C.
General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.

MODELS.—3701, sound-and-vision only. PRICE: 95 gns. 3702, as above, with all-wave sound set. PRICE: 120 gns. In each case a 9 by 7 in. picture is viewed direct. SUPPLIES of both models available.

MARKETING.—Policy based on creation of a body of stockist dealers through whom all inquiries and orders will be directed. Technical training to be given to these dealers' service staffs. Meanwhile, installations and maintenance are by G.E.C.

H.M.V.
Gramophone Co., Ltd., 98-108, Clerkenwell Road, London, E.C. 1.

MODELS.—901, 22-valve sound-and-vision superhet. PRICE: 95 gns. 900, as above, but with all-wave sound receiver, 23 valves. PRICE: 120 gns. Both give 10 by 8 in. pictures; vertical tube, viewed *via* a mirror. SUPPLIES: Available. Prices include special aerial; installation; 12 months' guarantee.

MARKETING.—H.M.V. instal, delivering direct to customer and themselves pay all carriage costs. Dealer discount, 20 per cent. Guarantee includes C.R. tube; valves under B.V.A. three-month guarantee.

Demonstration models available at 20 per cent. off list; three months' maintenance by E.M.I. Service. Demonstrations in prospect's home must be on set supplied by dealer; E.M.I. engineers must be called in, for which 3 gns. is charged, to be refunded if sale is made.

HALCYON
Halcyon Radio, Ltd., Sterling Works, Dagenham.

One set: 19-valve superhet; 8 by 7 in. picture; includes all-wave sound set.

MARCONIPHONE
Marconiphone Co., Ltd., 210-212, Tottenham Court Road, London, W.C.2.

MODELS.—702, sound-and-vision only. PRICE: 95 gns. 701, as above, but with all-wave sound set. PRICE: 120 gns. Prices include special aerial; installation; 12 months' guarantee, including C.R. tube; valves under B.V.A. three months' guarantee. In each model the tube is vertical, a 10 by 8 in. picture being viewed *via* a mirror.

MARKETING.—Discount of 20 per cent. to dealers; installation by Marconiphone; instrument supplied from works and carriage paid by Marconiphone.

Home demonstrations must be on a set supplied by the dealer and E.M.I. engineers must be called in; 3 gns. will be charged for their services, but will be refunded if a sale results.

Sets for dealer demonstrations at 20 per cent. off list price; this includes three months' maintenance by E.M.I. Service, Ltd.

MURPHY
Murphy Radio Ltd., Broadwater Road, Welwyn Garden City, Herts.

Models available for the Coronation in May.

PHILIPS
Philips Lamps, Ltd., 145, Charing Cross Road, London, W.C. 2.

MODEL.—One vision-and-sound and all-wave set; 21 valves; 8½ by 7 in. picture viewed direct.

PYE
Pye Radio, Ltd., Africa House, Kingsway, London, W.C. 2.

MODELS.—All giving a 10 by 8 in. picture viewed *via* a mirror. 4201, sound-and-vision only. PRICE: 95 gns. 4042, sound-and-vision and broadcast sound receiver. PRICE: 110 gns. 4043, sound-and-vision, all-wave and auto-radiogram model. PRICE: 135 gns. SUPPLIES available in each case.

MARKETING.—Through Pye Service Agents; Pye Radio instal.

TELEVISION

A concise and complete review of both principles and practice of high-definition television as broadcast by the B.B.C. is contained in the following pages. The section provides a rapid survey of the subject from scanning to the details of the Alexandra Palace transmitter.

The section has been written as a single article and should be read as a whole; for convenience in subsequent reference, however, it has been divided into the following chapters :—

1—The Problem and its Solution

TELEVISION is now out of the laboratory and every radio dealer should have at least an understanding of the basic principles and the major practical aspects of this new branch of radio science. Here the subject can be dealt with only on broad lines, but nevertheless the main points, both of theory and practice, can be covered.

The first factor to understand in television —it is, in fact, the key to the whole art— is scanning. A single instantaneous electric voltage cannot represent a scene: but it *can* represent a single spot of light. A scene, on the other hand, can be split up into a large number of tiny spots of light, each of a particular brightness.

A scene can be represented, then, by a series of voltages each of which represents one spot of light of the thousands into which the scene can be divided. The process by which the scene is divided is known as *scanning*, and it is this that really makes television possible.

Mechanical Method

Both mechanical and electronic scanning systems are in use. The basis of the mechanical system as employed by Baird's is a disc containing a spiral arrangement of holes. In direct television a light is thrown through the holes so that as the disc revolves a succession of light spots traverse every part of the object being televised. Light is reflected from the object in varying degrees according to whether the light spot is passing over, for example, a face or a coat. A bank of photo-electric cells "collects" this varying reflected light and produces a corresponding varying current. For the transmission of films, a light is shone through the moving film and hence through the holes in the revolving scanning disc on to the photo cells. In practice the scanning discs contain further holes which provide the synchronising impulses by which the receiving equipment is kept in step with the transmitter.

Electronic Systems

For electronic scanning a form of the cathode-ray tube (*see* below) is employed. In the Emitron and Zworykin types the tube contains a plate on to which the scene is focused. This plate is covered by a chemical mosaic, each tiny section of which is a photo-electric cell which becomes electrically charged in proportion to the brilliance of the part of the scene focused upon it. This mosaic is scanned by the cathode-ray which sweeps over it in a number of parallel lines. The passing of the ray discharges the cells successively and so creates the required voltage variations.

An alternative form of electronic scanning is used in the Farnsworth tube in which an

TELEVISION

electronic image of the scene is deflected over a small photo cell.

The second factor to appreciate is the speed with which the scanning process must be executed if the succession of light spots are to be reassembled into an apparently " whole " picture.

Fortunately, the human eye suffers from a " defect " known as persistence of vision : that is, it sees a spot of light for a fraction of a second longer than the spot is actually in existence. It is found that if all our succession of light spots are thrown upon the receiving screen within about a twelfth of a second the eye is deceived into " seeing " them all simultaneously—that is, providing the spots are reassembled in the order in which they were scanned and faithfully represent the varying light and shade values of the original, the televised object will be portrayed.

Persistence of Vision

To transmit an image of a moving object, kinema technique—which itself relies on " persistence of vision "—has to be employed. A series of complete images has to be transmitted in rapid succession just as, at the kinema, still pictures are projected with such speed that the eye appears to see continuous movement. In practice it is found that at least 16 complete images must be received every second and some flicker is apparent even at 25 pictures a second.

Now let us see in general terms what these speeds imply. Suppose our picture is scanned in 200 lines ; each " spot " will be square and, assuming the picture is as wide as it is deep, 200 variations of intensity, or 100 cycles (black to white and back again to black) will be possible during each horizontal sweep. Therefore, $200 \times 100 = 20{,}000$ cycles will be possible during one complete scanning sequence. If the picture is repeated 25 times a second, the total transmission frequency will be 500,000 cycles per second. In other words, the transmitter will have to have a band width of over a megacycle instead of the 9 kilocycles customary for sound transmission. Actually, the B.B.C. high-definition transmissions require band widths of 2 megacycles or so. It is, in fact, only possible to accommodate television transmitters on the ultra short-wave band.

To get an idea of how the television receiver works we will first have a general look at the cathode-ray tube.

2—Cathode-Ray Tube Technique

The principles of the cathode-ray tube are the same as those involved in a valve. The construction is such, however, that the electron stream, drawn from the cathode by the high tension voltage applied to the anode, does not terminate its journey at the anode as in a valve, but overshoots it and impinges on a chemically prepared wall of the tube. This chemical, or fluorescent, screen is composed of materials which glow under the impact of the electron stream.

A tube incorporates additional electrodes for the purpose of focusing the electron stream into a narrow beam, and for deflecting it from side to side, and also up and down. Sometimes the ray is controlled, not by deflector plates in the tube, but magnetic coils outside it. Occasionally both electrostatic and magnetic deflection are employed. (*See* Fig. 1.)

Soft and Hard

There are two classes of cathode-ray tube known as " soft " and " hard " respectively. Soft tubes contain a certain amount of gas which helps the focusing of the ray, and the focusing arrangements in the tube can be simpler than in the " hard " type which is highly evacuated. In the soft type, however, control of focusing effects spot brightness and, therefore, the hard tube is more suitable for television.

The cathode-ray tube is used for the formation of the picture in nearly all high-definition television systems. Its major use hitherto, however, has been for the study of electrical circuits. For this purpose a time base voltage is usually applied to the plates which deflect the electron stream or ray in a horizontal direction. The voltage is such that the spot of light travels across the screen at a determined speed, and then flies back to the starting point practically instantaneously. Due to the rapid repetition of the traversing movement of the light spot and the " persistence of vision " in the human eye the spot appears as a line. If a varying voltage is then applied to the plates which deflect the ray in a vertical direction, the line of light is bent into a shape which can be taken as a direct representation of the waveform of the varying voltage.

Much can be learnt of an unknown voltage when the time-base voltage and periodicity are known. For example, if the " sweep " frequency of the time base is 1,000 per second, and five cycles or waves appear on the screen, it is clear that the frequency of the unknown voltage is 5,000 cycles per second. A tube can be calibrated according to the voltage

required to deflect the ray. The voltage of an unknown "wave" can, therefore, be read on a calibrated tube.

A special radio application of the cathode-ray tube is its use during the alignment of tuned circuits. It shows in diagram form the effect of every adjustment upon the shape of the receiver's tuning curve which can, therefore, be made flat-topped or peaked as desired.

For television a further electrode is required in the cathode-ray tube. This is a "grid" which regulates the number of electrons permitted to reach the screen and controls, therefore, the brilliance of the spot. Television reception requires the use of two time-bases. One, the frame scan or low frequency, deflects the spot from top to bottom of the screen, say, 25 times a second (the fly-back, as usual, is almost instantaneous.) The second sweep circuit controlling the horizontal deflection or line scan has, for example, a "high" frequency of 240 × 25 : that is, during every descent of the screen the spot traverses 240 zigzag, side-to-side lines. If, therefore, the spot size is focused to 1/240th of the screen depth every part of the screen is traversed. As the whole process occupies only 1/25th of a second, due to the persistence of vision effect, the whole screen appears to be "floodlit."

The received television signal comprises the picture voltages, and also low- and high-frequency synchronising impulses. The latter are applied to the time base circuits, which are already set as near as possible to the required frequencies, and by just "tipping the balance" keep them exactly in step with the corresponding circuits at the transmitter. The picture frequencies are applied to the grid electrode and so regulate the brilliance of the light spot in accord with the corresponding spots scanned at the transmitter.

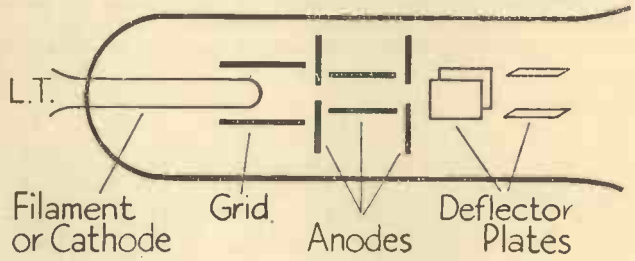


FIG. 1.—Sectional diagram illustrating the arrangement of electrodes in a typical cathode-ray tube. In magnetic types the deflector plates are replaced by external coils.

A mechanical receiving system is the Scophony. In this the picture is reassembled by an ingenious optical system upon which an oscillating light ray is shone from a moving mirror. The light is obtained from a small projection type of lamp, and is modulated by a special light cell. Advantages claimed are : large screen, low running costs and low operating voltages.

3—Practical Receiver Design

So much for our brief theoretical outline. What is a television receiver like in practice ?

Most instruments contain a vision receiver with an associated cathode-ray tube or other picture-forming device and a separate sound receiver. The sound sets follow well-known short-wave practice, and are, in fact, practically identical with standard sets but for the constants of the tuned circuits and the intermediate frequency. Both straight and superhet types of receiver are employed.

The vision side of the equipment is comparable with the sound side up to a point, and again both straight and superhet types are found.

In the superhets the frequency changer is a very important factor, as any drift will have severe effects. A common arrangement is to have a pre-set radio-frequency stage tuned to both vision and sound transmissions. This works into a single-frequency changer which, obviously, creates two different intermediate frequencies. It is followed, therefore, by two I.F. amplifiers, one for vision and one for sound. (Fig. 2.)

Special arrangements to ensure the stability of the oscillator—usually a separate valve—are employed (such as heat-insulated coils), and adjustment of the I.F. transformers is also, of course, a more complex matter than with normal receivers.

In fact, the first fundamental difference in the vision side lies in the intermediate amplifier. We are accustomed in sound practice to use an I.F. transformer consisting of a pair of coupled circuits, which are arranged to give a single peak or perhaps a slightly flat-topped or double-humped wave form.

With television, however, sidebands up to 2 megacycles or more are met with. The intermediate amplifier, therefore, has

TELEVISION

to have some form of special coupling device, and this part of the equipment gives much scope to the designer. One can use a scientifically designed dissipative filter or a somewhat simpler arrangement of very highly damped resonant circuits.

I.F. Stages

With high damping the stage gain is low and so, perhaps, three I.F. stages are required. This introduces another situation new to the dealer, because a multi-stage high-frequency amplifier operating at frequencies of several megacycles has to be built on rather different lines.

Great care is necessary in the earthing and screening. Earth points cannot be taken indiscriminately on the chassis, and a properly arranged and scientifically radiated earthing system is necessary. It is even necessary to take into consideration high-frequency troubles arising from cathode wiring and heater circuits.

In "straight" receivers the general arrangement is very similar to the schematic shown in the diagram, but the frequency changer and intermediate amplifier are replaced by a straightforward multi-stage amplifier working at the transmission frequency and, of course, having a wide frequency response.

Arrangements of this type are generally pre-set, there being no tuning adjustment whatever. This circuit, of course, is quite immune from frequency drift, as there is no oscillator likely to cause trouble.

When the sound is received at the transmission frequency without using the superheterodyne principle, it is general to include a small tuning control, because tuning of the sound is very much more critical than of the vision frequency. This is due to the comparatively narrow frequency band, and slight compensation is obviously necessary.

The cathode-ray tube can be said to take the place of the speaker. It is used in conjunction with the time base units. In these the voltage needed for deflecting the ray is usually obtained by charging a condenser through a valve network, and then instantaneously discharging it. Sometimes ordinary hard valves are used for this, whilst in other cases use is made of a special gas-filled or soft tube.

Controls are generally provided for adjust-

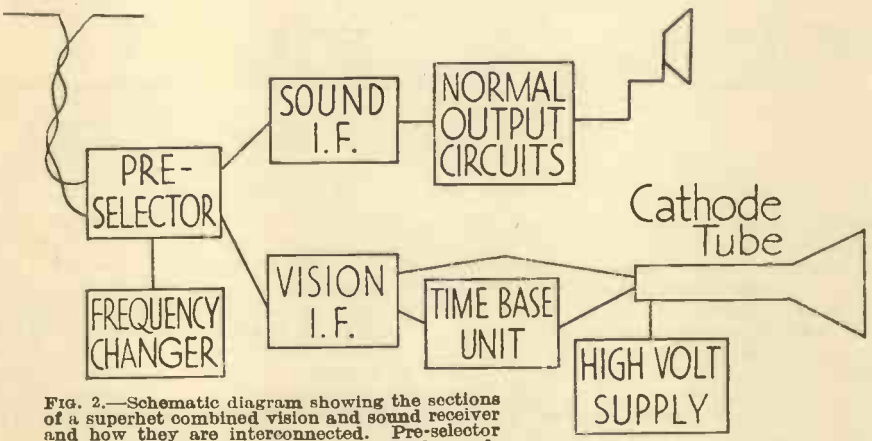


FIG. 2.—Schematic diagram showing the sections of a superhet combined vision and sound receiver and how they are interconnected. Pre-selector and oscillator are common to vision and sound.

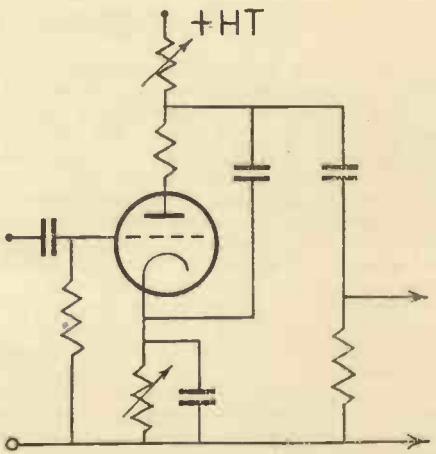


FIG. 3.—Basic circuit of a time base unit by which the light spot is deflected across the screen of the cathode-ray tube.

ing the magnitude and speed of the scanning voltage. (Fig. 3.)

Finally, mention of the power supply to a cathode tube must be made. Cathode tubes work at anything from about 2,000 up to 6,000 or 7,000 volts. When working with such voltages extreme care and precautions are necessary, because the danger is real.

It should also be realised that it is possible to damage a cathode tube by allowing the spot to remain stationary when under the influence of a high voltage. In other words, the beam should never be allowed to impinge on the screen unless the scanning or deflecting voltages are applied to the plates. The lowering of an anode voltage or application of a heavy negative potential to a control grid will have the same effect.

4—Ultra Short-Wave Aerials

In the main, the technique of reception of the ultra short waves employed for television is the same as that at 300 metres, but the aerial becomes much more important.

When receiving short wavelengths, most satisfactory results are obtained when the length of the aerial bears some definite relationship to the wavelength of the transmission. For example, one hears of quarter or half wavelength aerials.

Most familiar for reception of these ultra high frequencies is the dipole aerial. The vertical dipole consists of a vertical rod conductor.

The horizontal dipole consists of a pair of conductors arranged horizontally. Maximum pick-up is obtained when these are at right-angles to the direction of propagation.

In the case of a horizontal dipole, the transmission line (or lead-in, in the terms of ordinary reception) is connected to the adjacent ends of the two horizontal conductors. In most arrangements of the vertical dipole, one side of the transmission line is connected to the lower end of the conductor, and the other side is left free or connected through a special matching link.

When one has to receive from a given direction only, with maximum efficiency, use can be made of a highly directional aerial system using reflectors. These reflectors consist of accurately dimensioned rods correctly spaced behind the dipole.

One Aerial

As the sound and vision programmes are to be radiated on different wavelengths, it has to be considered whether two aerials must be used or if a compromise would do. The wavelengths to be used are reasonably near, and so in this instance it is quite a practical proposition to compromise and use one aerial, which will be reasonably efficient for both transmissions.

As the B.B.C. sound transmission is on 41.5 megacycles and the vision is on 45 megacycles, we can take a mean frequency of 43 megacycles. The length, in feet, of the aerial is given by a formula consisting of a constant divided by the frequency. This constant is 468.

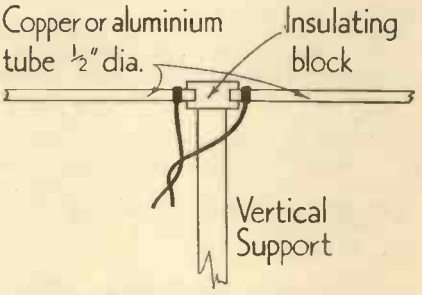


FIG. 4.—How a horizontal dipole aerial can be erected. The two sections feed into a transmission line which may take any of the forms shown in Fig. 5.

The length in feet is, therefore, given by 468/43=10.9.

A horizontal dipole should have each section, therefore, about 5½ ft. long.

It is desirable to use for the collector an efficient conductor. A light copper or aluminium tube is very suitable. Such an arrangement can be attached to insulating supports, so that the two rods project horizontally in opposite directions. The transmission line should be connected to the adjacent ends, which are spaced a small distance apart, as indicated in Fig. 4.

Thanks to the characteristics of the transmission line it is possible to place a television receiver at a fair distance from the aerial and obtain good efficiency. This means that the receiver can be placed in almost any desired position and connected by a transmission line to an aerial erected in a convenient position. Where the field strength is appreciable, an internal dipole can be used.

Most dealers are now acquainted with transmission lines through practical experience of screened aerial down-lead systems in which a transformer or impedance matching device is connected at the end of the aerial and a screened lead is taken from this to a suitable matching device direct on the set.

Ultra short-wave practice is somewhat

similar. A feeder or transmission line can be regarded as a guiding channel for wave energy rather than as an ordinary electrical circuit. For instance, the electrical constants are such that the length has nothing to do with the correct matching of the line. Providing the line is fairly well matched to the aerial it does not matter very much how long it is or what position it actually takes.

What affects the matching is what is known as the surge impedance of the line, which has to match the constants of the aerial.

It is out of the scope of this article to go into the manner in which the impedance of the line is calculated, but lines properly designed to suit a 7-metre aerial are produced by makers.

The transmission line can take several forms, which we will divide into three classes.

The first is a transverse pair, the second is the twisted flex arrangement, and the third is the co-axial type. (*See* Fig. 5.)

The transposed form consists of a pair of wires spaced a few inches apart and crossed every few feet. It is not a very convenient type of feeder for purely domestic use.

Most Practical

The most suitable from a practical point of view is probably a twisted flexible pair, or alternatively some form of reasonably flexible co-axial cable.

Provided one is dealing with a fairly strong field strength, surprisingly good results can be obtained with ordinary electric light flex. It is much better, however, to use a specially designed flex which has better electrical constants. The same applies to the co-axial cable.

The superiority of the co-axial cable lies in many directions. One may mention low losses and the ability to place it in almost any position without running into several troubles which may arise with other types.

5—At Alexandra Palace

This review can best be concluded by a glance at the Baird and Marconi-E.M.I. systems and apparatus as being used by the B.B.C. at the Alexandra Palace transmitter.

The B.B.C. has leased over 30,000 sq. ft. of floor space at the south-east corner of the building. This comprises three large halls on the ground floor, the rooms over them on the first floor, and the S.E. tower.

A further area of nearly 25,000 sq. ft. comprising a theatre and associated rooms adjoining in the Palace has also been taken.

The Baird vision transmitter, like its Marconi-E.M.I. counterpart, operates on a frequency of 45 megacycles (6.67 metres). A picture composed of 240 lines and repeated 25 times a second is radiated.

Baird's equipment comprises the following units ; a spotlight scanner for direct television of close-ups and a limited number of people in a studio ; an intermediate-film equipment by which large scenes can be filmed, and hence "televised" ; and a Telecine unit for the transmission of films generally. An electron camera has been introduced recently.

For the intermediate-film equipment there are two rooms, one above the other, looking, through large glass windows, over a studio arranged like any film studio. In the top room is sound equipment ; in the lower is a camera which takes, develops and fixes a film plus sound track in 30 seconds.

Built on to this equipment is "projection" and scanning equipment with an associated synchronising impulse generator. After scanning the film passes to a sound-head, where the sound is "picked up" for transmission. The sound has to be recorded and reproduced in this manner, of course, to obtain the necessary time delay, so that it synchronises with the vision.

Telecine Scanner

The Telecine scanner is capable of transmitting any standard 35-mm. film. The film passes through a projector which has been modified so that the film runs at a steady uninterrupted rate of 25 frames per second. The shutter is dispensed with.

After passing through various amplifiers, the vision signals, line and frame synchronising impulses and sound signals are fed to the control room. This can handle five programme sources.

Three panels comprise the transmitter. One contains crystal-controlled frequency drive equipment. The output is fed to the second unit, the drive stage, which is followed by the output stage. This incorporates a demountable water-cooled tetrode having a maximum output of 40-50 kilowatts.

A 405-line picture built up by interlaced scanning, in which the flicker frequency is raised to 50 per second, is provided by the Marconi-E.M.I. system.

Marconi-E.M.I. equipment at Alexandra Palace can be considered in three sections : the Emitron instantaneous cameras, of which there is provision for six, and associated

equipment ; the vision transmitter and aerial; and the sound channels.

The Emitron camera, which has been designed and developed exclusively in the Marconi-E.M.I. laboratories at Hayes, can

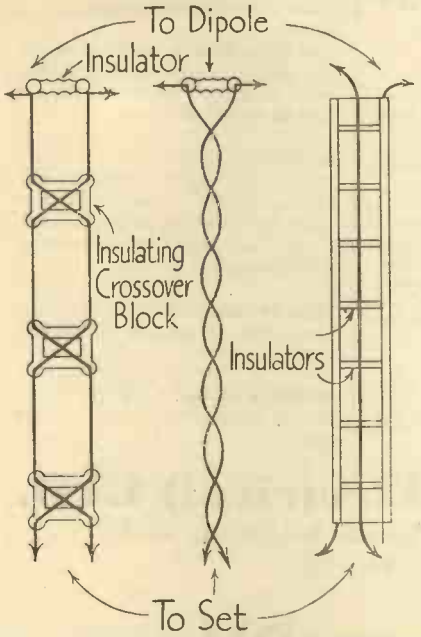


FIG. 5.—Three forms of the transmission line. Left is the transposed type ; centre, the twin flexible ; and, right, the co-axial form.

be used indoors or outdoors under ordinary lighting conditions. It contains no moving parts and generates the vision signals instantaneously direct from the scene.

The scene is focused on a mosaic plate and creates small potential differences between the particles of the mosaic and a metal back plate. A cathode-ray beam focused to a spot size of less than a millimetre in diameter sweeps the mosaic and discharges the cells. This generates the signal voltages, which are of the order of 2 millivolts. The Emitrons can be trucked and swung during use like a film camera.

The synchronising pulses and frequencies for all the cameras are generated in a two-bay pulse generator.

The transmitter consists of a master oscillator containing a modern version of a Franklin temperature compensated coil, a frequency doubler, five stages of carrier frequency amplification, and a single-stage modulated amplifier, having a band width of zero cycles (D.C.) to 2,000,000 cycles.

The final power amplifier unit consists of two CAT9 valves in push-pull. At peak white the power delivered to the aerial is of the order of 17 kw.

Sound Transmitter

Sound is radiated by a 3 kw. transmitter manufactured for the B.B.C. by Marconi's W.T. Company. It is capable of operating over a 35-50 mc. waveband and is functioning at present on 41.5 mc. (7.23 metres).

The equipment has been designed to take full advantage of the wide frequency waveband available and the frequency response is said to be substantially flat between 30 and 10,000 cycles.

Finally, there is the aerial, also made by Marconi's Wireless Telegraph Co. The mast is 300 ft. high, there being 215 ft. of steelwork above the brick tower. (The hill on which the Alexandra Palace is situated is 306 ft. above sea level.)

Two separate aerial systems are carried on the mast, one for vision and one for sound. Each consists of eight push-pull end-fed vertical dipoles with a similar set of reflector.

QUICK TESTS for Tracing Faults in Sets

Compiled from "The Service Engineer"

The correct operating voltages measurable at readily accessible points in approximately 70 of the most popular receivers are given on this and the following pages. This data forms an invaluable aid to the rapid tracing of faults in sets.

First, under each heading, are the voltages for mains sets which should be present at the terminals on the speaker transformer, if this is accessible. In the case of battery sets, the correct battery voltages are given.

In the second half of each paragraph are valve voltages and currents which can easily be measured by using adaptors.

By taking these measurements on a faulty receiver and comparing the results with the ideal figures given here, it is possible to ascertain, at the least, which stage the fault is in (provided the error results in a change of operating conditions).

The readings given have been obtained with the volume control at maximum, reaction (if fitted) at minimum, and the set tuned away from transmissions. It is advisable, in fact, particularly if there is a tendency towards instability, to connect the aerial and earth terminals together.

A popular meter of high resistance was used to obtain the readings, and slight discrepancies between the values given and those obtained may be due to the use of a meter of different resistance as well as to slight differences in the components in the actual receiver compared with the model used for these measurements.

Provided an efficient moving-coil meter is employed, however, discrepancies of more than a few per cent. indicate a fault.

Where high values of resistance are associated with detector valve anodes and screen and auxiliary grid circuits, the voltage readings—due to the load imposed by the meter—may be unreliable. The current measurement is then the one to go by.

Further details of how to make full use of "Quick Test" data are given on page 63.

Aerodyne Aeromagic.—Voltages between the terminal tags on the speaker transformer and chassis (no signal and volume control at maximum) :—Top (1) blue, 205v., V5 anode ; (2) red, 215v., H.T. smoothed ; (3) black 255v., H.T. unsmoothed.

Valve readings :—FC4 met., anode 220v., 1.5 m.a. ; aux. grid, 60v., 3.1 m.a. ; osc. anode, 60v., 1.75 m.a. VP4B met., anode, 220v., 10.5 m.a. ; aux. grid, 220v., 3.8 m.a. 2D4A met.. diode only. VP4B met., anode 220v., 4.7 m.a. ; aux. grid, 220v., 1.9 m.a. Pen. 4VB, anode 205v., 30 m.a. ; aux. grid, 220v., 3 m.a. 354v. met., anode 70v., 11-20 m.a.

Aerodyne 49 All-wave Battery Three.—Valve readings : VP2, anode 105v., 2.1 m.a. ; aux. grid, 103v., .75 m.a. PM1HL, anode, 40v., 1.1 m.a. PM22A, anode, 114v., 5.5 m.a. ; aux. grid,120v., 1.3 m.a.

Aerodyne 51 All-wave Battery Set.—Valve readings : VP2 met., anode, 108v.. 2.3 m.a. ; aux. grid, 108v., .65 m.a. PM1HL met., anode 46v., 1.1 m.a. PM22A, anode, 116v., 2.25 m.a. ; aux. grid, 120v., 2.35 m.a.

Aerodyne Bluebird.—Volts on speaker transformer : red, 220v., smoothed H.T. ; blue, 200v., V3 anode ; black, 300v., unsmoothed H.T. Valve readings : VP4B, anode, 200v., 7 m.a. ; aux. grid, 110v., 2.3 m.a. 354V, anode 80v., 2.3 m.a. Pen4VB, anode, 200v., 34 m.a. ; aux. grid, 210v., 3.7 m.a.

Alba 230 Battery Set.—From speaker strip : white, H.T., 134v. ; black, output valve anode, 130v. Valve readings : VP2 met., anode, 134v., .8 m.a. ; aux. grid, 134v., .25 m.a. FC2 met., anode, 134v., .75 m.a. ; aux. grid, 62v., 1.2 m.a. ; osc. anode, 134v., 1 m.a. VP2 met. [I.F., 117.5 kc.] anode, 122v., .75 m.a. ; aux. grid, 134v., .2 m.a. 2D2 met., diodes only. PM22D, anode, 127v., 4.5 m.a. ; aux. grid, 134v., .75 m.a.

Alba 550 Superhet A.C. Four.—From speaker strip : red, 250v., smoothed H.T. ; black, 230v., smoothed H.T. ; blue, 360v., unsmoothed H.T. Valve readings : FC4, anode, 250v., 2 m.a. ; screen, 95v., 5.5 m.a. ; osc. anode, 58v., 1.7 m.a. VP4A met. [I.F., 117.5 kc.] anode, 205v., 2.9 m.a. ; aux. grid, 95v., 1.4 m.a. 2D4A, diode only. Pen4VB, anode, 240v., 31 m.a. ; aux. grid, 250v., 3.5 m.a. IW3, filament, 360v.

Alba 870 All-wave Superhet Four.—From speaker strip : blue, 420v., unsmoothed H.T. ; black, 265v., smoothed H.T. ; red, 250v., smoothed H.T. Valve readings : TH4 met., anode, 265v., 2.2 m.a. ; aux. grid, 65v., 4 m.a. ; osc. anode, 125v., 4.2 m.a. VP4B [I.F., 117.5kc.] anode, 195v., 13 m.a. ; screen, 265v., 4.2 m.a. 2D4A, diodes only. Pen.4A, anode, 250v., 33 m.a. ; aux. grid, 265v., 3.5 m.a. IW4, filament, 420v.

Alba Model 880.—From speaker strip : yellow, earth link to chassis ; blue, 400v., unsmoothed H.T. ; white, 245v., smoothed H.T. ; black, 230v. V5 anode ; red, 245v., smoothed H.T. Valve readings : FC4, anode, 245v., 1.5 m.a. ; aux. grid, 85v., 5 m.a. ; osc. anode, 75v., 2 m.a. VP4B met. [I.F., 117.5 kc.] anode, 245v., 9.2 m.a. ; aux. grid, 245v., 3 m.a. VP4B met. anode, 165v., 8 m.a. ; aux. grid, 175v., 2.9 m.a. 2D4A, diode only. Pen.4VB, anode, 230v., 32 m.a. ; aux. grid, 245v., 3.4m.a. IW3, filament, 400v.

Burgoyne Dragon Superhet Four.—From speaker strip : top, (1) 380v., unsmoothed H.T. ; (2) bottom, 270v., smoothed H.T. ; (3) bottom, 260v., smoothed H.T. Valve readings : VO4 met., anode, 280v., 5.1 m.a. ; aux. grid., 110v., 3.1 m.a. ; osc. anode 100v. 2·8 m.a, VP4B met. [I.F., 473 kc.] anode, 80v., 1.7 m.a. ; aux. grid, 80v., 4.9 m.a. DD4, diodes only. APP4C, anode, 260v., 30 m.a. ; aux. grid, 230v., 3.4 m.a. AVP4, filament, 280v.

QUICK TESTS

Burgoyne Hollywood A.C.3.—From speaker strip : yellow, 380v., unsmoothed H.T. ; red, 280v., smoothed H.T. Valve readings : VP4B, anode, 275v., 5 m.a. ; aux. grid, 215v., .2 m.a. 904V, anode 110v., 3.3 m.a. Pen.4VB, anode 250v., 40 m.a. ; aux. grid, 275v., 4.6 m.a. R3, filament, 380v.

Burndept 245 A.C.-D.C. Three.—From speaker strip : black, 185v., smoothed H.T. ; green, chassis link ; blue, 122v., smoothed H.T. ; red, 220v., unsmoothed H.T. Valve readings : VP1321 anode, 112v., 5 m.a. ; aux. grid, 112v., 1.5 m.a. SP13C, anode, 18v., .2 m.a. ; aux. grid, 15v., .1 m.a. Pen.36C, anode, 143v., 38 m.a. ; screen, 172v., 8.4 m.a. ID5, cathode, 220v.

Burndept 246 Battery Three.—Valve readings : VP2 met., anode, 112v., 1.9 m.a. ; aux. grid, 112v., .8 m.a. HL2 met., anode, 105v., 3.4 m.a. PT2, anode, 107v., 2.6 m.a. ; aux. grid, 110v., 1 m.a.

Bush S.B.3 Battery Superhet.—From speaker strip : red, H.T. + ; yellow, 5v. lower. Valve readings : FC2 met., anode, 135v., .75 m.a. ; aux. grid, 51v., .8 m.a. ; osc. anode, 135v., .6 m.a. VP2 met. [I.F., 123 kc.] anode, 135v., 2.75 m.a. ; aux. grid, 126v., .7 m.a. 2D2, diodes only. PM22D, anode, 132v., 3.7 m.a. ; 135v., .6 m.a.

Cossor 376B Battery Superhet.—Valve readings : 210PG met., anode, 100v., .8 m.a. ; aux. grid, 50v. ; osc. anode, 75v., .9 m.a. 210VPT met. [I.F., 128 kc.] anode, 50v., 2 m.a. ; aux. grid, 50v. 220DD, diode only. 220PA, anode, 115v., 4 m.a. 220B, each anode, 120v., 1.5 m.a.

Cossor 364 Superhet A.C. Four.—From speaker strip : yellow, 235v., H.T. smoothed ; blue, 340v., H.T. unsmoothed ; red, 210v., output valve anode. Valve readings : 41MPG met., anode, 215v., 2.1 m.a. ; aux. grid, 100v. ; osc. anode, 105v., 2.4 m.a. MVS Pen. met. [I.F., 128 kc.] anode, 200v., 2.4 m.a. ; aux. grid, 100v. DD4, diodes only. 42MP/Pen., anode, 210v., 25 m.a. ; aux. grid, 235v., 5 m.a.

Cossor 737 Table Radiogram.—From speaker strip : red, 210v., output valve anode : blue, 368v., unsmoothed H.T. ; yellow, 240v., smoothed. Valve readings : 41MPG met., anode, 215v., 1.4 m.a. ; aux. grid, 70v., 3 m.a. ; osc. anode, 90v., 2.5 m.a. MVS/Pen. [I.F., 128 kc.] anode, 240v., 5 m.a. ; aux. grid, 90v., 1.4 m.a. DDT met., anode, 170v., 2.75 m.a. 41MP/Pen., anode, 210v., 35 m.a. ; aux. grid, 235v., 7.5 m.a. 442 B.U., filament, 360v.

Ekco A.C. 86 Five-valve A.C. Superhet.—From speaker strip : red-white, 380v., unsmoothed H.T. ; red, 245v., smoothed H.T. Valve readings : F.C.4, anode, 245v., 3.5 m.a. ; osc. anode, 120v., 3 m.a. AC/VP1 [I.F., 130 kc.] anode, 245v., 7.4 m.a. ; aux. grid, 245v., 1 m.a. V914, diodes only. 354V, anode, 145v., 2.7 m.a. A.C. Pen, anode, 220v., 30 m.a. ; aux. grid, 245v., 5.5 m.a. UU3, filament, 350v.

Ever Ready 5011 A C Superhet—Valve readings : A50N met., anode, 257v., 2 m.a. ; aux. grid, 52v., 1.4 m.a. A80A met., anode, 257v., 1.5 m.a. ; aux. grid, 50v., .4 m.a. ; osc. anode, 95v., 2.2 m.a. A50N met. [I.F., 465 kc.] anode 147v., 4.5 m.a. ; aux. grid, 70v., 2 m.a. A23A met., anode, 100v., 2.5 m.a. A70A, anode, 230v., 37 m.a. ; aux. grid, 257v., 5 m.a. A11B, filament 300v.

Ever Ready 5014 Superhet Three—From the speaker strip : red, 240v., smoothed H.T. ; black, 420v., unsmoothed H.T. Valve readings : A80A met., anode, 240v., 1.5 m.a. ; aux. grid, 75v., 4.5 m.a. ; osc. anode, 75v., 2.4 m.a. A30D met. [I.F., 465 kc.] anode, 81v., 4.1 m.a. A70C, anode, 215v., 35 m.a. ; aux. grid, 240v., 4.2 m.a. A11B, filament, 420v.

Ferguson 378 A C All-wave Superhet—From speaker strip : (1) top, 340v. H.T. unsmoothed ; (2) 240v., smoothed H.T. ; (3) 250v., smoothed H.T. ; (4) centre tap, 250v., smoothed H.T. ; (5) bottom, 250v., smoothed H.T. Valve readings : 6D6, anode, 250v., 4.4 m.a. ; aux. grid, 65v., 1.15 m.a. 6A7, anode, 250v., 1 m.a. ; aux. grid, 65v., 1.2 m.a. ; osc. anode, 140v., 3.8 m.a. 6D6 [I.F., 465 kc.] anode, 250v., 4.4 m.a. ; aux. grid, 65v., 1.15 m.a. 75, anode, 40v., .1 m.a. 76, anode, 40v., .4 m.a. 42, anode, 240v., 26.5 m.a. ; aux. grid, 250v., 5.6 m.a. 42, anode, 240v., 26.5 m.a. ; aux. grid, 250v., 5.6 m.a. 80, filament, 340v.

Ferranti All-wave Straight Three—From strip on mains transformer : red, 210v., unsmoothed H.T. ; green, 200v. Valve readings : VPT4B met., anode 200v., 10.5 m.a. ; aux. grid, 140v., 5 m.a. SPT4A met., anode, 40v., .2 m.a. ; aux. grid, 20v. PT4D, 195v., 28 m.a. ; aux. grid, 205v., 5.75 m.a. R4, filament 210v.

Ferranti 1936 Nova All-wave Superhet—From strip on mains transformer : blue, 95v. negative ; green, 285v. smoothed H.T. ; red, 290v., unsmoothed H.T. ; black, chassis link. Valve readings : VHT4 met., anode, 290v., 2.7 m.a. ; aux. grid, 100v., 5.1 m.a. ; osc. anode, 100v., 1.7 m.a. VPT4 met. [I.F., 125 kc.] anode 290v., 5.1 m.a. ; aux. grid, 100v., 2.7 m.a. PT4D, anode, 280v., 38 m.a. ; aux. grid, 290v., 9 m.a. R4, filament, 290v.

G.E.C. Fidelity All-wave—From speaker strip : white, 300v., smoothed H.T. ; red, 360v., unsmoothed H.T. ; orange, centre tap, 254v. Valve readings : VMS4, anode, 240v., 5.5 m.a. ; aux. grid, 65v., 2 m.a. X41, anode, 250v., 1 m.a. ; aux. grid, 60v., 1 m.a. ; osc. anode, 90v., 1.5 m.a.

VMP4G [I.F., 445 kc.] anode, 260v., 1 m.a. ; aux. grid, 85v., .5 m.a. VMP4G, anode, 245v., 1.75 m.a. ; aux. grid, 100v. — m.a. MH4, anode, 100v. MPT4, anode 250v., 35 m.a. ; aux. grid, 260v., 6 m.a. MPT4, anode, 250v., 34 m.a. ; aux. grid, 260v., 6.5 m.a. U14, filament, 320v.

G.E.C. Superhet A.C. Four.—Between the outer terminals on the rear side of the output transformer terminal strip and chassis : Top : (1) H.T. unsmoothed, 320v. (red and white) ; (2) V3 anode, 230v. (orange) ; (3) 0v. (black) ; (4) H.T. smoothed, 245v. (red).

Valve readings : MX40 met., anode, 250v., 3 m.a. ; screen, 150v., 1.5 m.a. ; osc. anode, 75v., 2 m.a. VMP4G met. [I.F., 125 kc.] anode, 250v., 4 m.a. ; aux. grid, 74v., 2.5 m.a. DN41, anode, 230v., 32 m.a. ; aux. grid, 245v., 8 m.a.

General Electric T.R.F. 3 Battery Set.—Valve readings : VS24 met., anode, 108v., 1.8 m.a. ; screen, 50v., .7 m.a. VP21 met., anode, 58v., 1.8 m.a. ; aux. grid, 50v., .5 m.a. PT2, anode, 100v., 3.4 m.a. ; aux. grid, 106v., .75 m.a.

G.E.C. A.C. Super Four.—Valve readings : X41, anode, 250v., 1.25 m.a. ; aux. grid, 60v., 2 m.a. ; osc. anode, 85v., 3 m.a. VMP4G [I.F., 125 kc.] anode, 250v., 3.85 m.a. ; aux. grid, 85v., 2.3 m.a. D41, diode only. N41, anode, 270v., 37 m.a. ; aux. grid, 250v., 8.25 m.a. U12, filament, 330v.

G.E.C. D.C.–A.C. 4 Universal Superhet.—From speaker strip : red-white, 210v. unsmoothed H.T. ; orange, 170v. smoothed H.T. ; red, 185v., smoothed H.T. Valve readings : X32 met., anode, 180v., 3.5 m.a. ; screen, 80v., 2 m.a. ; osc. anode, 110v., 2 m.a. W31 met. [I.F., 125 kc.] anode, 180v., 4 m.a. ; aux. grid, 80v., 2·5 m.a. D41 met., diode only. N31, anode, 170v., 30 m.a. ; aux. grid, 150v., 6.5 m.a. U30, cathode, 210v.

Invicta CW3B-A.C. All-wave Three.—From speaker strip : red, 410v., unsmoothed H.T. ; black, 230v., smoothed H.T. Valve readings : VP4B met., anode, 230v., 10.5 m.a. ; aux. grid, 50v., 4.5 m.a. SP4B met., anode, 30v., .05 m.a. ; aux. grid, 40v., 1.2 m.a. Pen.4VB, anode, 225v., 34 m.a. ; aux. grid, 210v., 4 m.a. IW3, filament, 420v.

Kolster-Brandes 426 Universal Superhet.—Voltages between the following points and chassis on 225v. A.C. mains and 225v. tapping : L.F. choke, top terminal, black, 234v. ; L.F. choke, lower terminal, black and red, 250v. (H.T. unsmoothed). Output transformer terminals in order from the top : (1)Black, 234v. H.T.+ from choke. (2) and (3) Red, 174v., H.T. smoothed. (4) 160v., V4 anode. (5), (6) and (7) are output transformer secondary connections, A, B and C respectively. Valve

readings : 13PGA, anode, 170v., 3 m.a. ; screen, 65v., 2.25 m.a. ; osc. anode, 100v., 3 m.a. 9D2 or 13VPA [I.F., 130 kc.] anode, 165v., 1.5 m.a. ; aux. grid, 105v., 1 m.a. 10D1, 2D13C or V13DD, diode only. Pen. 3520, anode, 160v., 30 m.a.; aux. grid, 174v., 7 m.a.

Kolster-Brandes 428 A.C. Six.—From speaker strip : red, 251v. smoothed H.T. ; blue, 240v. smoothed H.T. ; green, 330v., unsmoothed H.T. Valve readings : 9D2, anode, 205v., 4.5 m.a. ; aux. grid, 90v., 1 m.a. 15D1, anode, 210v., .25 m.a. ; aux. grid, 45v., 2.75 m.a. ; osc. anode, 90v., 2.5 m.a. 9D2 [I.F., 130 kc.] anode, 210v., 2.25 m.a. ; aux. grid, 95v., 1.1 m.a. 10D1, diodes only. Pen. 4VB, anode 210v., 35 m.a. ; aux. grid, 225v., 3.5 m.a. R3, filament, 365v.

Kolster-Brandes 510 Straight Three.—From speaker strip : black, 240v., H.T. smoothed ; red, 350v., unsmoothed H.T. Valve readings : 9D2, anode, 235v., 6.25 m.a. ; aux. grid, 90v., 1.6 m.a. HL, anode, 100v., 4.5 m.a. Pen. 4VB, anode, 220v., 36 m.a. ; aux. grid, 230v., 4.5 m.a. R2, filament 345v.

Kolster-Brandes 515 All-wave A.C. Three.—From speaker strip : red, 350v., unsmoothed H.T. ; black, 250v., smoothed H.T. ; blue, 230v., smoothed H.T. Valve readings : 9D2, anode, 240v., 11.5 m.a. ; aux. grid, 85v., 3.5 m.a. 4D1, anode, 80v., 6 m.a. 7A3, anode, 225v., 34 m.a. ; aux. grid, 240v., 6.5 m.a. R2, filament, 350v.

Lissen 8115 Battery Three.—Valve readings : K50M met., anode, 120v., 1.6 m.a. ; aux. grid, 72v., 5 m.a. K30D met., 20v., 1.6 m.a. K70B, anode, 118v., 4.3 m.a. ; aux. grid, 120v., 1.2 m.a.

Lissen 8130 All-wave A.C.–D.C. Three.—From speaker strip : (1) 216v., unsmoothed H.T. ; (2) 184v., smoothed H.T. Valve readings : C50N, anode, 140v., 7.5 m.a. ; aux. grid, 180v., 3.1 m.a. C30B, anode — ; aux. grid, 38v., 2.3 m.a. C70D, anode, 155v., 37 m.a. ; aux. grid, 184v., 8.5 m.a. C10B, cathode, 216v.

Lissen 8168 Portable.—Valve readings : K50M met., anode 125v., .45 m.a. : aux. grid, 72v., .1 m.a. K30C met., anode, 52v., .8 m.a. K30C met., anode, 63v., .8 m.a. K70D, anode, 125v., 4.2 m.a., aux. grid, 124v., .8 m.a.

Marconiphone 209 Five-valve Superhet.—From speaker strip : red, 240v., smoothed H.T. ; yellow-red, 220v., output valve anode ; black, earth ; yellow-black, 150v. negative, bias. Valve readings : MX40 met., anode, 210v., 2 m.a. ; aux. grid, 60v., 2 m.a. ; osc. anode, 90v., 2.5 m.a. VMP4G met. [I.F., 125 kc.] anode, 152v., 3.5 m.a. ; aux. grid, 80v., 2.8 m.a. D41 met., diodes only. MH4 met., anode, 96v., 2 m.a. MPT4 met., anode, 220v., 30 m.a. ; aux. grid, 208v., 5 m.a. U12, filament 242v.

Marconiphone 219 Five-valve Superhet.—From terminal plate on right of chassis : red, 240v., smoothed H.T. ; yellow-red, 220v. output valve anode ; black, chassis link ; yellow-black, 150v., negative, bias ; yellow, speech coil. Valve readings : MX40, anode, 210v., 2 m.a. ; aux. grid, 60v., 2 m.a. ; osc. anode, 90v., 2.5 m.a. VMP4 [I.F., 125 kc.] anode, 152v., 3.5 m.a. ; aux. grid, 80v., 2.8 m.a. D41 met., diodes only. MH4, anode, 96v., 2 m.a. MPT4, anode, 220v., 30 m.a.; aux. grid, 208v., 5 m.a. U12, filament, 390 v.

Marconiphone 224-236 Universal Chassis.—Taken on 230v. A.C. mains on 216–235v. tapping, between the following terminals on the speaker transformer and the chassis (note that the chassis may be "live" to earth) : Red, H.T. smoothed, 195v. ; yellow, H.T. unsmoothed, 215v. ; red and yellow, V3 anode, 180v. Valve readings : X30 met., anode 195v., 1.8 m.a. ; screen, 65v., 2.7 m.a. ; osc. anode, 70v., 1.3 m.a. WD30 met. [I.F., 456 kc.] anode 60v., 4 m.a. ; aux. grid, 67v., 1.9 m.a. N30, anode, 180v., 22 m.a. ; aux. grid, 145v., 4.6 m.a.

Marconiphone 234 Four-valve Battery Superhet.—Valve readings : X41 met., anode, 170v., .27 m.a. ; screen, 25v., .65 m.a. ; osc. anode, 25v., .7 m.a. VS24 met. [I.F., 456 kc.] anode, 165v., 3.2 m.a. ; aux. grid, 60v., .95 m.a. HD21 met., anode, 80v., 1.3 m.a. QP21, anodes, 168v., 1.2 m.a. ; screen, 140v., .9 m.a.

Marconiphone 257 Battery Superhet.—Battery voltages (2 x 84v.), H.T. : red, 159v. ; mauve, 72v., G.B. : grey, 9v. ; blue, 1.5v. Pink lead should be inserted into the voltage corresponding to the lettering on the bulb, as follows : W, 138v. ; X, 144v. ; Y, 151.5v. ; Z, 157.5v. Valve readings : X21, anode, 159v., .35 m.a. ; screen, 30v. ; osc. anode, 30v. VS24 [I.F., 456 kc.] anode, 159v., 3.5 m.a. ; screer, 72v. HD21, anode, 70–100v. Q.P.21, each anode, 159v., 1.8–2.8 m.a.

Marconiphone 345 All-wave Superhet.—From speaker strip : red with black tracer, 265v., H.T. smoothed ; red, 365v., H.T. unsmoothed ; red with yellow tracer, 232, output valve anode. Valve readings : VMP4G met., anode, 250v., 4.5 m.a. ; aux. grid, 65v., 2 m.a. X41 met., anode, 250v., 2.5 m.a. ; aux. grid, 65v., 2.5 m.a. ; osc. anode, 100v., 5 m.a. VMP4G met. [I.F., 460 kc.] anode, 250v., 4.5 m.a. ; aux. grid, 65v., 2 m.a. MHD4 met., anode, 105v., 2 m.a. N41, anode, 220v., 41 m.a. ; aux. grid, 265v., 10 m.a. U12, filament, 365v.

McMichael 135U Universal Superhet.—From strip on right-hand side of chassis (200v. A.C. supply) : top (F), red, 210v., unsmoothed H.T. ; (4) green, link to chassis ; (2) white and black, and (1) black, speech coils ; bottom (F), yellow, 180v., smoothed H.T. Valve readings : TP2620 met., anode, 140v. ; aux. grid, 139v. ; osc. anode, 58v. VP1321 met. [I.F., 128 kc.] anode, 172v., 6.5 m.a. ; aux. grid, 172v., 2.1 m.a. Pen. DD4020, anode, 165v., 23.8 m.a. ; aux. grid, 165v., 5 m.a.

McMichael 335 Superhet Battery Transportable.—Valve readings : VP215, anode, 102v., 1 m.a. ; aux. grid, 32v., .25 m.a. FC2, anode, 102v., .55 m.a. ; aux. grid, 34v., .7 m.a. ; osc. anode, 118v., .6 m.a. VP215 [I.F., 128.5 kc.] anode, 118v., 1 m.a. ; aux. grid, 34v., .25 m.a. HL210, anode, 48v., .7 m.a. QP21, anodes, 118v., 2.5 m.a. ; aux. grids, 120v., 1.6 m.a.

McMichael 361 Superhet Three.—From speaker strip : F, 355v., unsmoothed H.T. ; (1) 220, smoothed H.T. ; (2) (3) and (4), blank ; (F) 235v., smoothed H.T. Valve readings : AC/TP met., anode, 210v., 5.5 m.a. ; aux. grid, 210v., 2 m.a. ; osc. anode, 105v., 2 m.a. AC/VP1 [I.F., 128.5 kc.] anode, 235v., 13.5 m.a. ; aux. grid, 207v., 3 m.a. AC/Pen./DD, anode, 220v., 33 m.a. ; aux. grid, 235v., 6.8 m.a. UU3, filament, 355v.

McMichael 365 A.C. Radiogram.—From strip on right-hand of chassis : (F) 250v., smoothed H.T. ; (4) 320v., unsmoothed H.T. ; (3) 250v., smoothed H.T. (2) 200v., smoothed H.T. ; (1) earth. Valve readings : AC/TP met., anode, 153v., 4.2 m.a. ; aux. grid, 160v., 1.15 m.a. ; osc. anode, 90v., 1.5 m.a. AC/VP1 [I.F., 128.5 kc.] anode, 200v., 10 m.a. ; aux. grid, 170v., 2.5 m.a. AC/HL/DD, anode, 135v., 1.5 m.a. AC/2 Pen., anode, 245v., 40 m.a. ; aux. grid, 255v., 7 m.a. U12, filament, 330v.

McMichael 367 Portable.—Valve readings : S215A met., anode, 92v., .45 m.a. ; screen, 37v., .1 m.a. HL2 met., anode, 29v., .15 m.a. HL2 met., anode, 63v., .38 m.a. Pen. 220, anode, 104v., 3.2 m.a. ; aux. grid, 106v., .32 m.a.

Orr AW57 Superhet.—From speaker strip : red, 400v., unsmoothed H.T. ; black, 240v., smoothed H.T. Valve readings : FC4 met., anode, 230v., 1.9 m.a. ; aux. grid, 75v., 4.4 m.a. ; osc. anode, 65v., 1.5 m.a. VP4B met. [I.F., 465 kc.] anode, 240v., 10 m.a. ; aux. grid, 230v., 4.2 m.a. 2D4A met., diodes only. 354V met., anode, 75v., 1 m.a. Pen. 4VA, anode, 220v., 32 m.a. ; aux. grid, 240v., 3 m.a. IW3, filament, 400v.

Philco 282 Empire Five.—From speaker strip : red and black, external speaker ; green-white, 300v., unsmoothed H.T. ; white, 250v., smoothed H.T. ; green, 244v., output valve anode. Valve readings : 6A7, anode, 195v. ; aux. grid, 72v. ;

QUICK TESTS

osc. anode, 90v., 78E [I.F., 451 kc.] anode, 205v.; aux. grid, 65v. 75, anode, 53v. 42E, anode, 244v.; aux. grid, 240v. 80, filament, 300v.

Philco 295 All-Wave Battery Set.—Valve readings: 1A4E, anode, 164v., .25 m.a.; aux. grid, 27v., .5 m.a. 1C6 [I.F., 451 kc.] anode, 164v., .35 m.a.; aux. grid, 27v., .7 m.a.; osc. anode, 120v., 1 m.a. 1A4E, anode, 160v., .25 m.a.; aux. grid, 27v., .5 m.a. 2102, anode, 120v., 1.5 m.a. 2103, anodes, 164v., 4.4 m.a.; aux. grid, 164v., 2.4 m.a.

Philips 577A Super-Inductance Receiver.—Valve readings: VP4A met., anode, 250v., .75 m.a.; aux. grid, 95v., .5 m.a. VP4A met., anode, 230v., .75 m.a.; aux. grid, 95v., .55 m.a. 2D4A met., diodes only. SP4, anode, 150v., .24 m.a.; aux. grid, 32v., .1 m.a. Pen. 4VA, anode, 225v., 35.5 m.a.; aux. grid, 250v., 3.75 m.a. 1821, filament, 260v.

Philips 575A All-wave Superhet.—The only accessible points are the connectors in the leads to the speaker transformer. Between these and chassis the voltages are: Black lead, 285v., H.T. smoothed; red lead, 272v., V5 anode. Valve readings: VP4B met., anode, 176v., 5.9 m.a.; aux. grid, 190v., 2.4 m.a. FC4 met., anode, 190v., 1.7 m.a.; aux. grid, 68v.; osc. anode, 93v. VP4B met. [I.F., 115 kc.] anode, 235v., 7.8 m.a.; aux. grid, 205v. TDD4, anode, 95v., .8 m.a. ACO44, anode, 235v., 48 m.a.

Philips 745A All-wave Superhet.—FC4 met., anode, 255v., 6.5 m.a.; screen, 105v., 4.75 m.a.; osc. anode, 100v., 1.75 m.a. VP4B met. [I.F., 128 kc.] anode, 160v., 2 m.a.; aux. grid, 230v., 6.5 m.a. 2D4A, diode only. Pen. A4, anode, 225v., 38 m.a.; aux. grid, 250v., 4.75 m.a. 1821, filament, 290v.

Philips 797A All-wave Set.—Valve readings: FC4 met., anode, 260v., 2.2 m.a.; screen, 70v., 2 m.a.; osc. anode, 70v., 5 m.a. VP4B [I.F., 128 kc.] anode, 240v., 6.5 m.a.; aux. grid, 150v., 2.3 m.a. TDD4, anode, 70v., 1 ma. Pen. A4, anode, 250v., 34 m.a.; aux. grid, 260v., 3.9 m.a. 1821, filament, 285v.

Philips 940A Two-valve Set.—Valve readings: SP4, anode, 180v., .7 m.a.; aux. grid, 20v., .25 m.a. PM24M, anode, 220v., 20 m.a.; aux. grid, 210v., 4.1 m.a. 1821, filament, 240v.

Pye TP/B Battery Portable.—Battery connections: H.T. +, green lead, 88½v.; H.T.+, red lead, 136½v.; G.B.—, brown lead, —10½v.; H.T. —, black lead; screens, yellow and blue, adjusted to equalise Q.P.P. valve anode currents. Valve readings: VP215 met., anode, 130v., .6 m.a.; aux. grid, 90v., .3 m.a. TP22 met., anode, 128v., .6 m.a.; aux. grid, 85v., .25 m.a.; osc. anode, 75v., .15 m.a. VP215 met. [I.F., 127 kc.] anode, 130v., .6 m.a.; aux. grid, 82v., .25 m.a. L21DD met., anode, 104v., .75 m.a. QP240, anodes, 130v., .25 m.a.; aux. grids, 118v., .45 m.a.

Pye T10 All-wave Superhet.—Valve readings: A50N met., anode, 261v., 1.6 m.a.; aux. grid, 56v., 1.2 m.a. A80A met., anode, 261v., 1.3 m.a.; aux. grid, 53v., .2 m.a.; osc. anode, 98v., 2.1 m.a. A50N met. [I.F., 465 kc.] anode, 152v., 4.3 m.a.; aux. grid, 74v., 1.9 m.a. A23A met., anode, 106v., 2.1 m.a. A70C, anode, 234v., 35 m.a.; aux. grid, 261v., 4 m.a. V1 operates on short waves only.

Pye T9 A.C. Superhet.—Between the two lower terminals on the speaker and chassis (looking from the back): Right, (1) H.T. smoothed, 300v.; left, (2) H.T. unsmoothed, 420v. Valve readings: A80A met., or FC4 met., anode, 300v., 1.1 m.a.; aux. grid, 83v., 4.8 m.a.; osc. anode, 83v., 3.3 m.a. A50N met. or VP4A met. [I.F., 127 kc.] anode, 240v., 4.6 m.a.; aux. grid, 78v., 2.1 m.a. A23A met. or TDD4 met., anode, 130v., 3.6 m.a. S30C or ACO44, anode, 292v., 39 m.a.

Pye T10A All-wave Superhet.—From speaker strip: red, 252v., smoothed H.T.; black, 420v., unsmoothed H.T. Valve readings: A80A met., anode, 245v., 1 m.a.; aux. grid, 40v., 1.5 m.a.; osc. anode, 130v., 2.6 m.a. A50N met. [I.F., 465 kc.] anode, 120v., 4 m.a.; aux. grid, 80v., 2 m.a. A23A met., anode, 70v., 2 m.a. A70C, anode, 210v., 35 m.a.; aux. grid, 250v., 3.5 m.a. A11B, filament, 420v.

Pye T20 A.C. Transportable.—From speaker strip: red, 400v., unsmoothed H.T.; black, 280v., smoothed H.T. Valve readings: AC/VP1 met., anode, 225v., 4 m.a.; aux. grid, 165v., 1.4 m.a. AC/TP met., anode 175v., 5.1 m.a.; aux. grid, 235v., 1.5 m.a.; osc. anode, 105v., 1.9 m.a. AC/VP1 [I.F., 127 kc.] anode, 230v., 7.5 m.a.; aux. grid, 225v., 1.5 m.a. AC2/Pen./DD, anode, 255v., 35 m.a.; aux. grid, 280v., 6.9 m.a. A11B, filament, 400v.

R.G.D. Model 1202.—Valve readings: AC/SG/VM or VMS4, anode, 190v., 4.5; screen, 55v. AC/SG/VM or VMS4, anode, 200v., 1 m.a.; screen, 55v. MHL4, anode, 30v., 1.5 m.a. (not oscillating). AC/SG/VM or VMS4 [I.F., 110 kc.] anode, 200v., 5 m.a.; screen, 55v. AC/HL/DD, anode, 100v. (used for amplifying A.V.C.). AC/S2/Pen., muting only. MH4 or AC/ML, anode, 100v., 2 m.a. MH4, anode, 220v., 4.7 m.a. MH4, anode, 220v., 4.7 m.a. PP3/250 or PX4, anode, 340v., 40 m.a. PP3/250 or PX4, anode, 340v., 40 m.a.

Tannoy 15 watt GM15C P.A. Amplifier.—Valve readings: H30 met., anode, 80v., 1.8 m.a. L30, anode, 170v., 16 m.a. PX25, anode, 525v., 34 m.a. PX25, anode, 525v., 34 m.a. U18, filament, 550v. Microphone: 14v., 22 m.a.

Truphonic AW5 All-wave Superhet.—Valve readings: FC4 met., anode, 220v., 3 m.a.; osc. anode, 75v., 2.5 m.a. VP4B met. [I.F., 127 kc.] anode, 105v., 2.2 m.a.; aux. grid, 130v., 6 m.a. TDD4 met., anode, 110v., 2.8 m.a. Pen. 4VB, anode, 180v., 29 m.a.; aux. grid, 210v., 3.5 m.a. IW3, filament, 370v.

Ultra 26 A.C.-D.C. Superhet.—Valve readings: TP2620 met., anode, 130v., 3.25 m.a.; aux. grid, 120v., .5 m.a.; osc. anode, 60v., 2 m.a. VP1321 [I.F., 456 kc.] anode, 175v., 7 m.a.; aux. grid, 105v., 2 m.a. Pen. DD4020, anode, 110v., 32 m.a.; aux. grid, 130v., 7 m.a. U4020, cathode, 200v.

Ultra Model 77 Battery Three.—No batteries are supplied with the receiver, and the following are suitable: Siemens "Full o' Power" type H3 for H.T.; type G2 for G.B.; or type H120 for H.T. and type C.G.2 for G.B. Exide and Drydex H.T., H1006; G.B., H1001. Grosvenor H.T., G120; G.B., G9. Pertrix, H.T., 477; G.B., 460.

Tappings: H.T. + 1, brown lead + 20v. H.T. + 2, white lead, + 50v. H.T. + 3, red lead + 120v. G.B. — 1, light blue lead — 4.5v. G.B. — 2, dark blue lead — 9v.

The total set consumption, taken in negative lead at maximum battery voltage and new accumulator is 7.5 m.a. Valve readings: VP215, anode, 120v., 1.5 m.a.; aux. grid, 50v. SP215, anode, 50v., .3 m.a.; aux. grid, 50v. Pen. 220, anode, 120v., 5.5 m.a.; aux. grid, 75v.

Ultra 96 A.C. Radiogram.—From speaker, strip: black, 260v., smoothed H.T.; red, 365v., unsmoothed H.T. Valve readings: AC/TP met. anode, 185v., 6 m.a.; screen, 185v., 1.7 m.a.; osc. anode, 80v., 2.2 m.a. AC/VP1 met. [I.F., 456 kc.] anode, 230v., 17 m.a.; aux. grid, 225v., 5 m.a. AC2/Pen./DD, anode, 235v., 33 m.a.; aux. grid, 245v., 7 m.a. UU3, filament, 365v.

Ultra 101 A.C. Superhet.—From speaker strip: red, 360v., unsmoothed H.T.; black, 245v., smoothed H.T. Valve readings: AC/TP met., anode, 185v., 6 m.a.; aux. grid, 185v., 1.5 m.a.; osc. anode, 80v., 2 m.a. AC/VP1 [I.F., 456 kc.] anode, 225v., 17 m.a.; aux. grid, 220v., 5 m.a. AC2/Pen./DD, anode, 230v., 34 m.a.; aux. grid, 240v., 7 m.a. UU3, filament, 360v.

RADIO SERVICING

For receiver testing it is necessary to know the meaning of the common electrical terms and how to use Ohm's Law, to have certain equipment and know how to use it and, finally, to understand something of how receivers operate.

This section supplies information on all these points and for accessibility is divided into four " chapters " :—

" Circuit Details " contains practical, theoretical and testing notes on individual parts of receivers, P.A., accumulators, and charging. To aid reference it is presented in encyclopædic form.

1.—Terms, Units and Ohm's Law

When a battery or dynamo is functioning an Electro Motive Force occurs between the two poles of the apparatus. If the two poles are joined by electrically conductive substances, a circuit is said to be formed and the E.M.F. drives a current from the positive or high-potential pole of the generating apparatus to the negative or low-potential pole.

Negative potential should not be confused with zero potential. The earth, which can be used as a link common to all circuits, is accepted as zero potential. When a circuit is earthed the connection from the earth may be made to a point hitherto considered either positive or negative. With relation to the circuit itself the point will remain positive or negative, but it will, in fact, be at zero potential.

In practical radio, this fact means that when a plus or minus sign is encountered in a receiver, it cannot be assumed that the point is positive or negative with regard to the set as a whole (that is, the chassis). The indication may relate only to the particular component.

Any circuit, however short and however conductive the materials used, offers some opposition or resistance to the passage of a current. In fact, the greater the resistance the less current can a particular E.M.F. drive through a circuit. E.M.F., current and resistance are, therefore, interdependent and the relationship is expressed (by Ohm's Law) as follows :—

$$I = \frac{E}{R}$$

(where I stands for current, E for E.M.F., and R for resistance).

This law can also be given in equivalent mathematical forms as

$$R = \frac{E}{I} \text{ and } E = RI$$

Obviously if any two of the three factors, E.M.F., current and resistance, are known, Ohm's Law enables the value of the third to be found. It is essential when using the law, however, to state the values in the correct units.

The unit in which E.M.F. is measured is the volt. The unit of current is the ampere and the unit of resistance is the ohm.

In radio E.M.F.s are frequently measured in millivolts (thousandths of a volt) and sometimes in microvolts (millionths of a volt). Similarly, currents, of so many milliamperes or microamperes are met with. Resistances often amount to megohms (millions of ohms).

As stated above, the correct units, *i.e.*, volts, amperes and ohms, must be employed when applying Ohm's Law. The reason is obvious. If, for example, a current was to be found

by using the formula, the statement of the voltage as 50 when actually it was 50 millivolts or .05 volt would result in the current figure being a thousand times too great.

Mental calculations involving voltage, current and resistance are often done easily if it is remembered that one milliamp passing through 1,000 ohms drops one volt.

There is one further unit frequently met with in servicing. This is the watt or unit of power. When, for example, an E.M.F. drives a current through a resistance, power is expended in the resistance (usually taking the form of heat). The current flowing in amperes multiplied by the E.M.F. drop in volts gives the power dissipated in watts. That is :—

$$P\,(\text{watts}) = I\,(\text{amps.}) \times E\,(\text{volts})$$

$$\text{or } P = \frac{E^2}{R} = RI^2$$

2.—Service Equipment

A receiver is composed entirely of a number of separate circuits. Any particular receiver can only operate correctly when the correct number of circuits exist, and *only* the correct number exist. When a receiver fails, apart from valve trouble, which will be dealt with later, it is either because one of the circuits has become incomplete, or because a new circuit has developed.

Fault testing is, therefore, almost entirely a matter of testing for continuity. It consists of looking for continuity where it is required and of finding if continuity exists where it is not required. This is the basic and fundamental idea underlying every servicing or testing operation.

All tuning coils, high-frequency chokes, low-frequency chokes, and resistances, must be electrically continuous in the circuits in which they are included. If they are not, then a fault exists. In the case of a condenser, there must be no continuity in so far as direct currents are concerned. If there is continuity then the condenser is faulty.

In the case of a resistance, choke or transformer which consists of a winding of a large number of turns, there must still be continuity but there must be what is called a high-resistance path. The value of this resistance, which can be measured extremely simply, and can be regarded as the extent or degree of continuity, is an indication of the correct condition or otherwise of a particular component.

For radio testing, then, some means is required for discovering (1) continuity or complete circuit, (2) discontinuity or open circuit, (3) extent of continuity or resistance.

This means is provided by a large number of meters and "test-sets" on the market. Meters may measure current, voltage and resistance, and as the mechanism is basically the same in each case, single "multi-range" instruments which give all three kinds of reading are obtainable.

Using Meters.

To measure current a meter must be inserted in the path taken by the current. On the other hand, voltages are taken by connecting the meter across any two points between which there is a resistance.

Resistance is ascertained by measuring the current passed at a certain voltage and applying Ohm's Law. When the meter-scale is calibrated in ohms, the instrument is connected as if to measure current (which it will actually do) and a particular voltage depending on the calibration applied by means of a battery included in the circuit.

Choosing Meters.

When measuring either current or E.M.F., meters take power from the circuits to which they are applied (because the indicating mechanism has to be moved) and usually this extra load on a circuit slightly alters the factors which are being measured. The more efficient a meter, therefore—that is, the smaller current it passes at full scale deflection—the nearer will the values measured correspond to those actually obtaining when the meter is not in use.

Good meters pass only a few milliamps, for example, 1 m.a. or 5 m.a. Two meters actually requiring these currents, when used as voltmeters, would require resistances of 1,000 and 200 ohms respectively for every volt full-scale deflection. They would be described as 1,000-ohm-per-volt and 200-ohm-per-volt instruments. The ohm per-volt "figure of merit" is, of course, a direct gauge of the efficiency of a meter—the higher the figure the less being the current passed.

However, the figure of merit should be considered in conjunction with the length of the scale and the accuracy with which readings can be made. For example, if the scale of a 200-ohm-per-volt meter is so legible that 50 volts can be read as accurately as on a 500-ohm-per-volt instrument the scale of which reads up to 500 volts, the efficiency is the same in each case—both meters take 5 m.a.

Moving-Iron and Moving-Coil.

There are two principles on which meters are made. In the moving-iron type, the indicator is attached to a small magnet suspended in a coil through which the currents

to be measured are passed. The magnetic field set up by a current causes the magnet and consequently the pointer to take up a new position.

Due to the mass of the magnet, moving-iron meters generally take a relatively large power from circuits to which they are connected and, because of the inertia, are also slow to respond.

In moving-coil meters the construction is just the opposite. A light coil, with the pointer attached, is movably mounted in the field of a large fixed magnet. This type is the more efficient and is also more dead-beat—that is, the pointer comes to rest quicker.

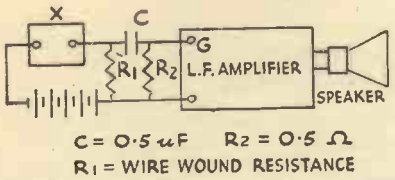
A.C. Meters.

To measure A.C. currents and voltages with the accuracy obtainable with moving-coil movements, a rectifier has to be employed to convert the current to D.C. Usually, this rectifier takes the form of a small metal rectifier.

Extending Ranges.

The range of readings obtainable with a current meter can be extended by connecting parallel resistances so that when the meter and its associated resistance is connected in a circuit it is known that a certain multiple of the current passed by the meter is at the same time passing through the resistance.

The value of shunt resistance required is given by $\frac{R}{X-1}$ where R is the resistance of the meter and X is the times the reading is to be multiplied. For example, if a 5 m.a. meter is to read 50 m.a. the parallel resistance must be a ninth (10—1) of the resistance of the meter.



When components are suspected of introducing crackling noises they can be tested in this circuit. A current from the battery is passed through a high resistance R1 and the component under test X. Connection to the grid of the first amplifier is through a condenser C, and a leak R2.

When the meter's resistance is not known the shunt required can be found by practical methods. First, by means of a battery and series variable resistance the total deflection of the meter is obtained. Then a shunt resistance (a length of Eureka is sufficient) is placed across the meter and adjusted until the reading is reduced to the required fraction of the maximum reading. If, for example, the range is to be extended 10 times, the shunt will be adjusted until the meter reads a tenth of the maximum deflection.

To increase the range of a voltmeter it is necessary to insert series resistances so that an increased voltage can be applied without driving an excessive current through the meter. First the resistance of the movement has to be found; then to increase the reading of the meter X times a resistance of XR—R is joined in series, R being the resistance of the meter.

Ranges Required.

A consideration of present-day receivers and also of the lines on which radio apparatus is likely to develop suggests that the service engineer should have meters or a multi-range meter providing ranges approximating to the following:—

D.C. volt ranges, 0–10, 250, 600 volts; D.C. current, 0–10, 100, 200 m.a., 1 amp.; A.C. volts, 0–5, 20, 250, 1,000 volts; A.C. current, 0–50, 250, 500 m.a., 5 amps.; Resistance, 0–100, 1,000 10,000, 1,000,000 ohms.

The Modulated Oscillator and the Output Meter.

Of considerable use to the service engineer, since it enables adjustments to be made to receivers when no broadcast programme is available, is the modulated oscillator. This is a valve apparatus which provides a fixed—or pick-up—modulated radio signal at more or less accurately known medium, long and intermediate frequencies as required.

To observe with accuracy the effects on the output of a receiver of adjustments of sensitivity and selectivity it is advisable to use an output meter. Any A.C. meter with ranges approximately matching the output stage of the receiver can be used as an output meter if a ·5 mfd. condenser is connected in series with the meter across the anode load of the output valve.

Using an Oscillator.

To gang a "straight" receiver, an output meter is connected across the primary of the output transformer and the oscillator is connected to the input of the set and adjusted to about 300 metres.

The H.F. and aerial trimmers are then alternately adjusted until maximum output is obtained. Now and again the main tuning control should be retuned.

When a band-pass circuit is being ganged, the trimmers should be set so that slight movement of the tuning control causes no difference. This will show that the flat-top effect for which band-pass circuits are designed is being obtained.

With superheterodyne receivers ganging is a little more complicated but when once understood is quite simple.

The oscillator is set to the intermediate

RADIO SERVICING—2

frequency of the receiver, one side of the output is earthed, and the other, which need not be taken through a dummy aerial, is connected to the grid of the last I.F. valve.

The trimmers are then adjusted until the note in the speaker is at its loudest or until the output meter, if one is used, gives its maximum deflection.

In some cases the I.F. transformer is tuned to give a slight flat top by a minute variation in the tuning of the two trimmers. If this is the case the necessary frequencies must be obtained from the manufacturers of the set or from service data sheets.

Previous I.F. valves are subsequently dealt with in the same way, and finally the radio-frequency portion is ganged up by connecting the oscillator through the dummy aerial to the set terminals.

The tracking of a superhet can be checked easily with an oscillator. First, a simple frequency in relation to the I.F. frequency is chosen. As an example, assume the I.F. frequency is 110 kc. Set the oscillator to 1,110 kc. (with the modulation switched off) and turn the set tuning knob until the oscillator section is tuned to 1,110 kc. This point can be found by putting phones in the anode of the first detector or mixing valve. An ordinary heterodyne whistle will be heard until the correct zero beat position is obtained.

Remove the phones and set the test oscillator to 1,000 kc., with the modulation on, and using a very weak input. Then, taking care not to move the set tuning control or the trimmer on the oscillator section, adjust all the other trimmers for maximum intensity. If a few more turns are required on a trimmer in either direction, repeat the whole adjustment, first of all altering the oscillator trimmer so that completely new settings are obtained everywhere. This will ensure correct ganging.

This method, while a little tedious, is bound to give perfect results, and spurious tune points are not likely to arise as they often do with less accurate methods.

Ganging a straight set is carried out simply by adjusting the trimmers for maximum output. Initial adjustments should be carried out in the region of the middle of the medium waveband and final checking should be tried near the beginning.

An oscillator can be used for checking both sensitivity and selectivity. Comparative sensitivity can be measured by noting the position required on the attenuator for a given voltage measured across the speaker terminals by a rectifier voltmeter. The smaller the input the more sensitive the receiver.

Selectivity can be checked by plotting the voltage across the speaker against changes in wavelength on the oscillator. A change of 10 kilocycles on the oscillator should reduce the voltmeter reading to an almost negligible figure in a highly selective set.

To avoid errors due to overloading of the valves, oscillators should always be adjusted to give the smallest input which provides satisfactory indications and if necessary the volume control of the receiver also "turned down."

If the volume control operates in the diode stage its operation probably will do nothing to prevent overloading of the H.F. valves.

3.—Receiver Testing

Properly equipped for service work, the retailer or service engineer must next know how to use his apparatus to discover receiver faults in the shortest possible time. Haphazard, planless testing may reveal a fault quickly once in a while. But there is no room in business for gambling, and to undertake service work successfully the radio man must work on a system.

A logical testing system may seem to demand an unnecessary amount of work but on a number of receivers it will always prove quicker. The complete series of tests carried out, the service man will either have found the fault or be able to return the set to the makers with the message "Your design is at fault."

Systematic examination does not preclude the use of rough-and-ready measures. A dab of the fingers on grid terminals is a simple test and a good one. But indiscriminate dabbing will sometimes fail to disclose a fact which would have become obvious if the dabbing had been done systematically.

The result of the application of "scientific" tests is largely the obtaining of various current and voltage measurements.

No two receivers from different factories are just alike and many are decidedly original. If his measurements are going to be of maximum use—sometimes, in fact, if they are going to be of any value at all—the service engineer must be able to compare them with the currents and voltages obtaining in a properly functioning receiver of the type concerned.

Knowing this, "The Broadcaster," since January, 1934, has been supplying its subscribers with a regular feature, "The Service Engineer," in which these figures and much other valuable data are given for all the popular receivers. The voltages and currents concerned are given in these "Service Engineer" reviews under

two headings, "Valve Readings" and "Quick Tests."

These figures for over 60 of the receivers dealt with during the past year in "Service Engineer" are given on pages 55–58 of this issue of "The Broadcaster Annual."

In the following descriptions of systematic testing methods to apply to battery and mains receivers, it is assumed that use is made of this data.

First Step.

The first step with any receiver is to see that both input and output connections are correct, that the aerial, earth and speaker connections are "good" and that the aerial is not, for example, shorted to earth.

Battery Receivers.

With battery sets fitted with reaction or pick-up sockets a twist of the reaction knob or a touch of the finger on the socket connected to the grid will immediately show if the detector and low-frequency valves are functioning. If they are, attention can at once be concentrated on the H.F. side: if no results are obtained it may be that the reaction or pick-up connections alone are faulty and further tests of the L.F. stages are necessary.

Usually if these stages are correct a ringing noise will be heard if the valves are lightly tapped. Alternatively, and if successful the results will be more unmistakable, the grid terminal can be touched with the tip of the finger. Failing satisfactory results it is now time to check the H.T. and L.T. voltages and the H.T. current.

In most cases the H.T. current can be measured by connecting a milliammeter in the common negative lead to the H.T. battery (if motor-boating occurs connect a 1 mfd. condenser across the meter), but if automatic bias is employed the inclusion of the meter may alter all the operating conditions of the receiver and the anode currents should be measured in each positive lead.

For these measurements the volume control should be at maximum (or just below oscillation point if reaction is fitted) and the set should be tuned away from stations.

The H.T. current readings obtained should, of course, be compared with the figures given in "Service Engineer" or those issued by the makers of the receiver, or even those obtainable by reference to the valve makers' data. Small discrepancies are to be expected, but differences of several milliamps will show that something is wrong and often indicate just which stage is faulty. If it is excessive, it may be due to a break in the secondary of the transformer, which deprives the last valve of its negative basis. If the current is very low it may be due to a partial fault in the speaker circuit introducing high resistance, or to the emission of the valve failing. Tests of this are described in another section.

If the last valve circuit appears correct, the anode circuit of the detector valve should be examined. If the current here appears correct and still no ringing noise is obtained in the speaker on tapping the first valve, the trouble is probably connected with the inter-valve transformer or the by-pass condenser. Temporary isolation of these points will indicate whether this is the troublle.

If the set has been proved correct from the anode circuit of the detector valve onwards, everything between the aerial terminal and the grid of this valve should be examined if it is the first valve.

A short on the tuning condenser or on the coil or the grid leak will cut signals off completely. A very easy test is made by disconnecting the grid of the first valve, temporarily attaching the aerial to the grid of the valve. If the transmission is reasonably powerful, something is sure to be heard, and it is then a simple matter to find where the trouble originates, connecting in progressive order the grid leak, condenser, tuning condenser, and finally the tuning coil itself.

Further details of means of testing the H.F and L.F. couplings can be obtained from the remarks given below relating to mains receivers. Details of the components used and ways of testing them individually are given under "Circuit Details" on pages 67–89.

Mains Receivers.

Having checked the aerial, earth and mains connections and ascertained that the mains supply is "on," it is advisable to proceed at once to the checking of voltages. In most sets the tags on the speaker transformer provide accessible means for this. The voltages obtained should be compared with those given under "Quick Tests" in "Service Engineer" data or those issued by the makers of the receiver.

To ensure that the measurements are secured under the same conditions as the ideal, the volume control should be set at maximum (unless it is ganged with reaction, in which case it should be set just below oscillation point) and the receiver should be tuned away from transmissions. Except with D.C. sets, it is often advisable to short the aerial and earth terminals.

Usually the connections on the speaker transformer give H.T.+ unsmoothed, H.T.+ smoothed and output valve anode. The field winding of the speaker lies between H.T. + unsmoothed and smoothed, and the primary of the output transformer between H.T. + smoothed and output valve anode.

Occasionally the speaker field is connected in the negative side of the receiver as in Fig. 3.

If no readings at all are obtained, the service engineer should proceed as outlined below, but if measurements are obtained it is advis-

RADIO SERVICING—3

able at this stage to apply a little mental arithmetic. By subtracting the H.T smoothed voltage from the H.T. unsmoothed and dividing the voltage drop thereby indicated by the resistance of the field in 1,000 ohm units, the total H.T. current drawn by the set is obtained. Similarly by dividing the voltage drop across the output transformer primary (obtained by subtracting output valve anode voltage from H.T. smoothed) by the resistance of the winding in 1,000 ohm units, one can obtain the current taken by the output valve alone.

Suppose for example, that the voltage drop across the field is 100 volts and the resistance is 2,500 ohms. The total current drawn by the set is 100 divided by 2.5, that is 40 ma. If the voltage across the speaker transformer primary is 10 and the resistance is 400 ohms the current is 10 divided by .4, that is 25 ma.

If both these current readings are smaller than they should be and the voltages are high, there is a high resistance connection associated with the output valve, this valve has lost its emission or, thirdly, it is overbiased. If the voltages are low and the current is also low, a fault in the rectifier or mains transformer is indicated.

High current and low voltages suggest a faulty smoothing condenser (on the receiver side of the field), a partial H.T. short, too low a bias on the output valve or, possibly, trouble in the valve itself.

The current through the field should be greater than that through the speaker transformer by the amount of current taken by the rest of the set. If not normal the difference will suggest either a short or a discontinuity in the H.T. circuits to all parts of the set except output valve anode.

When no H.T. voltage is obtained examine the transformer and rectifier wiring for continuity and, then, taking out the valve, measure the A.C. voltages across the anode and filament sockets. If no readings are obtained the transformer should be taken out and tested for continuity of the windings.

A resistance measurement between the rectifier filament sockets and chassis should give a reading of 20,000 ohms or more (caused by H.T. potentiometers for screen and auxiliary grid voltages). An instantaneous low reading may be caused by the electrolytic condensers, but a constant low or zero voltage shows there is a short circuit of H.T. to chassis.

A zero reading shows that the short occurs on the rectifier side of the smoothing choke and the smoothing condenser is chiefly suspect. Often a low resistance reading by its value suggests where the short exists. For example, if the speaker field or smoothing choke has a resistance of 2,500 ohms and this is the reading obtained between rectified filament and chassis it is clear that the short is situated at the " H.T. smoothed " end of the choke.

When a short circuit has occurred it is possible that the rectifier filament will be found to be burnt out since it will have been in the " path " of the short.

Between the anode sockets and chassis, a resistance test should give the resistance of each half of the H.T. winding or, if the speaker field is in the negative lead, half the winding plus the field resistance.

Testing of the L.T. secondary winding can be carried out by measuring the resistance between the centre point and each filament socket. Each pair of windings on the transformer should be tested for insulation and

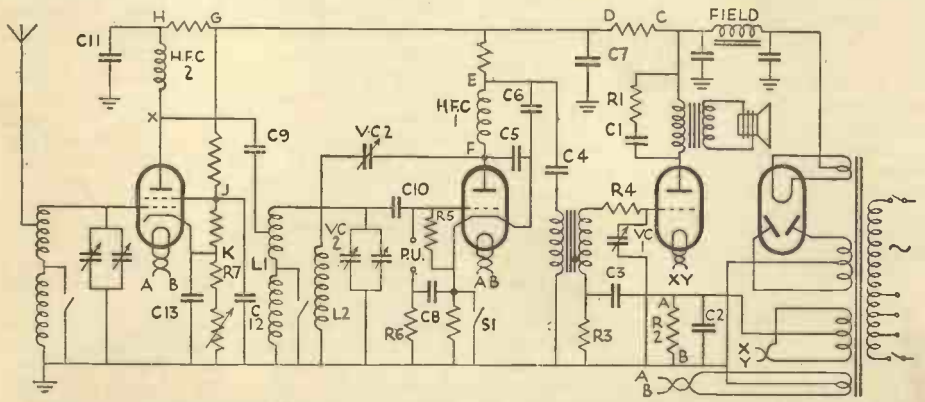


FIG. 1.—A typical A.C. mains receiver circuit incorporating a screen-grid H.F. valve (an H.F. pentode might just as well be used), a leaky grid detector and a directly heated output triode which obtains its filament current from a separate L.T. winding. Tuned grid H.F. coupling and resistance-fed transformer coupling are further features.

the primary should be measured to see if a partial short has occurred.

When the current supply arrangements are known to be correct, the valves should each be checked, first in the receiver with the aid of adaptors (and then, if necessary, in a special test panel).

This will probably immediately disclose any circuit discontinuities and eliminate the need for all the tests given below except the few appropriate ones. Assuming no fault becomes obvious, the speaker itself must be suspected and quickly checked by connecting another across it. (See also "Speaker" under "Circuit Details.") Shunt tone correction components such as R.1 and C.1 in Fig. 1 must also be examined.

If the output valve has been proved to be sound but its anode current is too high or too low when it is placed in the receiver, tone correction devices such as R.1 and C.1 (Fig. 2) should be inspected. Next the grid and bias circuits must be checked. The bias can be measured (using a high resistance range) across the bias resistance.

Bias Circuits

Different bias circuits are used according to whether the valve is directly or indirectly heated. In the former case (see Fig. 1) the resistance, R.2, is situated between the centre point of the filament winding and chassis. With indirectly-heated valves (Fig.2) the resistance is connected between cathode and chassis.

Sometimes the bias resistance forms part of the circuit carrying the total H.T. current of the receiver and may be part of the speaker field which is connected in the negative lead as in Fig. 3. In these sets the bias for the output valve is not correct unless all the other valves are operating properly.

Absence of bias voltage (across points A and B in diagrams) although current is flowing shows that the condenser C.2 across the resistance is shorting.

Presence of a bias voltage does not mean that it is applied to the valve. The grid circuit must be complete for this to be so. With the aid of a circuit diagram the grid path should be tested section by section. When a nickel-alloy transformer is used a current should not be passed through the secondary, however, and, as a last resource, another transformer should be substituted. The grid circuit usually obtains

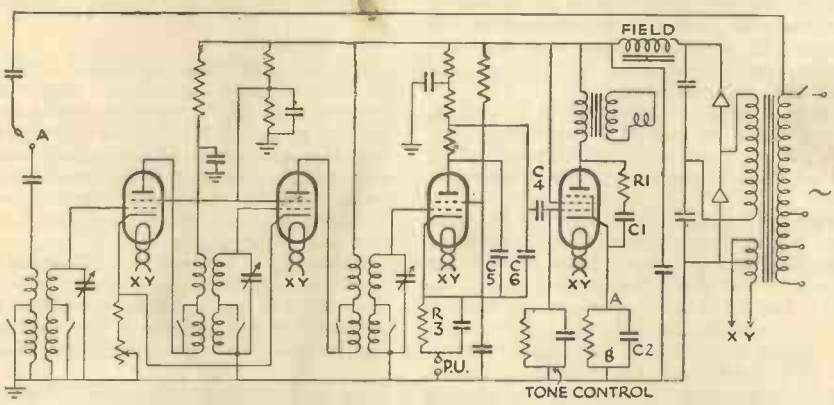


FIG. 2.—A circuit of a receiver employing H.F. transformer coupling between the H.F. valves, an anode bend detector, an indirectly heated output pentode and metal rectification of the H.T. supply. The pick-up connection, the use of a resistance as an H.F. stopper in the detector anode circuit and resistance-capacity L.F. coupling are points of interest.

a decoupling resistance and condenser (R.3 and C.3 in Figs. 1 and 3) and these should be tested for value and insulation respectively. If fitted the H.T. stopper R.4 and tone control condenser V.C.1 must be examined.

Bias may be made faulty by a leakage from the anode circuit of the preceding valve through the coupling condenser C.4, and/or the L.F. transformer. The voltage drop caused by this current passing through the resistance in the grid circuit tends to produce a positive bias.

Proceeding to the previous stage, usually the detector, test for voltages point by point (C, D, E, F in Fig. 1) to the anode and then, if necessary, for continuity or resistance. It is as necessary to see that the correct resistance exists across transformers, H.F. chokes and resistances as it is to see that the connecting leads are continuous. A short circuit through a component is, of course, as serious as a broken circuit. If the voltages are low or, alternatively, touching the grid of the detector does not produce noises, although anode current is flowing, see that the H.F. by-pass condensers, C.5 and C.6, reaction condenser V.C.2, coupling condenser C.4, and decoupling condensers C.7, are not leaking.

In anode bend detector stages screen-

RADIO SERVICING—3

grid and H.F pentodes are often used. These necessitate high anode resistances which make it impossible to obtain accurate voltage readings. The current has to be measured and then Ohm's Law applied.

Bias tests in this stage are carried out as with the output valve. If the circuit is like that in Fig. 1, leaky grid detection is employed, and the bias resistor may be shorted by a suitable switch S.1 on radio. It is not necessary for the resistance to be shortened when the grid leak R.5 is returned to the cathode. If pick-up results are unsatisfactory, test the pick-up decoupling condenser C.8 and resistance R.6.

In Fig. 2 anode bend detection is utilised and the bias resistor R.3 provides a bias, applied during radio reception, and amounting to about twice the normal bias for the valve used.

When, with a receiver in which the detector is the first valve, no reception is obtained although the above tests have proved the valve itself and the subsequent stages to be correct, the blocking condenser C.9, tuning-coil L.1, reaction coil L.2, tuning condenser V.C.3, reaction condenser V.C.2, grid condenser C.10 and grid leak R.5, must be examined.

With "straight" receivers employing H.F. stages the aerial should be tapped back to the anode connection (X) of the previous valve. In the case of tuned anode coupling (Fig. 3) a .0001 m.f.d. condenser should be included in the aerial lead while in a tuned grid circuit (Fig. 1) the H.F. choke (H.F.C.2) must first be tested for satisfactory resistance (a few hundred ohms).

L.1 and L.2 should now be tested for continuity (a resistance of a few ohms, which is increased a little by operation of the wavechange switch, should be obtained). V.C.3 and V.C.2 should be isolated from the circuit and should give a practically infinite resistance. R.5 should have its rated value and the quickest check for C.9 and C.10 is to substitute other condensers of the same capacities.

Diode Detection and Automatic Volume Control.

The only tests for diode detectors and diode circuits providing voltages which control the amplification of the H.F. stages, lie in seeing that the circuits themselves and the values of the components are correct. (See respective headings under "Circuit Details.")

H.F. Stages

The first step in testing an H.F. stage is the checking of anode, screen (or auxiliary grid in the case of H.F. pentodes) and bias voltages (at points G, H, X, J and K) and to see that the resistances of decoupling resistors, coils or H.F. chokes are approximately correct. As in the other anode circuits it should be seen that the decoupling condensers C.11 and C.12 are not shorting.

Observing bias voltage changes across K and chassis while the volume control V.R. is varied will ascertain the soundness of the potentiometer and show if C.13 is shorting. R.7 it should be noted fixes the minimum bias.

As in L.F. stages the grid returns must be checked for continuity and in A.V.C. receivers this will involve a check of the decoupling resistances.

All that remains to be checked now is the aerial tuning circuit which may consist of a single coil and condenser as in Fig. 1, or as a band-pass circuit as in Fig. 3. (See respective headings under "Circuit Details.")

Superheterodyne Receivers.

As far as the low-frequency, detector and input tuning arrangements are concerned superhets are no different from "straight"

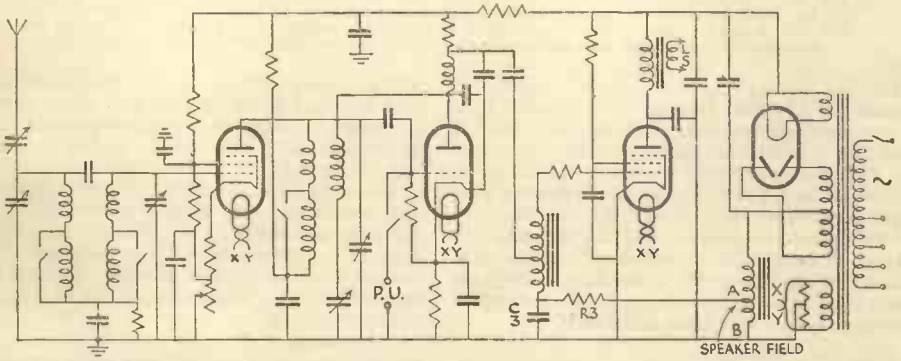


FIG. 3.—Here the speaker field winding is in the negative load and a tapping provides the bias for the output valve. Band pass coupling precedes an H.F. pentode, which is tuned-anode coupled to a leaky grid detector.

receivers. It is only when troubles occur in the oscillator and I.F. stages that special problems arise.

One can discover if the oscillator is oscillating by connecting headphones in the anode circuit. Heterodyne whistles should be heard. Alternatively a meter in the anode circuit should show a change in current when one of the oscillator coils is shorted.

If it is thought that the valve oscillates over only a part of the waveband, a change in the anode current as the tuning condenser is swung will show that this is so. Another valve should be tried or the screen (and perhaps, anode) voltage increased.

If the valve refuses to oscillate the oscillator coils should be tested for continuity (too high a resistance will indicate a bad switch contact or badly soldered Litz wire).

Intermediate-frequency transformers are easily checked by connecting the output of a modulated oscillator (set to the correct intermediate frequency) to the primary of each transformer in turn.

4.—Circuit and Miscellaneous Details

Accumulators

Accumulator charging and service forms a very important branch of practically every dealer's business.

There are three golden rules which if properly carried out will result in the minimum of trouble, and the maximum of efficient service. Here they are: The maximum life will be obtained from an accumulator if (1) it is regularly charged at the correct rate, (2) it receives regular attention as regards acid level and strength, and (3) it is kept clean.

Accumulators should be charged at their correct rates, not only in fairness to the batteries themselves, but also to the manufacturers and the owners. Nothing does more harm to a battery, and particularly a mass type battery, than charging it at too high a rate.

Acid strength should be checked by means of a hydrometer. The necessity of using a first-class instrument cannot be too strongly urged. Dealers should buy a thoroughly reliable float type hydrometer. The battery maker's recommendation as to specific gravity must be adhered to rigidly. While most cells operate correctly at about the same S.G., certain are designed to work at higher or lower values.

Great care must be taken to remove every trace of free acid from every part of the outside of an accumulator case, and particularly the terminals. It is a good plan to wipe the terminals over after charging, with water containing a little ammonia. Terminals should be well vaselined and, before handing a cell to a customer, the case should be given a good polish with a duster. Nothing is more revolting than an accumulator with an acid-covered top, and any charging station which sends out cells in this condition stamps itself as inefficient.

The keeping of spare accumulators in good condition is a problem that faces many dealers. There are three methods which may be used.

When a cell is charged and may be wanted at any time, it is sound practice to keep a continuous current passing through it of ½ to 2 per cent. of the normal charging rate.

If the accumulator is to be out of use a matter of weeks or months, and only occasional attention can be given it, it should be put in a dark place where there is no danger of either frost or excessive heat.

The case and terminals should be cleaned with a cloth dipped in ammonia, and metal parts should be liberally treated with vaseline.

Every two months the level of the electrolyte should be checked and the battery given a normal charge until fully up.

Where it will prove impossible to give any attention to a battery and it will be laid aside for some time, the following is the best course to follow:—

Charge the cell fully and then empty out and fill with distilled water. After fifteen minutes, remove the positive plates, and after twenty-four hours—not less—take out the negatives.

Both plates should be drained and, if necessary, flattened out by pliers or putting between boards in a vice.

For some time after this, the negative plates should be periodically examined. If they tend to heat, they should be repeatedly plunged in water until a cure is effected.

Plates should be stored in darkness and safe from extreme temperatures.

In extreme cases of sulphation, cells have to be scrapped, but cures can usually be effected if tried in time.

The first method consists of repeated charging and discharging. On beginning to charge, half the normal rate should be employed; after an hour increase this to a normal rate, and then, after a further hour, to the maximum rate.

After not more than an hour of this reduce the rate to normal once more and continue charging until the cell gases. The half-normal rate is then employed again.

Repeat the whole process of charging and discharging until the cell is in a healthy condition.

The alternative system is as follows: draw

RADIO SERVICING—4

off the acid and clean the plates in distilled water. Then fill the cell with a 5 per cent., by weight, solution of caustic soda and put the cell on charge.

Repeatedly test the electrolyte with litmus paper, and if it gives at any time an acid reaction, add caustic soda until an alkaline reaction is obtained.

Continue charging until the plates are healthy; then draw off the solution, replace the acid and give a gassing charge.

Practically the whole story of a battery's life can be learned from a study of its plates. Here are some of the symptoms that indicate the most common troubles.

Positive plates almost black, accumulation of spongy lead on the top edges of the negatives, and a thick deposit, chiefly of chocolate coloured positive material: the cell is being charged too much.

Positives light in colour, whitish sediment and blotchy negatives: not enough charging.

Negatives darkened, positives sulphated and scaling, grey sediment: cell over-discharged.

Negatives bulging, scrubbed appearance of positives, positive and negative material under plates: charging at too high a rate.

Buckling of plates, chiefly the positive: charging or discharging at too high a rate.

All-wave Receivers.—*See* "Short Waves."

Automatic Volume Control.

The two popular forms of automatic volume control encountered in superhets are "delayed" and "amplified and delayed."

Though no appreciable current flows through the components involved, a knowledge of the circuit employed is often essential in diagnosing troubles in the H.F., or even L.F., sections of a receiver.

The simplest form of the delayed A.V.C. circuit is given in Fig. 4, in which the diode anode used for L.F. purposes is coupled to the A.V.C. diode anode through an H.F. feed condenser C1.

The signal is rectified and the resultant D.C. is allowed to flow through the load resistance R2 and the bias resistance R1 back to cathode.

Due to the steady D.C. of the triode section flowing through the bias resistance R1 the point B is always positive with relation to A (or A is negative to B), and consequently, when a signal is impressed on the A.V.C. diode anode the anode circuit will remain unaffected until the signal reaches a rectified value greater than the original voltage drop across R1.

In this case it is customary to apply an initial bias (by cathode resistance) to the valves that are to be controlled.

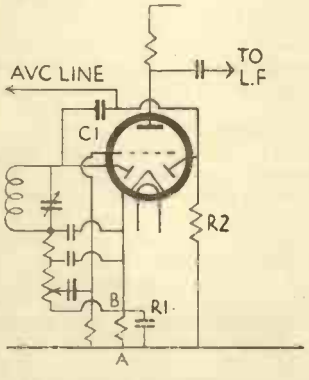
Another method of applying the delay voltage as an initial voltage to the diode A.V.C. anode and the controlled valves is to connect the lower end of R2 to some point on the H.T. system that is negative to the point A.

This is usually done by connecting a small resistance of from 30 to 100 ohms, depending on the current taken by the set, in the common H.T. negative lead.

The application of amplified A.V.C. is much more complicated.

The most popular form is illustrated in Fig. 5. The anode A1 is used for rectification for L.F. purposes, and the L.F. signal is taken from the low H.F. potential end of the coil (usually secondary of IFT2) through the H.F. stopper R3.

From that point it is fed to the grid of the triode section, which has as its grid leak R5,



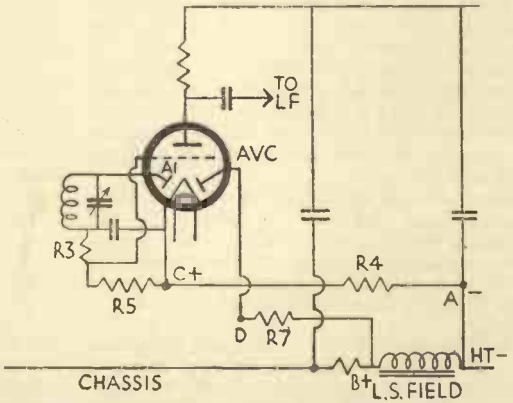


FIG. 4 (on the left) shows the simplest delayed A.V.C. circuit, and FIG. 5 (right) gives the most popular arrangement for amplified A.V.C. The A.V.C. line to the H.F. valves is taken from D in FIG. 5.

also the diode load resistance. When the signal is rectified, both L.F. and D.C. are impressed on to the triode grid.

The D.C. potential applies bias to the valve in proportion to the strength of the signal, but as the triode section has not variable mu characteristics the bias for operating conditions cannot be allowed to depend entirely on the strength of the signal. For this reason the other diode anode is used to compensate this to a certain extent.

To do this it is necessary to utilise the A.V.C. diode as a separate valve with only the cathode circuit common to the other elements and to depend on the fact that as long as the anode is negative with relation to the cathode no current can flow in the return circuit, but that whenever the anode is positive current will flow in the resistances connecting the two.

If, for example, in a set in which the speaker field is in the negative lead the A.V.C. diode were connected through a resistance to chassis and the cathode were connected to the H.T.—side of the field, the A.V.C. anode could be maintained positive with relation to the cathode, there would be a constant large bias applied to the A.V.C. line. To counteract this and to make the bias dependent on the signal the cathode is connected through a fairly high value of resistance (usually between 30,000 and 100,000 ohms depending on the mutual conductance of the valve) to a point on the smoothing choke or field that is negative to the chassis, and the A.V.C. diode anode is connected to the chassis through a decoupling resistance.

In Fig. 5 the cathode resistance is R4 and the A.V.C. decoupling resistance is R7. The circuit of the A.V.C. diode consists of R7, speaker field, and R4.

The relative potentials in these are balanced as follows : With no signal and, consequently, no bias on the triode grid the greater current through R4 causes the point C to be positive with relation to A, and B is positive with relation to A by the voltage drop across the L.S. field.

In practice the value of R4 is such that the voltage drop across it with no signal is slightly greater than the voltage drop across the choke ; a resistance in the common H.T. negative lead to the previous valves causes these to be biased with an initial bias which acts as a "delay" on the action of the A.V.C. diode.

Under no signal conditions the A.V.C. diode is negative with relation to cathode, but whenever a signal is applied to the diode A the triode is biased and less current flows through R4. Whenever this causes a voltage drop less than that across the speaker field the A.V.C. anode becomes positive with relation to the cathode and current flows in the circuit R7, making the point D negative with relation to B.

This voltage is considerably greater than the initial D.C. voltage applied to the grid of the triode section or of any that could be produced from the direct rectification of the I.F. or H.F. signal. The value of R4 in relation to the choke is chosen so that when the correct bias for good reproduction is applied to the triode the full A.V.C. voltage is applied to the control valves.

Band Pass Tuning.

Band pass tuners consist of two identical inductances tuned by two identical condensers. In addition to the two main coils, if no aerial tapping is provided there is a small coil which acts as an aerial coupler. In some cases there is a coil which is used as a common portion of the two inductances for coupling purposes. In other cases, the two coils are coupled through a common condenser.

The actual windings of the coils should be tested in the normal manner, and the same remark applies, of course, to the tuning condensers. It is essential that the ganging is perfect, as otherwise there will be loss of signal strength, and the quality will also suffer owing to side band cutting.

A band pass unit designed to work in conjunction with a screen should always be used with the screen.

The advantage of band-pass tuning is twofold. In the first place selectivity is considerably improved—for the obvious reason that two selector circuits are in use instead of one. Secondly, the two circuits can be adjusted so that their two tuning "peaks" are slightly offset.

This results in a flat-top tuning response which means that the sidebands of the transmission—those that carry the high notes—are adequately received.

Car Radio.—*See* "Motor Radio."

Cathode-ray Tubes.—*See* Television section.

Charging Plants.

The type and size of plant which is installed must be determined entirely by the estimated amount of charging which will have to be carried out per week.

Where only direct-current mains are available, there are only two suitable systems. The first consists of charging the cells directly from the mains and the second involves the use of a motor driving a dynamo or a combined motor generator set.

Direct charging from the mains can only be economical when the total number of cells connected in series gives a voltage of about the same value as that of the supply. This means that at least 60 or 70 cells should be available for charging at the same time. It must also be remembered that the charging current must be cut down to the value required for the smallest cell. It is obvious, therefore, that charging by this method will only be economical in a few isolated

RADIO SERVICING—4

cases. Those who have D.C. supplies are recommended to install a suitable motor generator set.

Where A.C. supplies are available some form of rectifying device or motor generator is immediately necessary. These can be classified under four headings : Motor generators, or motors driving dynamos, synchronous rectifiers, metal rectifiers, and valve or mercury rectifiers.

Valve, mercury, and metal rectifiers have practically no upkeep cost, since there are no moving parts. Replacements of the actual rectifying units are only necessary at long intervals. Motor generator sets, providing they are well made, run for long periods with little attention. Regular cleaning of the commutator and maintenance of the brush gear is of vital necessity for efficient operation of motor generator sets and synchronous rectifiers. Motor generators and synchronous rectifiers should not be installed without perfectly foolproof automatic cut outs.

The manufacturer's instructions regarding the correct method of installing any form of rectifying arrangement or generator set, and also the maximum outputs, should be strictly adhered to. No attempt should be made to overload any charging device.

Before carrying out any charging, dealers should make quite sure that their charging arrangements comply with fire insurance regulations. Cells should preferably be placed on glass sheets during charging. Meters should not be anywhere near the cells during charging operations because of fumes, and adequate ventilation should be provided. The ideal device, of course, is a fan extractor.

Providing the cells are carefully connected and arranged in a tidy manner there is practically no fire risk. A tangled mass of half-corroded wires lying haphazard on a heap of accumulators should never be tolerated. A proper system of time-keeping, and charging currents must be adopted, while careful inspection of all the cells during charging is invaluable. If a cell does not charge up in the correct time, there is something radically wrong, and it should be investigated as much in the dealer's as the customer's interest.

If there is no obvious cause, the dealer should communicate immediately with the manufacturers. Prompt action in this manner will save a tremendous amount of subsequent trouble between dealer, customer and manufacturer, while the dealer will do much to gain the confidence of both customer and manufacturer.

Chokes, High-Frequency

Desirable qualities in a high-frequency choke are a large inductance, a low self-capacity, and a small, concentrated field. A binocular arrangement helps to limit the field. Slots and fine wire limit the self-capacity and a large number of turns gives a high inductance. The resistance of a high-frequency choke varies very considerably with various makes. This does not matter, since the other factors are the most important.

There is no easy method of testing a high frequency choke, since it is really necessary to measure its impedance when connected in the anode circuit of a valve which is amplifying at all frequencies over the broadcast range. As a rough test, however, a choke can be connected in series with the aerial lead of a fairly sensitive receiver. If it is found that fairly loud signals are obtained when the choke is connected, it is usually an indication that it is not too effective.

An essential mechanical feature of a good high-frequency choke is a positive mounting of the former at the base so that it cannot rotate and so break the fine connecting wires taken to the terminals.

Chokes, Low-Frequency

Many of the statements made with respect to low-frequency transformers apply equally to chokes. When an ordinary alloy is used for the core, a large cross section and a large number of turns are required for a high inductance. In the case of special alloys, the overall dimensions can be reduced for the same inductance.

Faults likely to develop in chokes are intermittent contacts due to a breakage, short circuited turns and leakage to frame.

Most chokes intended to carry large steady anode currents have an air gap in the core. This air gap is only a matter of a few thousandths of an inch, and if any repairs are carried out to the choke, great care should be taken not to disturb the gap as may be done if the clamping frame is removed. Most air gaps, however, are filled with a thin sheet of insulating material against which the core stampings are firmly pressed.

There is no easy method of measuring the inductance of an iron core choke, particularly in the case of one carrying a D.C. current. A rough idea can be obtained by connecting the choke in series with a small battery and a milliammeter of the moving-coil type, watching the rate at which the needle rises to its maximum value. If the needle comes to this point very slowly, it indicates that the inductance is large. The quicker it reaches this value, the lower is the inductance of the choke.

Class B.

Class B amplification is the name applied to a quiescent system utilising a special double valve. The current consumed is

proportional to the signal strength, but the mode of operation is totally different from that of Q.P.P. and totally different components are necessary.

The basic feature of Class B lies in the fact that the Class B valve draws power from the preceding stage, and is not a voltage operated device, like an ordinary valve.

A Class B valve consists of two triodes of special construction in a common bulb, fitted with a seven-pin base. Each half is similar to an HL type of valve.

The valve is operated by a driver transformer, which in construction is similar to a small output transformer. It has, however, a step-down ratio of the order of 2–1 or 3–1, and a centre-tapped secondary.

The primary is connected directly in the anode of a small power valve or 10,000 ohms general purpose valve. The secondary delivers current into the grid circuit of the valve and it must, therefore, have a very low resistance.

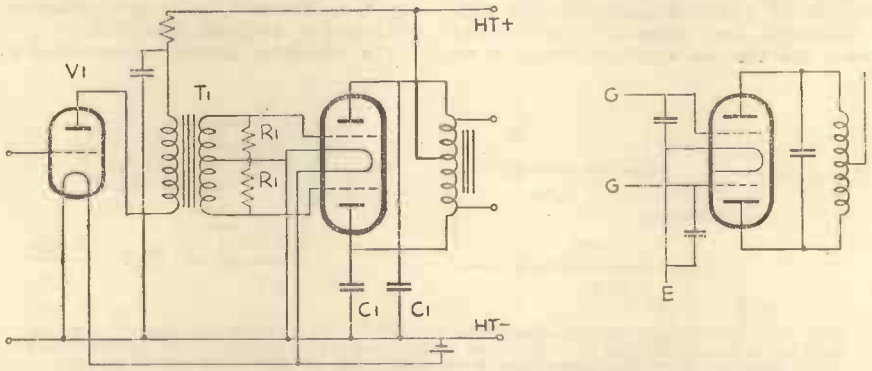


FIG. 6.—V1 is a driver valve of the small power type, and the secondary of the Class B transformer T1 is connected to the two grids and negative filament of the B valve without bias. Two condensers C1 between the anodes and earth give stability and correct tone, while fixed resistances R1 prevent parasitic oscillation. To the right is an alternative correction arrangement with condensers across the grids and a single condenser across the anodes.

The Class B valve is connected to a standard speaker through a matching choke similar to that used in a Q.P.P. stage, although the electrical constants are different. This type of stage cannot work direct from a detector, and there must be an intermediate driver valve.

No grid bias is used and the quiescent current of the Class B valve is only of the order of 2–3 m.a. or even less. Distortion may be introduced by the absence of decoupling on the driver stage, or the production of parasitic oscillation, generally of a transient type.

This can usually be prevented by fixed resistances, R1 in Fig. 6, across the secondaries, and it is general to use fixed condensers, C1, between the anodes and earth. Occasionally one condenser is used between the two anodes.

It is advantageous to use top cutting condensers on the grid side as shown on the right in Fig. 6, and not on the anode side, as this prevents wastage of current due to almost inaudible heterodyne voltages being applied to the grid. If the condensers are placed on the grid side, they should be comparatively large, the actual value being found by trial.

Coils, Tuning

The technique of the design of the high-frequency portion of a receiver has advanced so tremendously in recent years that it is a little difficult to make any definite statements.

The design of a tuning coil for the anode circuit in a high-frequency amplifier is determined largely by the type of valve with which it is to be used and the general circuit arrangement as a whole. It is a fallacy to assume that a large coil wound with heavy gauge wire, or spaced turns, or even Litz wire, will be more efficient than a smaller coil which has no apparent good points.

A few general statements can be made with regard to aerial coils. The lower the aerial tapping, the greater will be the selectivity, and the smaller the voltage applied to the grid of the first valve. A coil of this type is obviously necessary for use in a simple receiver near to a Regional transmitter. At a greater distance from the transmitter a higher aerial tapping is necessary, because more voltage will be required owing to loss of signal strength with distance, while, on the other hand, the less will be the interference.

For general single circuit tuners, one incorporating a variable coupled aerial coil is an excellent component, since it is so readily adapted to meet any particular requirements.

Faults in tuning coils are likely to be due

RADIO SERVICING—4

to mechanical troubles rather than electrical. Unsound construction may result in the turns slipping. No attempt should be made to remedy this defect by coating the coils with shellac or celluloid, as this will increase the high-frequency resistance considerably, giving defective tuning and loss of strength. Damp has the same effect, and if a single circuit tuner, for example, suddenly goes below standard the possibility of damp should not be excluded.

A coil which is not designed to work with a screen should never be closely screened. It can be safely used in a screened compartment, however, if the screen is large and the coil is kept at a distance from it. A coil designed to work in a screening case is usually of small dimensions, and it has fairly compact field.

If a tuning coil fails, a fault can be readily checked up by means of the circuit testers. These should give continuous circuits with all windings, and discontinuous circuits between the various windings except in so far as they are intended to be connected. This can be determined from the maker's diagram.

If a coil gives a clear test on the circuit tester and still functions indifferently, its efficiency can be tested quite easily by the mere substitution of an equivalent coil known to be in order.

Coils, Iron Core

Use is made of iron dust cores for tuning coils. These cores consist of minute insulated particles of iron.

An effective permeability of the order of 3–4 can be obtained on an open core, and a permeability of the order of 10–15 on a closed core. This reduces the number of turns necessary for a given inductance, and the lowering of the copper losses thereby increases the overall efficiency.

Dust core tuning coils can be used in exactly the same way as air core coils, but it is generally best not to use them directly in anode circuits, although this method is permissible. In the case of matched assemblies, it is essential not to displace the coils or cores, as this will upset the ganging.

Condensers, Fixed

Small fixed condensers rarely give trouble if they are of the mica type. Cheap varieties which are not too well made sometimes develop a fault at the connection of the plates to the terminal. This fault can be detected by using a silence tester of the type shown on page 63. If any "scrapiness" arises when the terminal is moved or lightly tapped, the condenser should be discarded. A complete breakdown of this type of condenser is very rare.

Larger condensers of the tin foil and wax-paper variety are far more likely to develop faults. A complete short circuit will be shown by one of the continuity testers. Partial leakage is not so easy to determine without a sensitive instrument. The following test, however, will show whether a condenser is in a good condition.

The condenser should be connected to a 200 volt high-tension battery or to D.C. mains, and allowed to stand for half a minute after being disconnected, care being taken not to touch the terminals. It should then be short circuited through a resistance of about 100 ohms when there should be a distinct spark. If there is no spark, it is a fairly certain indication that the condenser is leaking.

A leaking condenser can be regarded as a high resistance and tested accordingly, provided a sufficiently sensitive measuring instrument is available. The best arrangement is a small battery and a microammeter or galvanometer as in Fig. 7A. When connecting the microammeter and battery in circuit with the condenser, the circuit should include a safety resistance of such a value that if the condenser were completely short circuited only full scale deflection would be obtained. This will safeguard the meter. In addition, it is essential to short circuit the meter for a few

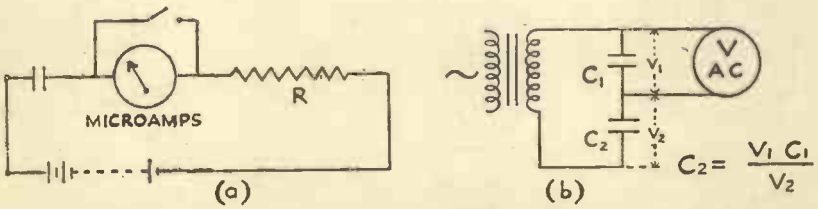


FIG. 7A.—When measuring the insulation of a condenser, a safety resistance R must be included in the circuit, the microammeter being shorted by a switch, while the condenser charges. How the capacity of a condenser can be checked is shown in (B).

seconds when the circuit is first connected, as a comparatively heavy charging current flows into the condenser.

The capacity of a large fixed condenser can be checked roughly by the arrangement shown in Fig. 7B. It is connected in series with a condenser of known value. A high resistance A.C. voltmeter such as a rectifier instrument is connected across both condensers. The capacity of the unknown condenser is given by the formula shown in the diagram. It is, of course, a matter of proportion.

In electrolytic condensers the electrodes are an electrolyte and aluminium, and the dielectric is a fine chemical film on the aluminium. The construction provides high capacity in small space.

The normal electrolytic requires a polarising voltage which must be applied in one "direction" only. The steady voltage combined with any ripple voltage must not exceed the rated peak value.

In D.C. and universal sets where the voltage may be applied in either direction, reversible electrolytics should be used. These, like the ordinary type, need a polarising current and must not be used only on A.C.

Condensers, Variable

Modern variable condensers are made so accurately that there is rarely occasion to question the capacity. Points to look for in a condenser are: sound bearings with an even "feel" throughout the entire movement, and absence of hard or slack spots; a good connection to the rotor, preferably by a pigtail; and firm anchoring of the stator assembly on a reasonable amount of insulating material which does not lie in the field of the condenser.

Accurate alignment of the plates is necessary. When a condenser is full-in the spacing should appear even. In particular, the spacing should appear the same when viewed from either side.

Scrapiness is the chief trouble caused by variable condensers. It is usually due to a bad friction connection to the rotor. Tightening and lubrication of bearings usually effects a cure.

If a fault persists the condenser should be returned to the makers. The slightest suspicion of scraping in a condenser used in a powerful receiver is the cause of intermittent background noise which is sometimes extremely difficult to trace.

Fuses.

For the main fuses of an A.C. set it is usual to use types capable of carrying twice the current normally required by the set.

As fuses are usually rated to blow at twice their carrying capacity, an ample factor of safety over the initial heavy current taken when switching on the set is provided.

The standard colour code for fuses is:—

Black, 60 m.a.; grey, 100 m.a.; red, 150 m.a.; brown, 250; yellow, 500; green, 750; dark blue, 1 amp.; light blue, 1.5 amps.; purple, 2 amps.; white, 3 amps.

Grid Bias Supply.

Grid bias can be derived either from a separate metal rectifier and smoothing circuit, or from the main high-tension supply in which the high-tension voltage is robbed of a few volts for the grid bias.

Fig. 8 shows one of the most convenient methods to employ, particularly in a multi-valve receiver, since the arrangement of wiring is considerably simplified and the

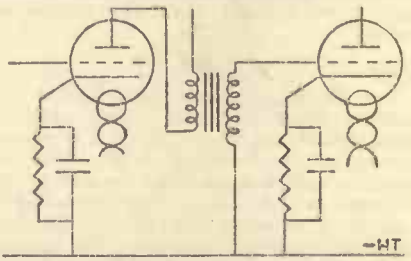


FIG. 8.—The most usual auto-bias arrangement with separate resistances and condensers in each cathode lead.

adjustment of grid bias for any particular valve is easily accomplished. The system consists in placing a resistance, shunted by a condenser, between the cathode of any particular valve and the negative high-tension terminal. The grid returns, of course, are taken to the negative high-tension terminal which is the main earth busbar, and not to the cathode.

An alternative arrangement is shown in Fig. 9 in which a main bias resistance is included in the negative high-tension lead, and is tapped off at various points for the respective bias voltages. In some cases, it is found necessary to decouple the grid circuits in a similar manner to that used for high-tension supplies, and separate high resistances and condensers shown at R_1, C_1, and R_2, C_2 respectively are included.

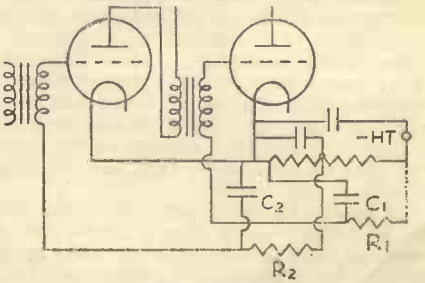


FIG. 9.—A common auto-bias resistance in series with the main negative high-tension lead tapped off for various bias voltages. Decoupling resistances and condensers are also shown.

RADIO SERVICING—4

The circuits given in Figs. 1, 2 and 3 show how these principles are applied in practice.

When testing automatic bias voltages it is essential to use an exceptionally high resistance voltmeter, as otherwise the load imposed will totally unbalance the voltage and give a false reading. It is best to check the bias voltage by measuring the resistance and measuring the current which passes through the resistance with a milliammeter, working out the actual voltage from the simple Ohm's Law equation.

The components used for auto-bias can readily be isolated from the circuit and tested.

Hum.

Pure inductive hum can originate in a receiver itself and also outside the set. Hum which has its origin in a receiver is due entirely to incorrect design. The most prolific cause is inadequate smoothing, and the cure is just a matter of increasing the smoothing by using more efficient chokes of high inductance and increasing the capacity.

Hum which still persists is then invariably due to induction caused by relatively strong fields adjacent to grid wires, or even interaction amongst the low-frequency components and the mains transformer or smoothing chokes. This is easily detected by moving any components or leads which are suspected of causing trouble, and seeing if this has the effect of increasing or diminishing the hum.

Care must be taken particularly with regard to long leads connected to the input of the amplifying portion, as, for example, the pick-up connection. An earthed screen lead will usually cure the trouble. It sometimes happens on a set with which an external pick-up is used that the mains lead is brought too near to the pick-up or even to the aerial or earth lead of the set. In this manner hum is sometimes introduced, and the remedy of course is obvious.

Instability.

When uncontrollable oscillation occurs it may be due to either induction between components or feed-back.

An indication of which of these alternatives is present can frequently be obtained as follows. Tune the set to about 300 metres and reduce the efficiency of the high-frequency valves—dropping the voltage on the screening grid is advisable—until the oscillation ceases.

If tuning to the lower end of the wavelength scale causes reappearance of the trouble, more screening is required; oscillation at the top end will mean that the decoupling is inadequate.

Don't forget that H.F. interaction may be caused by wavechange switch rods and the rotors of gang condensers. These should be earthed between the different sections.

Failure of H.F. decoupling condensers, the use of inductive condensers where non-inductive are essential, and even the connection of a condenser the wrong way round are frequently responsible for trouble.

The way a condenser is connected is sometimes a deciding factor, because if the outside electrode is connected to the earthed side of the circuit screening is enhanced.

Oscillation may be caused by leads to the speaker lying near and parallel to aerial, earth or pick-up wires.

See also Motor-boating.

Interference.

Effects which are introduced either through the mains connection or by high-frequency radiation are best dealt with together. There is practically nothing which can be done in the set itself, and the trouble has to be cured by eliminating it at its origin.

Some of the most usual sources of interference are sparking at the brushes of motors, contactors, or similar controls, and vibrating interrupters such as tremblers on induction coils.

In the majority of cases interference can be prevented simply by the use of fixed condensers which form a low impedance path between the origin of the disturbance and earth.

The simplest case is that of sparking at motor brushes. Interference of this type can be eliminated by connecting each brush to earth through a fixed condenser of 0.1 mfd. or a 0.01 mfd. can be connected between the two brushes. High insulation types must be used.

Interference is frequently increased by radiation from the supply mains. In this case the trouble can be cured by what is known as a centre point earth system. Two condensers are connected in series and placed across the leads, the junction point of the condensers being taken to earth. A centre point earth may be used at either end of a pair of leads.

On rare occasions H.F. chokes have to be inserted in the supply leads to a set. In this case the chokes are preferably placed in an earthed metal box, while the condensers are arranged on the set side of the chokes.

Interference from sparking plugs or distributors and magnetos on petrol engines can be reduced by using screening over the exposed portion of the electrical circuit. The high-tension leads may have a length of wire wrapped closely round them, the wire being earthed to the frame, while a metal screen can also be placed over the tops of the plugs and the distributors.

Adequate insulation, of course, is necessary and thick rubber cable should be used for the leads. Small apparatus which is the subject of tremendous electrical disturbance

may require to be enclosed in an earthed screen, while centre point earth condensers and even chokes may be necessary.

Gas discharge tubes used for charging rectifiers also generate oscillations which cause interference, and these can easily be prevented by a fixed condenser from 0.001 mfd. to 0.01 mfd. connected between the anodes and earth.

The first rule is always to disconnect the aerial from the receiver, and then the earth, to determine if the interference is being picked up on the radio-frequency side of the set. Interference which comes in strongly with the aerial connected, and is absent without the aerial, must be eliminated at its source unless anti-static aerial equipment be used.

Interference Suppression Standards.

As a result of work undertaken jointly by the Post Office, the Institution of Electrical Engineers, the Radio Manufacturers Association and other organisations, a British Standard Specification for Components for Radio Interference Suppression Devices has been issued. Details, including recommended circuits are given in later pages.

Mains Units.

A mains unit consists of a smoothing circuit and a voltage distribution arrangement. In the case of an A.C. mains unit it includes, in addition, a rectifier.

A smoothing circuit consists of an inductance in the form of an iron core choke and common condenser. Provided that this filter is properly designed it gives far better smoothing than the arrangement of Fig. 10 (a).

An arrangement which is not used to a very great extent is shown in Fig. 10 (c) in which a choke is included in each leg. Sometimes these two chokes are wound on the same core, and the actual mode of operation is somewhat involved.

Faults can occur in the smoothing circuits of mains units. The chokes and condensers should be tested in the manner described for the components in question.

FIG. 12.—Essential safety condenser for the earth connection of a D.C. mains unit.

It is a good plan never to connect a mains unit to the supply without a load on the output since this reduces peak voltage on the condensers and tends to prolong the life.

Fig. 11 shows two basic systems of voltage distribution. It will be seen that the output of the filter is shunted by a resistance R1, the full positive tapping being shunted by a condenser C3. An intermediate tapping is taken across the resistance R1 which acts as a

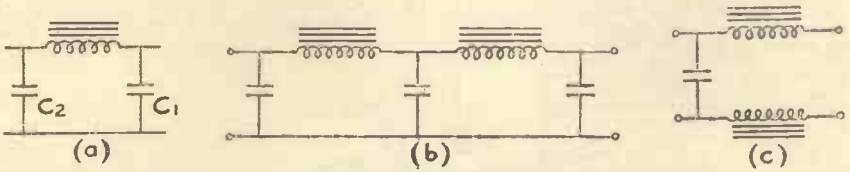


FIG. 10.—Three examples of fundamental smoothing circuits comprising iron cored chokes and large condensers.

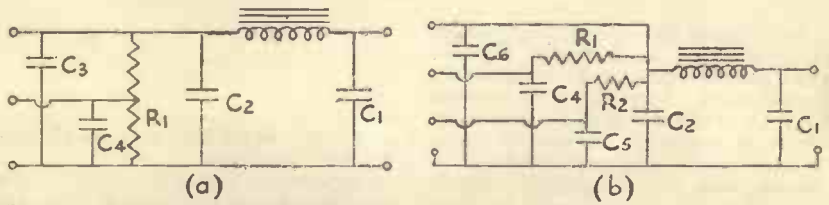


FIG. 11.—Shows two voltage distribution systems. (a) Potentiometer or constant load method. (b) Series resistance method.

two condensers. Fig. 10 shows three typical smoothing circuits. The first (a) is the most usual. It is sometimes referred as a simple *pi*. The first condenser C1 takes the feed from the supply, and the second one C2 feeds the output.

A double *pi* filter is shown in Fig. 10 (b), and it is essentially two *pi* filters with a potentiometer, this in turn being shunted by a condenser C4.

Fig. 11 (b) indicates an alternative form in which the voltage is dropped for the intermediate tapping by means of series resistances R1 and R2, each shunted to earth by condensers C4 and C5. The values of the resistances R1 and R2 are sometimes made

RADIO SERVICING—4

variable, taking the form of carbon composition resistances or wire-wound types. The actual values obtainable are very frequently such that they suit the normal connections of typical receivers, and the arrangement shown in Fig. 11 (b) is the basic principle of what is known as decoupling. When the values are fixed, however, it frequently happens that they do not suit a receiver, in which case additional decoupling resistances are necessary.

Scraping noises in an eliminator are sometimes caused by faults developing in the resistances, and these should be carefully checked.

The components of an A.C. mains unit can be tested as indicated in the appropriate sections. It is more important in the case of an A.C. unit than in the case of a D.C. unit not to connect it to the supply without a load on the output, since the first condenser in the filter circuit is subjected to much greater peak voltages than in the case of a comparatively smooth D.C. output on which there is only a commutator ripple.

It should be particularly noted when using a D.C. mains eliminator consisting as it does of a filter and voltage divider, that the earth connection is not made directly to the receiver, but it must be taken through a mica insulated condenser as shown in Fig. 12. This condenser is frequently incorporated in D.C. mains units. Its object is to prevent accidental short circuiting of the mains by connection to earth. It should be noted that in some cases, and particularly on a three-wire system, that the positive main is earthed.

When dealing with mains units or mains sets employing a really large output valve, it is essential not to connect the high-tension supply before the filaments and cathodes are really hot. Exceptionally large valves really require a delay action switch, examples of which are now available. Sets run from D.C. mains are identical in operation with those worked from A.C. supplies. The only difference lies in the filament circuits.

Motor Boating.

Motor boating or a continuous definite frequency "plopping" sound is due to interaction of circuits, and it can invariably be cured by decoupling of the circuits in question.

Sometimes the reversal of the secondary winding of a low-frequency transformer will effect a cure, since it changes the phase relationship, but this is not recommended as it may affect the quality appreciably.

There is no golden rule for determining the value of a decoupling resistance, as it is largely a function of the impedance of the valve with which it is working, and also whether the valve is carrying radio-frequency or audio-frequency components, or both. A large increase in the decoupling resistance is accompanied by a corresponding fall in the effective anode voltage with loss of power.

A fairly simple way of determining which anode circuit needs decoupling, if any doubt exists, is temporarily to isolate it from the power supply, and connect it to a separate external battery. The same process applies, of course, to grid returns.

Motor Radio.

But for the need for the suppression of interference originating in the car itself, the fitting of a motor radio receiver is usually a matter involving only straightforward practical problems.

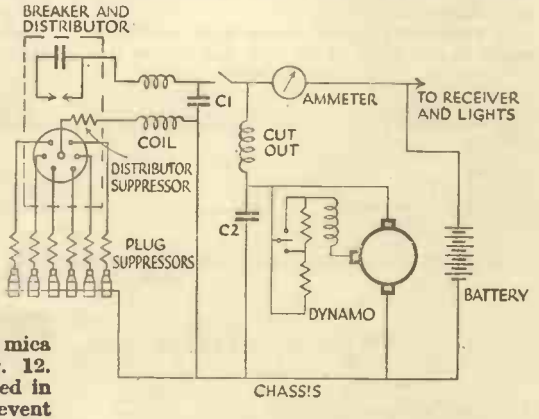


FIG. 13.—A typical car ignition circuit showing how suppressor resistances and condensers should be added to prevent interference with a receivor fitted to the car. The special heat and vibration-proof resistors should be connected as close as possible to the sparking plugs and the distributor and the high voltage condensers C_1 and C_2 should be near the sparking points.

High sensitivity and robust construction are the primary requisites of a car receiver. The aerial will be small and the car may be used at a considerable distance from receivers in unfavourable areas.

Again, high amplification allied with effective automatic volume control is necessary if screening effects are not to mar reception.

Filament current is taken from the car battery and H.T. may be derived from a vibrator unit. When results are poor the

battery should be checked for voltage and the contacts of the interrupter in the H.T. unit examined.

The aerial may consist of a few strands of insulated wire unobtrusively mounted in the roof or one of the proprietary lines, such as a special plate fixed under a running board.

Interference is principally caused by the ignition circuit comprising the coil or magneto, the distributor and the sparking plugs. Suppressor resistances should be connected as close as possible to the distributor and plugs as shown in Fig. 13.

These resistors should have a value of about 20,000 ohms, and it is advisable to use the special heat- and vibration-proof types made for the purpose.

The spark at the interrupter of the coil (in the distributor box) should be "silenced" by a 1 mfd. condenser (high-voltage type). The generator brushes are also liable to create disturbances and should also be shunt by the 1 mfd. condenser. Both these condensers should be connected as close as possible to the sparking points (see C 1 and C 2 in Fig. 13).

Static may be induced into the receiver from wires such as those running to interior lights. These wires should be replaced by ones with earthed screens or a special filter obtained from one of the firms specialising in this kind of apparatus.

Motors, Spring.

Most troubles with spring motors are usually associated with the governor mechanism starting with a little jerky action which gives rise to uneven running.

Practically all governors are controlled by a leather pad working on a friction disc. If this becomes dry and hard, uneven running results. Proper lubrication almost immediately rectifies the trouble. If the leather has become very worn and hard a new piece should be fitted.

The motor should be kept well lubricated. Special oil for this purpose is available and only this should be used. Uneven running, recognisable by inconsistency of pitch, may also be due to worn or slack bearings. This can be determined by pressing on the turntable, when any lateral movement or shake will be readily apparent.

Most records are intended to run at 78 r.p.m. The speed adjuster should, therefore, be capable of running the turntable at just below 78 to just above 80.

The easiest way to check the speed is by means of a stroboscopic disc. This is used either in conjunction with a neon lamp or an incandescent electric lamp operating on an alternating current supply. Stroboscopic discs consist of circles of dots which when viewed by interrupted light appear stationary at certain speeds, depending upon the frequency of the electrical supply, the number of dots, and the rate of revolution.

Motors, Electric

Electric motors can be divided into two classes, induction motors without brush gear, and universal motors with brush gear. Gearless induction motors require practically no attention with the exception of occasional oiling or greasing according to the type of bearings fitted.

Motors with brush gear require occasional overhaul, which involves merely cleaning of the commutator by removal of any loose carbon dust, and perhaps the removal of the brushes from their holders, and the general clearing of particles of carbon from the actual holders themselves.

Gearing arrangements and governors with friction controls require exactly the same treatment as those of clockwork motors. When installing an electric motor, it is usually found necessary to earth the frame, as a protective measure against shocks from the metal turntable and also in the elimination of interference with the amplifier.

Oscillator, Detector-.

Octode, heptode, H.F. pentode, and screen-grid valves are all used for frequency-changing or "mixing" and fulfil at the same time the functions of first detector and oscillator in superhets.

The octode valve consists of a central

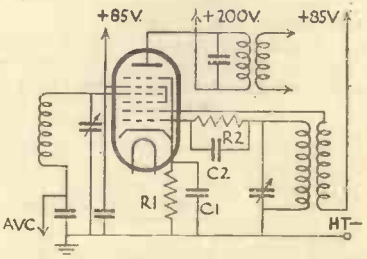


FIG. 14.—How a mains type octode valve is used as a combined first detector and oscillator with electronic coupling.

cathode, six concentric grids and an anode surrounding the whole assembly. The cathode and first two grids are utilised to form a triode oscillator. A "space charge" of electrons pulsating at the oscillator frequency occurs between the third and fourth grids and forms the "cathode" for the H.F. pentode part of the valve—that is the four remaining grids and the anode. On its way to the anode the electron stream is modulated by the radio frequency signal which is applied to the fourth grid.

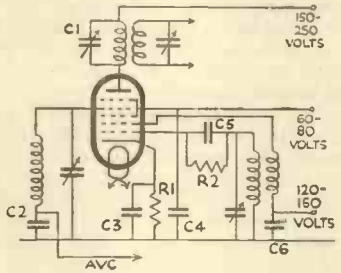
The heptode frequency-changer operates on exactly the same principle, the detector

RADIO SERVICING—4

or mixing section, however, being the equivalent of a screen-grid valve instead of an H.F. pentode.

The great advantage of these valves is that variable-mu characteristics are obtained and consequently more effective A.V.C. in small receivers is possible. Also radiation is reduced.

A typical octode circuit is given in Fig. 14.



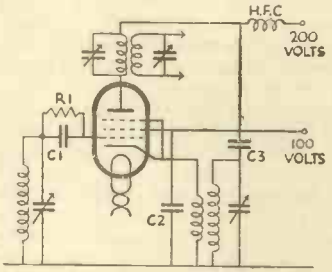


FIG. 15.—On the left is a circuit (simplified as regards coil switching) showing how a heptode is used as a combined detector-oscillator or frequency-changer. In FIG. 16 (right) the connections for using an H.F. pentode for the same purpose are indicated.

Values are R.1, 250 ohms; R.2, 12,000 ohms.; C.1, .1 mfd.; C.2, .001 mfd.

In the heptode circuit in Fig. 15 the component values are R.1, 500 ohms; R.2, 50,000 ohms; C.1, 50 mmfd.; C.2, .01 mfd.; C.3, .1 mfd.; C.4, .1 mfd.; C.5, .0001–3 mfd.; C.6, .1 mfd.

An H.F. pentode may be used for frequency changing as shown in Fig. 16. The radio signal is introduced at the normal grid while

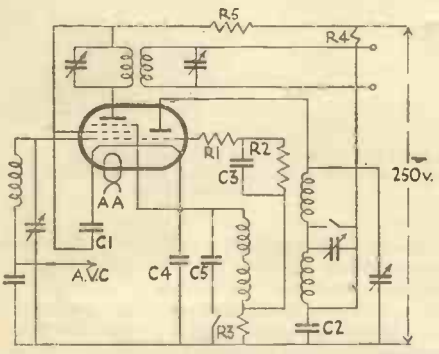


FIG. 17.—The triode-pentode which is virtually two valves with a common cathode is employed for frequency-changing in this manner.

the valve is caused to oscillate by means of the tuned circuit connected across the valve and the coupling coil in the cathode circuit. When the same system is used in connection with battery valves, small H.F. chokes are placed in the filament leads.

The triode-pentode is another popular frequency-changing valve, although it is not actually a "combined" mixer as it comprises two separate valves in one "bottle"—a triode oscillator and an H.F. pentode first detector. Only the cathode is common to both sections. Variable-mu characteristics are possessed by the pentode section.

Values in the typical triode-pentode circuit, Fig. 17, are: R.1, 1–2,000 ohms; R.2, 50,000 ohms.; R.3, 500 ohms; R.4, 60-70,000 ohms; R.5, 7,000 ohms; C.1, .1 mfd.; C.2, .1 mfd.; C.3, .0005 mfd.; C.4, .0003 mfd,; C.5, .001 mfd.

Pick-ups.

A good pick-up is usually characterised by a small light armature which is fairly freely mounted. This means that little force is required to move the armature. It results in minimum record wear and good bass reproduction, since large amplitudes are then permissible.

Two types of fault can develop in a pick-up, electrical trouble due to the winding, and displacement of the armature. If the armature gets out of centre, it will almost certainly hit one of the pole pieces. This is recognisable by loss of volume and thinness of tone. The higher frequencies will reproduce but there will be no bass response.

If, when the needle is felt with a finger, the movement seems restricted in one direction and free in the other, and if it is accompanied by a "ploppy" sound in the speaker, it is a good indication that the armature is fouling the pole pieces. Mere inspection of the pole system with the cover of the pick-up removed does not always show a displaced armature.

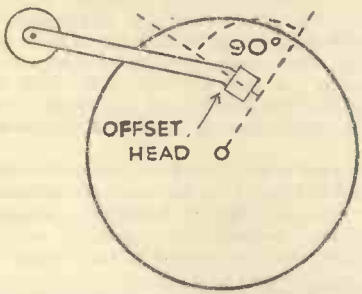
A winding can break down completely, or it can develop short circuited turns. Short circuited turns give the same symptoms as an armature touching the poles, but the needle test described is not applicable.

Sometimes the clamping screw thread

wears slack and the needle is not clamped properly. This gives rise to chatter. There is no real cure for this. Undue wear can be prevented by using less force in screwing up the needle clamp.

Continuity of winding and the possibility of one side of the winding being joined to earth or frame can be tested by one of the continuity testers.

The leads from a pick-up should preferably be screened, particularly with a pick-up which employs a single coil, or one which has a very high impedance. Omission to screen



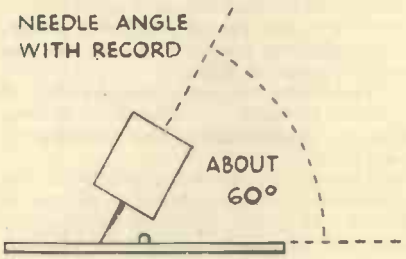


FIG. 18.—These three sketches show the correct position of a pick-up with respect to the record, and how to connect an external volume control.

the leads of a pick-up may be the cause of instability or bad hum in the amplifier.

When the volume control is situated on the motor board itself and does not form part of the receiver, the leads to and from the control should be similarly screened.

If a new volume control has to be fitted to a motor board, great care should be taken to see that one of the correct resistance is obtained. A volume control with too low a resistance will cause a serious cutting of top, and in some cases it may reduce the output of the pick-up very considerably.

To ensure correct playing and minimum record wear, carrier arms and tone arms should be fixed so that most accurate tracking is obtained. By tracking is meant relationship of the pick-up or sound box to the record grooves. Theoretically, the movement of the needle should be in a plane at right angles to a tangent drawn at the point of contact in the groove. It is obvious that the longer the tone arm the more accurate will be the tracking. Even better tracking is obtained by means of an offset tone arm, the head of the arm carrying the pick-up pointing slightly inwards towards the centre of the record.

The needle angle is also a matter of importance, and this should neither be too flat nor, on the other hand, too steep. The accompanying diagram, Fig. 18, shows suitable positions for pick-ups and carrier arms in their relation to the record.

It is important to see that a pick-up is not capable of side movement with respect to the carrier arm, as chatter may be set up which causes bad reproduction on heavily recorded passages.

Portable Receivers.

There is no basic difference between portable and the ordinary types of receiver. The absence of an earth connection, however, and the general compact nature of the receiver generally makes it somewhat less stable.

When most of the components are contained within the field of the frame aerial it follows that there is a great possibility of high-frequency energy being picked up by portions of the circuit connected to the low-frequency amplifier. For this reason, a good portable receiver should be very efficiently screened, and this applies to such portions as the leads connected to the speaker. These leads very frequently run near to the turns of the frame aerial.

Low-frequency oscillation at an inaudible frequency causes loss of amplification and general thinness of quality and is not easy to detect. It should never exist in a properly designed receiver. It is caused by interaction in the low-frequency stages.

One of the commonest forms of trouble is due to interaction both in high-frequency and low-frequency stages upon the high-tension battery's becoming exhausted which increases the internal resistance. For this reason, it is important that the detector valve is adequately decoupled.

It is also essential to keep the high-frequency energy out of the amplifier, and a by-pass condenser in the anode circuit of the detector valve is most necessary.

RADIO SERVICING—4

Public Address.

A successful public address demonstration is one of the best forms of advertisement which can come to a dealer. It does much to enhance his business reputation. Unfortunately the converse is true, and failure of public address does untold harm. It is absolutely essential to make quite sure that any public address demonstration will be an unqualified success from the outset.

There are only two important points which need to be watched. The first is meticulous care in the connection of the apparatus and the wiring of the amplifier. The second is the use of adequate power. Without sufficient power, a public address system is doomed to failure.

Public address arrangements can be divided into three sections, broadcast reception, gramophone reproduction, and microphone reproduction.

When radio reception is contemplated, the main receiver must have an ample reserve of sensitivity on the high-frequency side. Preferably, it should be capable of working from a frame aerial or a short length of wire hung across a room, unless it is definitely known that a large aerial is available.

It is necessary to build special apparatus for public address work, but an ordinary receiver can be utilised for the first part of the reception. This, of course, must be followed by a really powerful power amplifier.

Unless it is definitely known that A.C. mains are available, it is best to utilise a generator, since anything from 400 volts upwards is required.

Where gramophone reproduction is concerned, a pick-up jack of an ordinary receiver may be used for the first part of the amplifier, being followed, of course, by a power bank. The leads to the pick-up must be completely screened and earthed. The output side of the amplifier must be kept well away from the input connections.

With microphones even greater care is necessary. Connecting a microphone to the pick-up jack of an ordinary set is not advised. Very considerable amplification is necessary, and unless the low-frequency side of the receiver is completely screened, and this is unlikely, trouble may be experienced. It is preferable to build a special amplifier for the initial stages.

In arranging speakers in a hall for demonstration purposes, it is general to place them so that they all point in the same direction. One successful arrangement consists in hanging them from the roof with the horns pointing slightly downwards.

No trouble is experienced with broadcast or gramophone reproduction. Where microphones are concerned, however, great care must be taken in the placing of them. They must be so arranged that no sound waves from the speakers can fall upon them, as otherwise continuous ringing or howling will be obtained. The less resonant the microphone, the less howling.

Only first-class microphones should be used for public address work. These are expensive and insensitive, but they should certainly be employed. The greater the number of people in the hall the less will be the tendency to howl back, owing to greater absorption.

From two to three times the volume of sound which fills an empty hall will be required to fill it when the seats are occupied by a large number of people. If the music is to drown the general room noise of talking or dancing, then even greater power will be necessary. A speaker which is only just audible at the bottom of an empty room will be quite useless during a demonstration.

Dealers who are bound to give a demonstration and feel that they have not the necessary power should, without hesitation, apply to firms who manufacture public address equipment for the loan of suitable gear.

Push-pull Circuits.

These are for increasing the output and reducing distortion by using two valves in such a way that the signal is fed to each grid alternately in opposite phase. The amplified signals are then fed into a single output circuit through a transformer with a centre-tapped primary. There are three main types of push-pull. In Class A the valves are biased and generally operated in the ordinary manner, and the standing anode current remains constant. In Class B the grids are over biased and the consequent distortion is balanced out by the fact that the valves are working in opposite phase. With this arrangement the standing anode current is very small, but increases to high values during operation. This method takes two forms in practice: "Q.P.P." in which the bias is so great that no grid current flows at any time; and "positive grid drive" (generally referred to simply as Class B) in which the bias, if any, is low with the result that the grid becomes positive and draws current. (For further details of Class B and Q.P.P., see separate headings.)

The third type of push-pull output circuit is known as Class A–B or "low load." This is a modification of the first two types in which the load impedance is lower than normal. On peak signals, Class B conditions obtain. The output of this arrangement may be double that obtained from a normal Class B output with the same voltages.

Q.P.P.

In an ordinary amplifier the valve is worked about the mid point of its characteristic. When two valves are used in push-pull the same principle is adopted. In quiescent

working, however, the valves are biased to the bottom of the straight portion of the characteristic.

On one half cycle the operating point is swept along the entire length of one characteristic, and a similar effect takes place with the other valve during the second half-cycle.

Normally, the quiescent current is negligible and the amount of current flowing during operation is obviously proportional to the signal strength.

This system, known as Q.P.P., an abbreviation for quiescent push-pull, can be arranged with two ordinary triodes or pentodes. The fundamental circuit is shown in Fig. 19.

To obtain sufficient grid voltage to swing the operating point over the entire characteristic, it is necessary to use a high step up

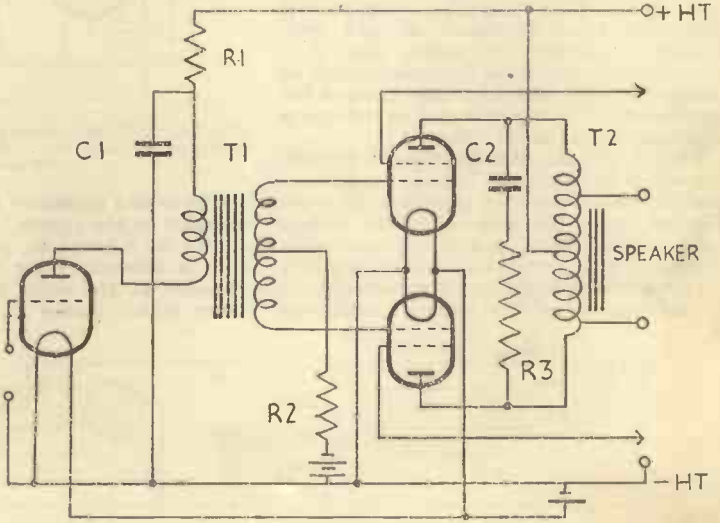


FIG. 19.—The Q.P.P. input transformer T1 is decoupled through R1 and C1. The resistance R2 in the grid bias lead prevents instability, while C2 and R3 form a tone correction to the centre tapped matching choke T2. The quiescent currents of the output pentodes are matched by individual adjustment of the priming grid voltages.

transformer—usually one with a ratio of about 10–1. This is of the centre-tapped or push-pull variety.

For a useful output direct from a detector it is usually better to use two pentodes in the output stage. To prevent distortion, these should be matched (makers will supply pairs) and final adjustment should be made by means of the priming grid voltage.

So as to stabilise the circuit, a fixed resistance of 100,000 to 150,000 ohms (R2, Fig. 19) is connected in the common bias lead. A correction circuit in the form of a fixed condenser C2 and resistance R3 is also generally placed between the anodes to minimise peak voltages and correct over-emphasis of high notes.

A fixed resistance of about 50,000 ohms is frequently placed across the primary of the input transformer to prevent destructive surge voltages.

As the H.T. battery runs down, it is necessary to readjust the bias to prevent distortion. Sometimes a large fixed resistance is put in shunt with the grid battery so that this runs down at the same rate as the H.T. battery.

The optimum load conditions for a Q.P.P. stage are different from those of an ordinary amplifier. Accordingly, when used with a standard speaker a step-down centre-tapped matching choke is generally used. The correct ratio can be calculated from the standard formula.

Rectification.

When an A.C. supply is available, a smoothing circuit and voltage divider may be energised through a transformer and rectifier, that is, either a valve or a metal rectifier. Fig. 20 shows the basic circuit for half and full wave rectification.

The input transformer is designed to operate from the supply mains and it is provided with two secondary windings. The first suits the filament of the valve and is frequently centre tapped. In the case of the half wave rectifier as shown in Fig. 20 (a) a single winding is used, one end going to the anode, and the other forming the main negative high-tension terminal. The positive terminal is the filament or centre tap of the filament winding.

Fig. 20 (b) shows an almost identical arrangement for a full wave rectifier, *i.e.*, a double anode valve. In this case, the high-tension secondary winding is centre tapped, the outers going to the two anodes, and the centre tap forming the main negative terminal of the high-tension supply. When a metal rectifier is employed the input trans-

RADIO SERVICING—4

former has only one secondary winding, since there is no filament to heat.

Three forms of rectifier circuits are employed. In Fig. 21, (a) shows a simple half wave rectifier in which the rectifier is connected to one of the leads from the secondary winding, the other lead forming the negative terminal. The more general arrangement, however, is shown in (b), in which the metal rectifier has four terminals. The unit actually contains four separate elements connected on what is sometimes called the Gratz system. A form of bridge arrangement is actually employed.

The third method is shown in Fig. 21 (c) and is known as the voltage doubling method. It employs a special double metal rectifier unit, the high-tension being derived from the outer terminals of two condensers connected in series. The A.C. voltage is connected to the centre point of the rectifier unit and the centre point of the condensers. The effective output voltage is about double the input voltage.

The introduction of indirectly-heated rectifier valves with separate cathode connections enables voltage doubling circuits to be used. Fig. 22 shows the connections for such a valve used without a mains transformer. The advantage is two-fold : a high output is obtained and no transformer is necessary.

The capacity of the reservoir condenser affects the output regulation and a large value is preferable.

Metal rectifiers are practically free from trouble. On no account should they be dismantled, since the success of a rectifier depends largely upon its mechanical assembly.

The easiest way to test a rectifier is to connect it to an alternating current supply and provide an artificial load on the D.C. side in the form of a resistance with a milliammeter included in the circuit. The makers rating should be referred to, and if, for example, with a 200-volt input 20 m.a. should be obtained at 160 volts, the calculated resistance which passes 20 m.a. at 160 volts

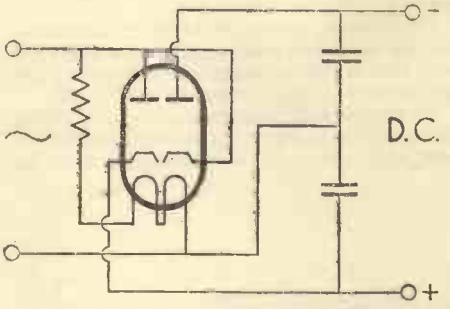


FIG. 22.—Indirectly-heated cathode rectifiers are available suitable for use in voltage-doubler circuits.

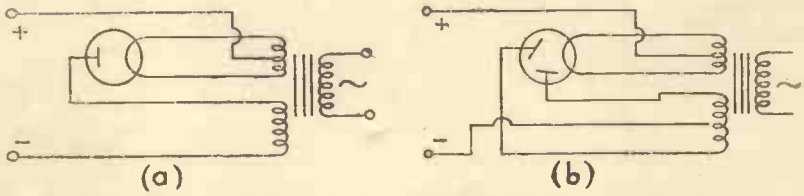


FIG. 20.—Half and full wave valve rectifier circuits.

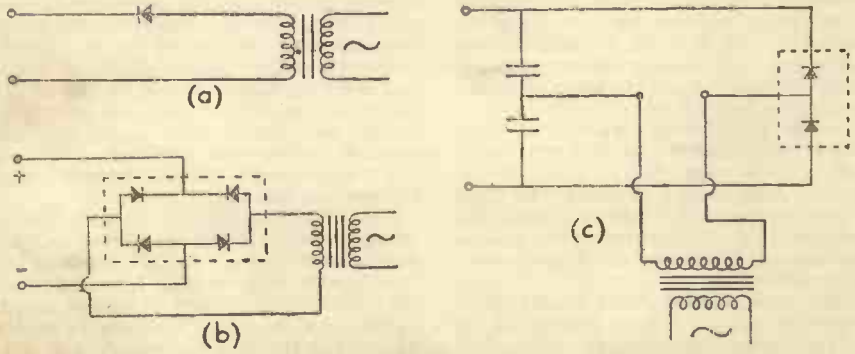


FIG. 21.—Half wave, full wave, and voltage doubling metal rectifier circuits.

should be connected to the output in series with a milliammeter. The value of this resistance is worked out, of course, from Ohm's Law, the value being given by the rated output voltage divided by the rated output current. In the example quoted, for 160 volts at 20 m.a., 8,000 ohms would be required.

The steadiness of the milliammeter needle should be carefully watched. Slight tremor may be experienced owing to the unsmoothed nature of the current, but there should be no violent needle kicks either up or down. If there are it indicates some trouble in the rectifier which should be returned to the manufacturers for their examination.

Resistance-capacity Coupling.

In resistance-coupled amplifiers the anode resistance should be two or three times the resistance of the valve, and the following grid leak should be about four times the value of the anode resistance.

The value of the grid leak automatically gives the correct capacity of the coupling condensers.

Here are the condenser values to be used for 90 per cent. bass reproduction:—5 meg. leak, .0015 mfd. condenser; 3 meg., .002 mfd.; 2 meg., .003 mfd.; 1 meg., .0065 mfd.; .5 meg., .015 mfd.

Resistance Feed System.

The performance of a small transformer is always improved by removing the steady anode current from the primary winding. In the case of a special nickel alloy transformer which has a high incremental permeability, it is essential.

The transformer should be connected as shown in Fig. 23. This indicates alternative arrangements which vary the ratio by making an ordinary transformer an auto transformer, in which the primary and secondary windings are electrically continuous.

The value of the anode resistance depends upon the impedance of the valve with which the transformer is used. Approximately from 20,000 to 50,000 ohms is a useful range. The higher the impedance of the valve, the higher must be the value of the resistance. The feed condenser should be from 0.5 mfd. to 1 mfd. in capacity.

If a resistance-fed stage suddenly gives trouble resulting in loss of amplification and thinness of quality, it may appear at first sight to be due to shorted turns. On the other hand, it is more likely to be caused by failure of the feed condenser. Should this develop a bad leakage path a direct current load is imposed upon the primary of the transformer, the performance of which will then be completely spoilt. This fact should be determined by isolating the condenser and testing it separately.

Resistances.

Resistances can be divided into two classes, wire wound and composition.

The essential features of a good wire-wound resistance are sound mechanical construction with good electrical joints at the ends. Spaghetti or link resistances should preferably be connected to their tags by electrical welding, while adequate protection in the form of reinforced high-grade sleeving is essential to prevent trouble due to absorption of moisture, and mechanical breakage through bending of the tag.

The only troubles likely to arise in resistances are bad joints and intermittent internal short circuits, giving rise to noisy operation. A noisy resistance should be tested by a silence tester.

The actual value can be quite accurately determined by measuring the current which flows through the resistance at a known voltage. The resistance, it will be remembered, is given by the voltage divided by the current.

It is essential not to overload resistances. If a resistance becomes very hot in use, it should be replaced by one of a larger current carrying capacity.

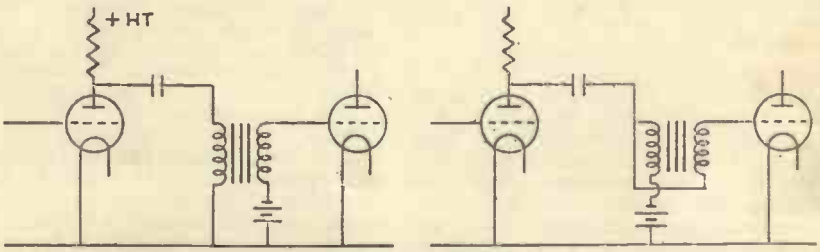


FIG. 23.—Anode feed system for a transformer giving (A) a direct connection and (B) an auto-connection, which increases the step-up ratio.

Resistors, Colour Code for.

The Radio Manufacturers' Association standard colour code for resistors entails the use of colours to each of which a number has

RADIO SERVICING—4

been allocated. The colours and figures are :—

Colour.	Figure.	Colour	Figure.
Black ...	0	Green ...	5
Brown ...	1	Blue ...	6
Red ...	2	Violet ...	7
Orang ...	3	Grey ...	8
Yellow ...	4	White ...	9

The body of the resistor is coloured to represent the first figure of the value. One end is coloured to give the second figure of the value and a spot on the body indicates the number of ciphers following the first two figures.

When there is no "end" colour or spot, the figure is the same as that of the "body."

A brown resistor with a green end and an orange spot has a value of 15,000 ohms. A resistor with only two colours, for example, a red body and a green tip would have a resistance of 2,500 ohms.

Selectivity, Variable.

A radio transmission consists of a carrier frequency (the wavelength of the station) and several thousand frequencies above and below the carrier. If any of these "side-band" frequencies are not received corresponding audio frequencies are lost. When a receiver is made highly selective so that distant stations can be sorted out, the audio response is noticeably limited. This involves a sacrifice of the quality available from near-by transmitters. Variable selectivity, however, enables the number of side-bands received to be adjusted to suit conditions and permits the best possible audio response to be obtained. The selectivity is usually controlled by mechanically varying the coupling of intermediate-frequency transformers. A variable screen consisting of a winding controlled by an external resistance is a purely electrical method that has been employed.

Short Waves.

Short waves can be taken to be those of 10–100 metres in wavelength. There has been a revival of interest in these high frequencies following the introduction of a number of all-wave receivers. These are generally ordinary medium and long wave-band receivers with additional short-wave windings on the coils. In some superhets, however, only the oscillator tuning circuit includes a short-wave coil and the ordinary aerial tuning coils are used to form an aperiodic coupling on the short waves.

Ordinary "straight" and superhet receivers can be used on the short waves when a converter unit is employed. This usually consists of a single valve used as an oscillator —first-detector. The normal receiver then acts as I.F. amplifier and second detector.

Short-wave reception depends almost entirely on local conditions. An efficient aerial in an unscreened position is essential for best results.

These high-frequencies penetrate the ionised layers of atmosphere more readily than longer wavelengths and are not reflected to earth unless they strike the layers at a "flat" angle. This means that outside the area served by direct rays from a short-wave there is a large "skipped" area. Hence short-wave stations cannot be relied upon for local reception.

Ultra short-waves are those below 10 metres and owing to the low impedance presented to them by even minute capacities special circuits are necessary for their reception and amplification. One method is that of super-regeneration. In this system a valve is used in its most sensitive condition, oscillation, and is "quenched" at some high audio frequency. Sometimes a background note is audible, but this can be eliminated by a suitable filter.

Ultra short-wave reception is a very specialised branch of radio engineering and circuits, aerials and components are different to those generally employed. Reception of the shorter wavelengths is restricted to the area covered by direct rays. Further reference to these wavelengths is made in the television section.

Speakers, Extension.

Most receivers now contain terminals for the connection of additional speakers. When terminals are not provided and an extra reproducer is to be used, two methods of connection are available. Leads can be taken from either the primary or secondary of the output transformer in the set. In the former case a high impedance additional speaker should be used. A low impedance speaker must be employed with the alternative method.

A high impedance connection is likely to result in slight loss of high notes if the extension leads are long. On the other hand a low impedance output will result in considerable loss of volume unless the leads are of very low resistance.

Some loss of volume occurs with both systems when internal and extra speakers are used simultaneously. When a switch is fitted to cut out the internal speaker arrangements should be made so that it is impossible to run the receiver for more than a few moments without a load.

Speaker Matching.

For optimum volume and quality the speaker and output valve must be matched. Usually an output transformer with a suitable ratio is used for this purpose. The correct transformer ratio can be derived from the following formula :—

$$2\sqrt{\frac{\text{Optimum Load}}{\text{Speaker impedance}}}$$

The optimum load can always be obtained from the valve makers' rating. The speaker impedance generally resolves into that of the impedance of the moving coil. This is not always known, but as a rough rule it can be taken as twice the D.C. resistance. If the optimum load of a valve is not given by the makers, this can also be taken as twice the impedance.

When two valves are used in parallel, the valve impedance is halved. With push-pull the effective impedance is doubled. The necessary alteration to the effective impedance must be made when applying the formula.

For example, to match two 2,000 ohms valves in parallel, using a speech coil with an impedance of 5 ohms, the correct transformer ratio is :—

$$2\sqrt{\frac{2,000}{5}}=20$$

With a 4.2 ohms impedance coil and a pair of 8,000 ohms valves in push-pull, the ratio is :—

$$2\sqrt{\frac{32,000}{4\cdot2}}=87$$

Speakers, Moving Coil.

Speakers can be tested in two different ways, for faults and for frequency response. The only satisfactory way of testing the frequency response of a speaker is to connect it to a good amplifier energised either from a beat oscillator or from a constant note record. This test will show two qualities of the speaker, a complete cut off or a resonance. If the input is kept constant, resonances will be apparent by a great increase in volume of certain frequencies. Cut off, of course, will be shown by the absence of any appreciable radiation.

Record scratch does not necessarily indicate that a moving coil speaker gives good top response, because very frequently scratch frequencies come out well, while frequencies in the neighbourhood of 4,000 to 6,000 cycles show a distinct drop.

An excellent way of testing the bass response of a speaker is to utilise a 50 cycles mains supply. A true 50 cycle note should be used. It is easily obtained by connecting a long length of flex to the input of an amplifier and bringing it near to the mains leads. A grid leak should be connected between the grid and the bias battery.

A true 50 cycle note has a very deep boom the presence of which can be almost felt.

While this test is conducted, the diaphragm should be touched with the hand. This should practically completely remove all the 50 cycle radiation, leaving only the harmonics audible. This actually occurs in a moving coil speaker if the moving coil is restricted owing to touching the gap. An excellent laboratory method of centring the coil is to supply a 50 cycle input.

A coil should not get out of adjustment in the normal way. But if it has done so, there is a possibility of the turns almost shorting owing to the insulation being scraped off due to friction in the gap. If this occurs, the output will fall and the quality will be ruined.

Matched pairs of speakers are not, as is sometimes supposed, designed so that one handles the bass and the other the top. They should be designed so that their individual resonances occur at different frequencies. Both electrically and acoustically this "levels up" the response.

"Tweeter" speakers are special types with very light diaphragms designed to reproduce frequencies of 5–10,000 cycles and higher. These frequencies cannot be properly handled by the large and comparatively heavy diaphragms necessary for good bass radiation. Tweeter speakers are not intended to reproduce low frequencies and should be fed through a filter which eliminates these.

High-note speakers have small diaphragms, usually of metal, and are fitted with horns. Moving-coil and piezo-electric crystal types are available. Rigidity is essential or resonances and "jingles" become troublesome.

Some ordinary moving-coil speakers are fitted with double diaphragms. Inside the normal diaphragm is a light, free-edge cone which increases high-note radiation.

Super-Regenerator.

A highly sensitive, but unselective receiver in which a valve is worked about the point of self-oscillation. Under these conditions a valve gives far greater amplification than normally. The circuit contains anode to grid coupling which ordinarily would produce self oscillation. Also included, however, is a tuned arrangement which provides a quenching frequency which repeatedly stabilises the valve. The quenching frequency is above audibility, and hence the interruptions of the signal are not evident.

Superheterodyne Principle.

The ordinary method of reception of broadcast signals consists, first, of amplifying the received energy from an aerial coil at the frequency at which it is received. This process is known as high-frequency or radio frequency amplification. Energy thus amplified is then detected or rectified, a low-frequency component being obtained.

Supersonic or superheterodyne reception, however, is fundamentally different, in that amplification is carried out at an "intermediate" frequency different from the frequency of the received signal. Signals on the normal broadcast band are transmitted at frequencies in the region perhaps of, say, 1,000 kilocycles. This is a comparatively high frequency. Signals obtained at this frequency in supersonic reception are con-

RADIO SERVICING—4

verted to another or intermediate frequency by the heterodyne beat principle.

This consists of combining the received oscillations with oscillations produced locally by an oscillating valve. When the two sources of oscillations are combined and the resultant output is rectified or detected, oscillations are obtained at a frequency equivalent to the numerical difference of the two frequencies. In actual practice the received oscillations are often combined with a source of local oscillations which give a frequency difference of 100 to 130 kilocycles. This corresponds to a wavelength in the region of 2,700 metres.

The high-frequency valves in a superheterodyne receiver are, therefore, arranged to amplify not at the incoming frequency, but at a pre-determined intermediate frequency, such for example, as 2,500 metres. For this purpose incoming signals are detected by an ordinary detector circuit which is also used to detect a source of local oscillations which is tuned to a slightly different wavelength from that at which reception is desired.

Instead of the anode circuit of this detector valve containing a low-frequency transformer, it contains an intermediate frequency transformer tuned to a wavelength in the region of 2,500 metres. The output of this detector valve is then amplified by one or more H.F. pentode stages which are generally coupled by high-frequency transformers tuned to the wavelength of 2,500 metres.

Amplification having been carried out at this frequency, the output from the last valve is fairly considerable, and this is then detected so as to obtain audio frequency components.

It will be seen that one great advantage of this system lies in the fact that there is no need to have a large number of variable tuned circuits, since the amplifier always operates at the same frequency or wavelength.

See also Oscillator Circuits.

Tone Correction.

A broadcast transmission consists of radiation at a given radio-frequency which is modulated at speech frequencies. This produces side bands, as they are called, which have frequencies equal to the carrier frequency plus or minus the modulated frequency.

For example, a 300 metre transmission consists of a radio-frequency oscillation having a carrier value of 1,000,000 cycles per second, and if this is modulated at 1,000 cycles, the two side bands have a value of 1,000,000 plus 1,000, and 1,000,000 minus 1,000.

In a sharply tuned circuit the resonance curve has a marked peak at the resonance point with very quickly falling away sides.

This means that the upper side bands, that is those produced by the high speech frequencies, will only be received at far smaller strength. Accordingly, distortion is present, the form of distortion being known as side band cutting. It is apparent by a marked absence of the higher speech frequencies, therefore, circuits have to be used which compensate for the side band cutting.

It should be understood that what is definitely removed from the output can never be introduced, so that tone correction can only be applied so long as there is a slight amount of the frequencies which have to be corrected. The obvious method of tone correcting is to employ an L.F. amplifier which has an exactly opposite or inverse characteristic to that of the input or detector circuit.

It is only necessary, therefore, to use an L.F. amplifier in which one stage, or sometimes several, have a characteristic which is deficient in bass, so that when a falling top output is amplified by an amplifier with a falling bass characteristic, the resultant output will be substantially level.

Transformers, Low-Frequency.

Low-frequency or inter-valve transformers can be divided into two classes: Those employing the normal soft iron alloy cores, and those employing special cores of some type of nickel alloy.

For an even response over the entire useful frequency scale, a transformer must be of fairly large size if it employs an ordinary type of iron core. This is due to the fact that a definite impedance is required in the anode circuit of an amplifying valve. This impedance is provided by the primary winding of the transformer, and it cannot be sufficiently great unless a large amount of iron is employed. It follows, therefore, that a very small transformer with an ordinary iron core cannot give first-class results.

A small nickel alloy core, however, is satisfactory owing to the fact that a much higher impedance is obtained with a small core. However, when a very small core is used, it is necessary to remove the steady anode current from the primary winding. This is done by means of an anode feed system as described elsewhere.

Three faults can develop in a transformer: complete breakage of a winding, partial short-circuit of turns or complete or partial connection of windings to each other or the frame. A circuit tester will show whether the windings are complete, and whether they are in contact with themselves or the frame. The resistance measuring arrangement will give a rough indication of whether the windings are reasonably correct, but it will not show

the presence of a short circuit of a few turns.

An intermittent short circuit or high resistance joint gives rise to intense scraping and crackling noises.

Short-circuited turns cause a loss in amplification and, generally, raising of the tone, the reproduction sounding very thin and high pitched.

With the special high-permeability nickel-iron type of transformer designed for use in parallel-feed circuits it is inadvisable to pass

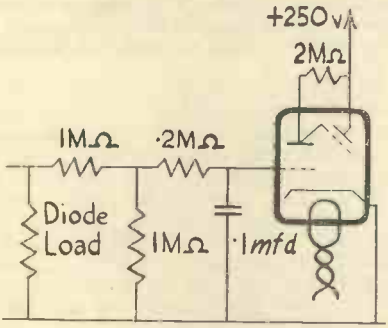


FIG. 24.—A form of electronic or "magic eye" tuning indicator in which one bulb contains both a triode amplifier and the cathode-ray control electrodes.

any current through the windings, and tests are best carried out by substituting a transformer known to be correct.

Transformers, Output.

Output transformers are very similar to low-frequency transformers. Taken as a whole, however, they must be of even larger dimensions, since they have to carry heavy anode currents. Some transformers have air gaps to keep the inductance reasonably constant and to prevent the core from saturating.

When a large step down ratio is used, it is essential that the leads between the secondary and the actual moving coil are kept as short as possible, while the resistance must be low as otherwise there is a loss of power.

Tuning, Automatic.

This is found in two forms. In the first, the receiver automatically corrects any slight mistuning by the operator. In the second form the receiver is tuned by a mechanism which is controlled by the listener—usually from a distance. Automatic tuning of the first kind may be accomplished by using the received signal to shift the oscillator frequency and thereby bring the intermediate frequency signal in "tune" with the I.F. transformers. One method is to obtain a signal voltage from an I.F. stage by a special circuit and apply this to the screen grid of tetrode or H.F. pentode. Alterations of voltage change the operating conditions of this valve and also the effective capacity of its input circuit. This is connected across the oscillator condenser, thereby providing the required change of oscillator frequency.

For the remote control form of automatic tuning, the tuning condenser can be driven through a clutch by a small reversible electric motor. The circuit can be arranged so that in addition to control by the operator, the driving mechanism will stop at every signal above a determined strength.

Tuning Indicators.

Tuning indicators are used to show when the carrier frequency is being received at maximum strength. That is, when the receiver is tuned to the centre of the group of frequencies comprising a transmission. Distortion of audio frequencies should then be at a minimum. Tuning indicators may be electro-mechanical or electronic. The former consist of a sensitive current meter movement and sometimes the pointer is used to reflect a light beam or cast a shadow. The movement is connected in the anode leads of valves whose anode current varies with the strength of the received signal.

Neon types consist of a small gas discharge tube containing three electrodes. A "striking" voltage is applied between two of these and a control voltage applied to the third draws a column of light up the tube. The length of the column depends on the voltage and this in turn is obtained from an anode circuit in such a way that it depends on the received signal.

Miniature cathode ray tubes are also being used as tuning indicators. The electron beam is directed upon a small fluorescent screen and is controlled, by the voltage of some part of the receiver, to form a pattern. The operating voltage may be obtained from across a resistance connected in the anode circuit of an I.F. valve. This voltage may then be applied to two deflecting plates in the cathode ray tube. As the voltage-drop across the anode resistance decreases when a signal is tuned in the spot of light moves across the fluorescent screen.

In another form the indication on the tube takes the form of a shadow-band of varying thickness. This effect is obtained by using a central anode which results in the electrons being sprayed more or less evenly over the fluorescent screen. The control voltage is applied to short rod electrodes which produce the required "shadows."

RADIO SERVICING—4

In some types a special stage of amplification is required for the cathode-ray indicator. In the Mullard TV4 a triode amplifier and the indicator are housed in a single tube. The control signal is taken from the load resistance of the diode detector. The recommended circuit is shown in Fig. 24.

Valve, the Harries.

A type of output valve containing a screen-grid, but dispensing with the suppressor-grid employed in pentodes. It is claimed that the undesirable secondary radiation which the suppressor-grid is employed to overcome is prevented in the Harries valve by critical spacing of the anode at a certain distance from the other electrodes. Advantages are said to be : better characteristics—the anode current curve has a sharp "knee" and is then practically straight ; low internal impedance ; and low internal capacity.

Valves, Mains.

Mains valves usually employ a flat tube coated with an electron-emitting substance. The tube is heated by means of an insulated hair pin which takes the place of the ordinary filament.

On switching on a valve a short time elapses before the cathode becomes uniformly hot. Owing to the thermal inertia of the coated tube, any changes in temperature due to the wave form of the A.C. supply do not affect the total electron emission, and, therefore, the valve operates without any appreciable hum.

The cathode, i.e., the coated tube, replaces the valve filament in so far as the grid returns and earth connections are concerned. It is the usual practice to connect the centre point of the heater winding to the earth or common cathode connection.

"Universal" valves suitable for A.C. or D.C. mains have 16 or 32 volts., .2 or .4 amp. heaters. The valves are connected in series and as the sum of their voltages is high a minimum of additional series resistance is necessary when they are run direct from the mains.

Valves, Midget.

Midget valves are produced in two types—those that are merely small editions of the standard type and are intended for use in compact portable receivers, deaf-aid amplifiers, and so on ; and those, such as the American Acorn-type, which are specially produced and designed throughout for ultra short-wave reception.

The Acorn valve is only 1¼ in. high by ¾ in. in diameter. All the dimensions are correspondingly reduced. A valve with this close electrode spacing is found to give an amplification gain of 10 to 15 on frequencies which would simply "jump" unaltered through a valve of the ordinary size.

Valves, Testing.

There are two properties of a valve which we can measure, the filament consumption, and the anode current at any particular high-tension voltage and grid voltage.

Occasionally the grid will come into contact with the filament, and this should be determined by one of the circuit testers when the filament is hot. This sometimes causes expansion, and the grid-filament contact will only show up when the filament is actually hot.

Providing the filament is intact and no electrodes are in contact, the next test is that of the anode current. A milliammeter is included in the anode circuit of the valve, the correct high-tension and grid bias being applied. The value of the anode current should then be accurately observed and compared with the maker's curve. If it is found that the anode current is considerably smaller than that shown in the curve, it indicates that the filament has lost part of its emission.

This is bound to occur with a valve which has been in use for a very long time, but should it happen in the case of a comparatively new valve, further investigations should be made.

A valve must never run at too high an anode voltage or with too small a grid bias value. The position in which it has been used in a set should be investigated and the voltages measured.

If the anode current at the correct grid voltage appears correct and a valve still fails to give the presumed amplification, the slope and amplification factor can be roughly checked.

The slope is the relationship of the change in anode current with respect to grid voltage. For example, a slope of 3 m.a./v. means a change of 3 m.a. for change of 1 grid volt. The anode current at a given high-tension voltage is noted at a given grid bias value. The grid bias is then increased by a few volts, for example, 3 volts, when, of course, the anode current fails. Extra voltage is then added to the high-tension circuit until the former value of anode current is again reached. The extra voltage which has been added is noted and this is divided by the change in grid voltage which was applied to the valve. If 15 volts were added then the amplification factor of the valve would be 5.

From these two values we can calculate the impedance of a valve. It is only necessary to divide the amplification factor by the slope and multiply the result by 1,000. For example, a valve with an amplification factor

of 14 and a slope of 2 would have an impedance of 7,000 ohms.

Mention has not previously been made of rectifying valves. The method of testing, of course, consists in checking the filament consumption in the normal manner, while the total emission should be measured by including a milliammeter in circuit with a fixed resistance and using the maximum high-tension supply. This is a safety resistance to protect the valve, and the value is always contained amongst the manufacturer's data. On no account should this be omitted.

Valves, Universal.

Valves for operation from either A.C. or D.C. supplies have heater ratings which

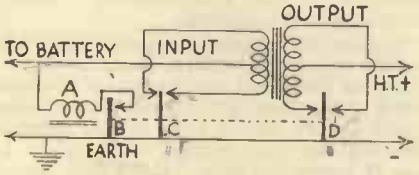


FIG. 25.—While there are various forms of vibrator units, this diagram shows the basic principles employed.

enable them to be used in series across the mains supplies.

Usually the output and rectifier valves, which require "larger" cathodes than other types, are rated at twice the voltage of the other types, the current remaining the same, of course, to permit the series connection.

The value of the voltage dropping resistance to be connected in series with the valves is obtained by adding the voltage ratings of the heaters and subtracting the total from the mains voltage. The difference of these two voltages when divided by the heater current in amps gives the ohms required for the additional resistance.

To minimise hum, universal—and D.C. type—valves should be connected in the following order: rectifier, output, first H. F., second H. F., detector, chassis.

Valves, Variable-Mu.

The variable-mu valve is a screen grid amplifier in which the effective amplification factor and mutual conductance are variable over very wide limits.

When an ordinary screen grid valve is operating under correct conditions, it will only handle a small applied grid voltage. A large signal would oversweep the grid bias and cause considerable distortion introducing a rectification effect. This is a condition which is likely to obtain when a set using a screen grid amplifier is tuned in to a strong local signal.

If the effective amplification factor could be lowered, the valve would handle a very much greater grid swing without running off the straight portion of the curve. This is what is achieved in the case of the variable-mu valve.

In the case of battery variable-mu valves, the necessary bias control is sometimes obtained from a potentiometer which can be connected across the bias battery.

Vibrator Units.

These are commonly employed to obtain the necessary H.T. for car radio receivers from the car battery. Various types are made, each with individual features, but the form illustrated in Fig. 25 will enable the basic principles to be understood.

When the unit is switched on, current flows through the coil *A*. This attracts the armature *B* which moves, breaks the circuit, springs back, remakes the circuit and so continually repeats the cycle. The action is, in fact, similar to that of the ordinary electric bell. Mechanically, but not electrically, coupled to the armature *B* are other contact arms *C* and *D*. These operate across the centre-tapped input and output windings of a step-up transformer. As arm *C* oscillates from contact to contact the current from the battery flows first in one direction through half the transformer, then in the reverse direction through the other half. The alternating voltage thus produced appears in stepped-up form across the ends of the secondary winding. Contact arm *D* alternately changes the secondary earth connection so that the voltage is always applied to the output circuit in the right direction—it is, in other words, a mechanical rectifier. It is possible for a basically similar arrangement to be used with a full-wave rectifying valve in place of the arm *D*.

For good operation the air gap at the contact points should be accurately set to the distance stated by the makers, the contact points should be absolutely clean and properly aligned.

Vibrator units are also being employed to enable A.C. receivers to be operated from D.C. mains and to replace H.T. batteries in battery sets. In both cases the principles involved are fundamentally the same as in the car radio unit.

Volume Controls.

Volume controls can be divided into two types, wire wound and composition. Wire wound volume controls rarely have a value much greater than 50,000 to 80,000 ohms. A control of this type should not be used across a high impedance pick-up winding or across the secondary of a low frequency transformer.

A control in this position should have a value of the order of 500,000 ohms. This usually necessitates a composition type.

VALVE CONNECTIONS

Valve connections in the following guide are all given *looking at the valve base* itself, or looking at the valve-holder *from underneath*. The diagrams shown are of valve bases, or the *underside* of holders.

With the exception of the Mullard universal valve bases, the number of pins a valve has can easily be seen by noticing how far its entry goes in the "pin" columns.

Whether valves are mains or battery types is indicated by an "M" or "B," respectively, following the name of the type.

Continental Valves

Continental valves, though the majority do not suit British valve-holders, have the connections in the same order as British valves. Reference to the table for standard British types will, therefore, give the connections, although the valve, being Continental, may not fit a corresponding British valve-holder.

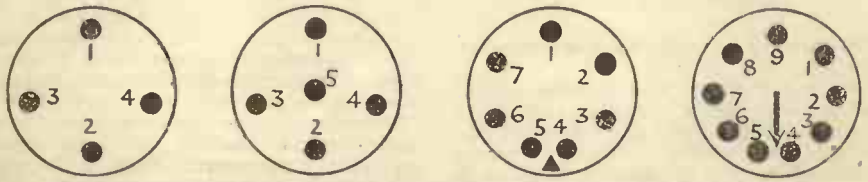
Only Continental valves with unorthodox bases, therefore, are dealt with in the separate chart and diagram below.

Code Explained

The following code is employed to denote what electrode is connected to the pin: C.G.=control grid; A.=anode associated with control grid; S.G.=screening grid; A.G.=auxiliary grid; S.=suppressor grid or screen; O.G.=oscillator grid; O.A.=oscillator anode; D.A.1, D.A.2, D.A.3=diode anodes, 1, 2 and 3 respectively; Met.=metallising; C.=cathode.

An asterisk (*) means that other electrodes are also connected to these pins.

Control grids and anodes which are contained in the same set of electrodes in class B and Q.P.P. valves have similar numbers following the code entries. Example: In class B valves the grid "C.G.1" is associated with the anode "A.1," while "C.G.2" is associated with "A.2."



This diagram shows the arrangement of the pins on the bases of valves made by members of the British Radio Valve Manufacturers Association. The bases are (left to right) four, five, seven and nine pin types. The numbering of the pins corresponds with the table below, and the code in the table is explained at the top of this page.

B.R.V.M.A BASES.

Valve type.	Pin Connections.									Top.
	1	2	3	4	5	6	7	8	9	
Triode, B	A	CG	F	F	—	—	—	—	—	—
" M	A	CG	H	H	C	—	—	—	—	—
" M (A.C.–D.C.)	M	—	—	H	H	C	A	—	—	CG
Screen grid, B	SG	CG	F	F	—	—	—	—	—	A
" M	SG	CG	H	H	C	—	—	—	—	A
H.F. Pentode, B	AG	CG	F	F	—	—	—	—	—	A
" B	Met	CG	S	F	F	—	SG	—	—	A
" M	AG	CG	H	H	C*	—	—	—	—	A
" M	Met	CG	S	H	H	C	AG	—	—	A
Heptode, B	OA	OG	SG*	F	F	—	A	—	—	CG
" M	OA	OG	SG*	H	H	C	A	—	—	CG
Octode, B	OA	OG	AG*	F	F	—	A	—	—	CG
" M	OA	OG	AG*	H	H	C	A	—	—	CG
H.F. pentode triode, B	AG	A	S	F	F	—	OA	OG	Met	CG
" " M	AG	A	S	H	H	C	OA	OG	Met	CG
Double diode, B	DA1	DA2	F	F	—	—	—	—	—	—
" M	DA1	DA2	H	H	C and M	—	—	—	—	—
Double diode triode, B	A	DA1	F	F	DA2	—	—	—	—	—
" " M	DA1	Met	DA2	H	H	C	A	—	—	CG
Double diode pentode, M	DA1	A	DA2	H	H	C	AG	—	—	CG
Double diode H.F. Pen.	AG	A	—	H	H	C	DA1	DA2	M	CG
Single diode tetrode, M	—	CG	SG	H	H	C*	DA	—	—	A
Triple diode triode, M	DA1	DA3	DA2	H	H	C	A	—	—	CG
" " "	DA1	DA2	—	H	H	C	A	DA3	M	CG
Class B, B	CG1	CG2	A2	F	F	—	A1	—	—	—

B.R.V.M.A. BASES—*continued.*

Valve type.	Pin Connections.									Top.
	1	2	3	4	5	6	7	8	9	
Double pentode, B	CG1	CG2	A2	F	F	AG	A1	—	—	—
,, B	CG1	A1	AG1	F	F*	—	AG2	A2	CG2	—
Output pentode, B	A	CG	F	F	—	—	—	—	—	AG (side)
,, B	A	CG	F	F	AG	—	—	—	—	—
,, M	A	CG	H	H	C	—	—	—	—	AG (side)
,, M	—†	CG	AG	H	H	C	A	—	—	—
Rectifier, half-wave	A	—	F	F	—	—	—	—	—	—
,, full-wave	A1	A2	F	F	—	—	—	—	—	—
,, universal	—†	A1	C1	H	H	C2	A2	—	—	—
Barretter lamp	—	—	F	F	—	—	—	—	—	—

† In Marconi-Osram A.C.–D.C. range (1) is heater centre tap for series or parallel operation.

CONTINENTAL BASES.

Valve type.	Pin Connections.						Top.
	1	2	3	4	5	6	
Triode, B	A	CG	F	F	—	—	—
,, M	CG	C	H	H	A	—	—
Output pentode, M	CG	AG	F	F	A	—	—
Screen grid, M	SG	C	H	H	A	—	CG
Screen grid, M and B	S	C	H	H	A	SG	CG
Double diode triode, M	D1	C	H	H	A	D2	CG
Output pentode, M and B	AG	C	H	H	A	CG	—
Rectifier	C1	A1	H	H	A2	C2	—

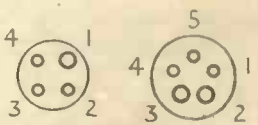
These bases are (left to right) four, five and six pin Continental types, and the "P" and "V" type Mullard universal side-contact bases, respectively.

MULLARD UNIVERSAL VALVE- BASES.

Valve type.	Base.	Contacts.								Top.
		1	2	3	4	5	6	7	8	
H.F. pentode..	P	Met	H	H	C	S	—	AG	A	CG
Octode	P	Met	H	H	C*	OA	OG	AG	A	CG
Triode	P	Met	H	H	C	—	—	—	A	CG
Double diode	V	Met	H	H	C	DA1	—	—	—	DA2
Output pentode	P	—	H	H	C	—	—	AG	A	CG
Rectifier full-wave	P	—	H	H	C	A1	—	—	A2	—
,, half-wave	P	—	H	H	C	—	—	—	A	—
,, voltage-doubler ..	P	C1	H	H	C2	A1	—	—	A2	—

HIVAC MIDGET VALVES.

Valve Type.	Pin Connections.					Top
	1	2	3	4	5	
Screen-grid, B.	CG	F	F	S	—	A
Triode, B.	CG	F	F	A	—	—
Output-pentode type, B. ..	A	F	F	S	CG	—



Four and five-pin Hivac midget bases.

B.S.S. 613 INTERFERENCE

Recommended circuits for the suppression of radio interference as well as standards for the components to be used are contained in the British Standard Specification which has been produced by a committee of representatives of the R.M.A., R.C.M.F., B.B.C., G.P.O., National Physical Laboratory, I.E.E., B.E.A.M.A., and other associations of the electrical Industry.

Measuring apparatus and permissible limits of static are to be dealt with in a further specification, but the contents of this specification are such that there is no longer any need for suppression work to be held up.

The standards are in entire agreement with the R.C.M.F. standards published in August, 1934, and several members of the R.C.M.F. are in a position to supply suppression equipment in accordance with the specification. Retailers and engineers ordering equipment should specify that it must comply with B.S.S.613.

Under the specification condensers for connection across 250 v. A.C. or D.C. appliances must withstand a 1,500 v. D.C. test between terminals and a 1,500 v. A.C. test between terminals and metal casing.

Condensers for connection between a 250 v. appliance and the casing of the appliance or an earth terminal, for connection across a 500 v. D.C. appliance or between the appliance and its casing (or earth), for connection between a 500 v. A.C. appliance and its casing (or earth) must be capable of withstanding a 2,250 v. D.C. test between terminals and a 1,500 v. A.C. test between terminals and casing.

Filter Circuits for Silencing

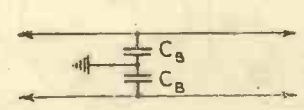


Fig. 1.

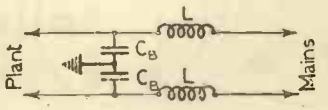


Fig. 2

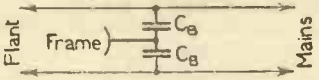


Fig. 5

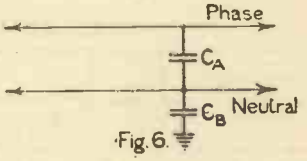


Fig. 6.

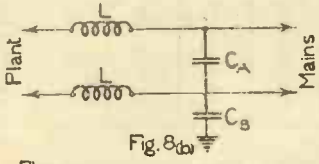


Fig. 8(b)

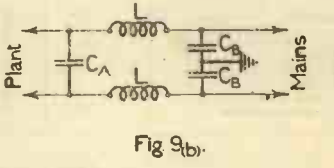


Fig 9(b).

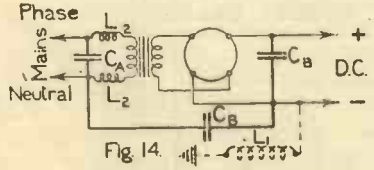


Fig. 14.

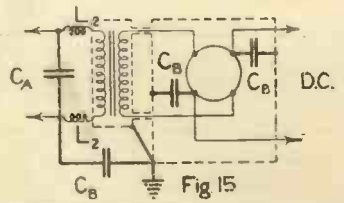


Fig 15

SUPPRESSION DEVICES

Condensers for connection across 500 v. A.C. appliances shall be tested at 3,000 v. D.C. between terminals and 2,000 v. A.C. between terminals and casing.

R.F. inductances are standardised in seven values from 100 to 10,000 microhenrys, and they shall be capable of withstanding a test voltage of 2,000v. (R.M.S.) between windings and between windings and earth.

Other regulations deal with the construction and other electrical properties of the condensers and chokes.

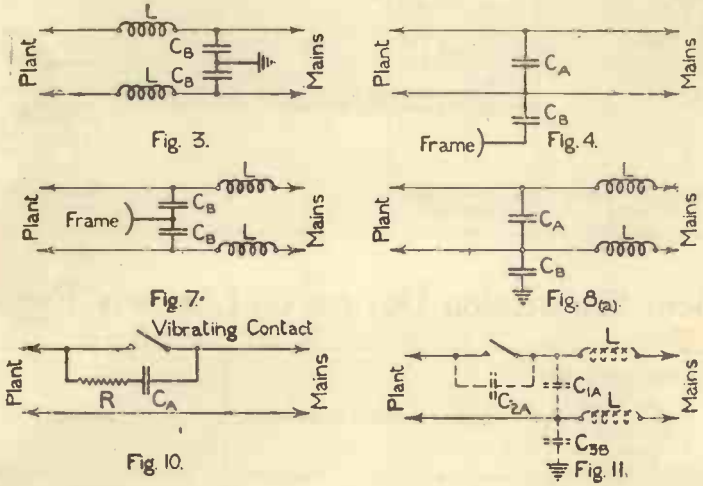
In addition to the recommended circuits and tables of values reproduced herewith the specification contains similar information dealing with commercial apparatus and plant.

In the tables given overleaf on page 94 the letters A and B appear following the letter C. "A" indicates that the condenser must comply with the regulations concerning condensers which are connected to one or both poles of the appliance, but are isolated from the case or any earthing terminal. "B" indicates the condenser must comply with the tests for condensers which are connected to the casing of the appliance or any earthing terminal.

Where the cases of appliances cannot be earthed and are accessible to users, the values of condensers connected to the cases should be restricted to those shown in columns 5 and 6.

The specification is entitled "British Standard Specification for Components for Radio-interference Suppression Devices (Excluding Devices for Traction Equipment)" and is known as B.S.S. 613. It is available at 2s., or 2s. 2d., post free, from the British Standards Institution.

Various Electrical Appliances



Reading from left to right, across the opposite page and this, here are the circuit arrangements which are referred to by their figure numbers in the tables overleaf on page 94. The meanings of the code letters used in the diagrams and tables are explained in the text matter above.

INTERFERENCE SUPPRESSION—(*contd.*)

Domestic and other Small Appliances up to 1 h.p.

Item.	Appropriate Filter Circuit (see Diagram).		Suggested Values of Components.			Remarks.
	Universal or A.C.	D.C.	With earthed Frames.	Frames not earthed. Universal or A.C.	Frames not earthed. D.C.	
1	2	3	4	5	6	7
	Fig.	Fig.				
Electric Toys, Fans, Floor Polishers, Gramophone Motors, Hair Dryers and Clippers, Refrigerators, Vibrators (body and face) Vacuum Cleaners, Washing Machines.	4	5	$C_A = C_B = 0.1$-1mfd	$C_A = 0.1$ mfd. $C_B = 0.01$ mfd.	$C_b = 0.1$ mfd.	If the values shown in columns 5 and 6 do not give sufficient suppression use filter No. 7 with L = 500-5,000 mH.
Bells, mains or battery operated.	10	10	$C_A = 0.1$ mfd. R = 50-200 ohms.	$C_A = 0.1$ mfd.; R = 50-200 ohms.	$C_A = 0.1$-1 mfd.; R = 50-200 ohms.	Only affects receiving sets in the same premises.
Electric Clocks, other than synchronous.	10	10	$C_A = 0.1$ mfd.; R = 50-200 ohms.	$C_A = 0.1$ mfd.; R = 50-200 ohms.	$C_A = 0.1$-1 mfd.; R = 50-200 ohms.	Synchronous Clocks are non-interfering.
Electric Clocks, having make-and-break contacts.	4	5	$C_A = C_B = 0.1$mfd.	$C_A = 0.1$ mfd.; $C_B = 0.01$ mfd.	$C_B = 0.1$ mfd.	
Heating Pads with thermostats.	10 or 11	11	$C1_A = C3_B = 1$mfd; $C2_A = 01$ mfd.; L = 2000 mH.	$C_A = 0.1$ mfd.; R = 50-200 ohms.	$C1_A = C3_B = 1$mfd; $C2_A = 0.1$ mfd.; L = 2,000 mH.	The alternative components should be tried in the following order: $C2_A$ $C1_A + C3_B$; L.
H.F Medical Apparatus.	8 (a or b)	—	$C_A = C_B = 1$-2mfd.; L = 2,000 mH.	—	—	Also requires complete screening of apparatus and patient.
Rotary Converters (D.C. to A.C.).	6 or 8a	1 or 2	$C_A = C_B = 1$-1 mfd. L = 500-5,000 mH.	—	—	A.C. and D.C. sides should both be corrected.
Rotary Rectifiers ..	14 or 15	—	$C_A = C_B = 1$-4mfd.; L1 = 500 mH; L2 = 500-10,000 mH.	—	—	In severe cases machine must be screened.
Sewing Machines ..			$C_A = 0.1$-0.5 mfd.; $C_B = 0.01$-0.1 mfd.	$C_A = 0.1$-.5 mfd.; $C_B = 0.01$ mfd.	$C_A = 0.1$-.5 mfd.; $C_B = 0.01$ mfd.	Frames of Controller and Motor should be bonded together, and, if required, a 0.1 mfd. condenser connected across controller.
Water Heaters, with thermostats.	8 (a or b)	2 or 3	$C_A = C_B = 1$ mfd.; L = 2,000 mH.	—		Suppression seldom required.

Independent Suppression Devices on Listeners' Premises

Item.	Appropriate Filter Circuit (see Diagram).		Suggested Values of Components.	Remarks.
	Universal or A.C.	D.C.		
1	2	3	4	5
	Fig.	Fig.		
Set-supply Filters: H.F. Filter ..	9b	9b	$C_A = 0.1$-1.5 mfd.; $C_B = 0.01$ mfd.; L = 5,000-10,000 mH.	
L.F. Filter ..	—	—	2H iron core inductor in one main and 4 mfd. condenser across mains, on receiving set side of inductor.	Only used for D.C. mains from mercury-arc rectifiers.
Mains entry Filters	6 or 8a or 8b	1, 2 or 3	$C_A = C_B = 1$ mfd.; L = 500 mH.	Placed as near mains switch as possible.

ELECTRICAL FORMULÆ & DATA

FOR D.C. CIRCUITS.

Ohm's Law.

$$I=\frac{E}{R} \qquad E=IR \qquad R=\frac{E}{I}$$

Power.

Power (watts) = E.M.F. (volts) × Current (amps.).

FOR A.C. CIRCUITS.

Current in A.C. circuit containing Inductance (L) only :—

$$I=\frac{E}{\omega L} \qquad \omega=2\pi f.$$

Current in circuit with Capacity (C) only :—

$I=\omega CE$.

Current in circuit containing Resistance, Capacity and Inductance in series :—

$$I=\frac{E}{\sqrt{R^2+\left(\omega L-\frac{I}{\omega C}\right)^2}}$$

Impedance.

$$\text{Impedance } Z=\sqrt{R^2+\left(\omega L-\frac{I}{\omega C}\right)^2}$$

Reactance.

$$\text{Reactance } X=\left(\omega L-\frac{I}{\omega C}\right)$$

$$\textit{Power Factor}=\frac{\text{True Power}}{\text{Apparent Power}}=\frac{EI\cos\phi}{EI}$$

RESISTANCES, CAPACITIES AND INDUCTANCES IN SERIES AND PARALLEL.

Units.	*Series Total.*	*Parallel Total.*
Resistances : r_1, r_2, r_3	$R=r_1+r_2+r_3$	$R=\frac{1}{\frac{1}{r_1}+\frac{1}{r_2}+\frac{1}{r_3}}$
Capacities : C_1, C_2, C_3	$C=\frac{1}{\frac{1}{C_1}+\frac{1}{C_2}+\frac{1}{C_3}}$	$C=C_1+C_2+C_3$
Inductances : l_1, l_2, l_3	$L=l_1+l_2+l_3$	$L=\frac{1}{\frac{1}{l_1}+\frac{1}{l_2}+\frac{1}{l_3}}$

AUTO BIAS RESISTANCE.

Bias resistance is given by the expression—

$R=\frac{E_B}{I_A}$ where E_B = Bias volts and I_A anode current.

The values are obtained from the valve makers' data.

ANODE VOLT DROP RESISTANCE.

The value of the volt drop resistance is given by the expression—

$$R=\frac{V_1-V_2}{I_a}$$

where V_1 equals the H.T. voltage and V_2 the correct anode voltage for the valve, and I_a the steady anode current.

UNIVERSAL VALVE BALLAST RESISTANCE.

The value of the ballast resistance is given by the expression :—

$$R=\frac{V_m-V_v}{I_v}$$

where V_m equals the mains voltage and V_v the total voltage of the valve heaters connected in series and I_v the heater current.

FOR COILS AND CONDENSERS.

Inductance.

In a single-layer coil close wound on a cylindrical former, the inductance is given by :

$$L=\pi^2d^2n^2lK,$$

where d = diameter of coil in cms. ; l = length of coil in cms. ; n = number of turns per cm. ; K = factor depending on the ratio of diameter to length of coil ; L = inductance in micro-henries.

$\frac{d}{l}$.	K.	$\frac{d}{l}$.	K.
0·00	1·000	1·5	0·595
0·10	0·959	2·0	0·526
0·20	0·920	2·5	0·472
0·30	0·884	3·0	0·429
0·40	0·850	4·0	0·365
0·50	0·818	5·0	0·320
0·60	0·788	6·0	0·285
0·70	0·761	7·0	0·258
0·80	0·735	8·0	0·237
0·90	0·711	9·0	0·218
1·00	0·688	10·0	0·203

For a single-layer close-wound coil, the coil of maximum inductance from a length of wire is given by—

$$\frac{\text{Diameter}}{\text{Length}}=2\cdot4.$$

Capacity.

In a parallel metal plate condenser capacity is given by—

$$C\text{ (cms.)}=\frac{nkA}{4\pi d},$$

where n = number of sheets of dielectric, k = specific inductive capacity of dielectric

ELECTRICAL FORMULÆ

with air as unit; A = area of one plate in sq. cms., and d = distance between plates.

Charge held by condenser is Q (coulombs) = C (farads) × V (volts).

WAVELENGTH AND FREQUENCY.

Radio waves travel at 300 million metres a second.

Wavelength × Frequency = Velocity.

$$\text{Wavelength (metres)} = \frac{\text{300 million}}{\text{Frequency (cycles per sec.)}}$$

FOR OSCILLATORY CIRCUITS.

Wavelength of a circuit LC is given by :—

$$\lambda = \frac{C}{1885\sqrt{LC}}$$

where λ is wavelength in metres, L is inductance in microhenries and C is capacity in microfarads.

Resonant frequency of a circuit LC is given by :—

$$f = \frac{1}{2\pi\sqrt{LC}}$$

where f is cycles per second, L is inductance in henries and C is capacity in farads.

VALVE ANODE DISSIPATION.

The anode dissipation of a valve is given by the expression :—

$$W = \frac{I_a E_a}{1{,}000}$$

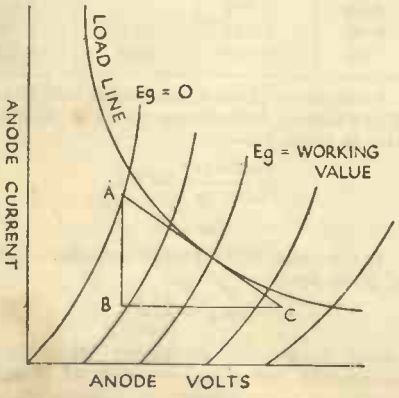
where I_a equals the steady anode current in milliamps and E_a is the anode voltage.

POWER VALVE A.C. OUTPUT.

The output of a valve is given by the expression :—

$$W = \frac{AB.BC}{8}$$

AB and BC are obtained by drawing a tangent to a curve at the normal bias point as shown in the diagram. AB equals change in anode milliamps and BC change in anode volts.



VALVE CONSTANTS.

Amplification factor is the ratio of the voltage produced in the anode circuit to the grid voltage (μ).

Mutual Conductance is the ratio of the anode current change to grid voltage. ($m.a./v$).

Impedance is the ratio of the amplification factor to the mutual conductance, which is given by the expression :—

$$Z = \frac{\mu}{m.a./v.}$$

Flux Density and Permeability of Iron.

$$\text{Permeability} = \frac{\text{Flux Density}}{\text{Magnetising force}}$$

$$i.e. \quad \mu = \frac{B}{H}$$

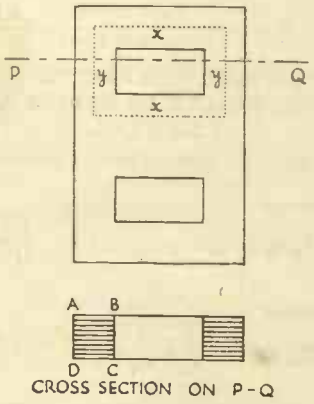
IRON CORE INDUCTANCES.

The inductance of an iron core is given by the expression :—

$$L_{(H)} = \frac{4\pi T^2 \mu A\, 10^{-9}}{l}$$

where π equals 3.14, T^2 equals the turns, μ equals the permeability, A equals the cross sectional area, and l the magnetic length.

The magnetic length is measured on a transformer stamping as dotted in the diagram, the length line being taken centrally along the width of the outer frame and a quarter of the width of the inner limb (2x + 2y).



The area is accurately determined by dividing the volume of iron by the magnetic length, but for general work the cross section area of the frame (as at A, B, C, D) may be taken. Dimensions are in centimetres.

POWER TRANSFORMERS.

The turns are in the ratio of the primary

and secondary voltages, the condition being given by the expression :—

$$\frac{E_1}{E_2} = \frac{T_1}{T_2}$$

The turns per volt depend upon the cross-section area of the core, the frequency of supply, and the flux density at which the iron is worked. This is given by the expression :—

$$\frac{1}{T} = 4{\cdot}44\ 10^{-8} fAB$$

where f equals the frequency, A the cross-section in square inches, and B the flux density.

For small power radio transformers with a cross-section area of 1·5 sq. in. the normal turns are 6 turns per volt.

SPEAKER OUTPUT TRANSFORMER

The ratio of a transformer depends upon the valve load and the speaker impedance, which is given by the expression :—

$$\sqrt{\frac{\text{Valve Load}}{\text{Speaker Impedance}}}$$

Both values are in ohms.

Optimum load is obtained from the valve manufacturers' data, and is approximately equal to two to three times the valve resistance.

For parallel output valves the valve resistance is halved, and for push-pull working it is doubled.

ATTENUATION.

Attenuation N is expressed in decibels when

$$N = 10 \log \frac{P_2}{P_1} \quad \text{or} \quad 20 \log \frac{E_2}{E_1}$$

where P_1 and P_2 are relative powers or E_1 and E_2 relative voltages.

EQUIVALENT TEMPERATURES.

$$F = \frac{9}{5}C + 32$$

$$C = \frac{5}{9}(F - 32)$$

F = Fahrenheit scale.

C = Centigrade scale.

RESISTANCE OF WIRE.

$$R = \frac{l\rho}{\frac{\pi}{4}d^2}$$

where R = resistance
l = length of wire
ρ = resistivity
d = diameter

Sectional area of a wire = $\cdot 7854\, d^2$
where d = diameter

COMPARATIVE RESISTANCES.

Resistances of materials taking that of copper as unit.

Aluminium	1·6
Brass	4·4
Concondin	60
Constantin	30
Eureka	29
German Silver	13
" "	18
Gold	1·5
Iron	6·2
"	7·4
Kruppin	52·6
Manganese Copper	62
Manganin	26
Mercury	59
Neusilber	23
Nichrome	55
Nickel	4·4
Nickel Steel	18
" "	46·5
Nickeline	20
"	27
Phosphor Bronze	4·4
Platinoid	20
"	31
Platinum	6·3
Rheostan	30
"	62
Silicon Bronze	1·5
Silver	·94
Steel	12

QUANTITIES OF WATER AND ACID IN VARIOUS S.G. ELECTROLYTES.

Quantities of Water and Acid to be added to produce required specific gravity.

Using 1·400 acid.

Required Specific Gravity.	Water Parts by Volume.	Acid Parts by Volume.
1·300	4·5	10
1·280	5·5	10
1·275	6·25	10
1·260	6·5	10
1·250	6·75	10

1·835 acid.

1·400	15·6	10
1·350	19·5	10
1·300	24·7	10
1·290	26·0	10
1·280	27·5	10
1·270	29·0	10
1·260	30·0	10
1·250	32·2	10
1·240	34·0	10
1·230	36·0	10
1·225	37·2	10

BRITISH STANDARD WIRE TABLES

BARE COPPER.

S.W.G.	Diam.	Section Area.	Ohms per 1,000 yds.	Length per Ohm.	Weight per 1,000 yds.	Ohms per lb.	Approx. safe current.
	ins.	sq. in.		ins.	ozs.		in amps.
50	·001	·00000079	30,570	1·18	·145	3,365,000	·003
49	·0012	·00000113	21,230	1·7	·209	1,623,000	·005
48	·0016	·00000201	11,941	3·02	·372	513,500	·008
47	·002	·00000314	7,642	4·71	·581	210,300	·012
46	·0024	·00000452	5,307	6·78	·834	101,440	·02
45	·0028	·00000616	3,899	9·24	1·14	54,750	·025
44	·0032	·00000804	2,985	10·77	1·49	32,090	·03
43	·0036	·0000102	2,359	15·26	1·88	20,040	·04
42	·004	·0000126	1,910	18·87	2.32	13,146	·05
41	·0044	·0000152	1,578	22.81	2·81	8,978	·06
40	·0048	·0000181	1,326	27·15	3·35	6,340	·07
				yards.	lbs.		
38	·006	·0000283	849	1·18	·327	2,597	·1
36	·0076	·0000454	529	1·89	·525	1,008	·15
34	·0092	·0000665	361	2·77	·769	469·8	·25
32	·0108	·0000916	262	3·82	1·06	247·4	·4
30	·0124	·000121	199	5·03	1·40	142·35	·5
28	·0148	·000172	139·5	7·18	1·99	70·14	·7
26	·018	·000254	94·3	10·6	2·94	32·06	1·0
24	·022	·000380	63·2	15·8	4·4	14·366	1·5
22	·028	·000616	39	25·6	7·12	5·475	2·5
20	·036	·00102	23·6	42·4	11·8	2·004	4
18	·048	·00181	13·27	75·4	20·9	·634	7
16	·064	·00322	7·46	134·6	37·2	·2	13
14	·08	·00503	4·78	208	58·1	·08216	19
12	·104	·0085	2·83	353	92·8	·02877	28
10	·128	·013	1·87	535	148·8	·012537	35

RESISTANCE WIRES.

Gauge.	Beacon Wire.			Iron Wire.		German Silver.	
	Ohms per yd.	Yards per lb.	Current amp.	Ohms. 1,000 ft.	Current.	Ohms. 1,000 ft.	Current.
8	·067	5·5	15·7	2·4	47	6·8	30
9	·083	6·5	13·4	3·1	40	8·7	26
10	·104	8	12·4	3·8	37	11	24
11	·134	9·5	10·9	4·8	33	14	22
12	·159	12	9·5	6·1	28	17·3	19
13	·205	15·5	8·1	7·8	24	21·6	16
14	·270	20	6·7	9·8	20	27·4	13
15	·330	25	5·7	12·2	17	34·7	11
16	·422	31	4·7	15·5	14	44	9
17	·540	41	3·8	19·5	11	55·3	8
18	·750	55	2·9	28	8	77	6
19	1·04	83	2·0	39	6	112	4
20	1·33	100	1·7	48	5	138	3·5
21	1·66	125	1·4	62	4	176	3
22	2·15	164	1·05	79	3	224	2

SINGLE COTTON COVERED.

S.W.G.	Total thickness of covering in mils.	Turns per inch.	Turns per sq. inch.	Yards per lb.
40	4	112.5	26,600	3,910
38	4	100	10,000	2,550
36	4	86·2	7,430	1,610
34	5	70·5	4,970	1,280
32	5	63·3	4,010	835
30	5	57·5	3,300	634
28	5	50·5	2,550	452
26	5	43·5	1,892	311
24	5	37	1,369	219
22	5/6	29·8	888	134
20	5/6	24·1	581	81·7
18	6/7	18·3	335	46·3
16	7	14·1	198	26·1
14	7/8	11·4	130	16·9
12	7/8	9	81	10·3
10	7/8	7·4	54	6·63

DOUBLE COTTON COVERED.

S.W.G.	Total thickness of covering in mils.	Turns per inch.	Turns per sq. inch.	Yards per lb.
40	7/9	78	6,080	3,456
38	7/9	71·5	5,110	2,287
36	7/9	64	4,010	1,477
34	8/10	55	3,020	1,024
32	8/10	50·5	2,550	755
30	8/10	47	2,210	587
28	8/10	42	1,790	422
26	8/10	37	1,400	294
24	8/10	32·3	1,043	·203
22	9/11	26·3	692	129
20	9/11	21·7	473	79·4
18	9/11	17·3	299	45·4
16	10/12	13·3	177	25·6
14	12/14	10·75	115	16·6
12	12/14	8·5	72	9·09
10	12/14	7·1	50·3	6·58

SINGLE SILK COVERED.

				per oz.
47	1·2	312	97,300	1,875
46	1·2	278	77,300	1,000
45	1·2	250	62,500	752
44	1·2	227	51,530	599
42	1·2	192	36,860	387
40	1·3	164	26,900	276
				per lb.
38	1·3	137	18,770	2,871
36	1·3	112	12,540	1,815
34	1·3	95·2	9,060	1,250
32	1·3	82·6	6,820	912
30	1·3	73	5,330	695
28	1·3	62·1	3,860	488
26	1·3	51·8	2,680	332
24	1·5	42·5	1,810	222
22	2	33.3	1,090	137
20	2	26·3	692	83·3
18	2	20	400	46·8
16	3	15	222	26·4

DOUBLE SILK COVERED.

				per oz.
47	2·2	238	56,600	1,190
46	2·2	217	47,100	871
45	2·2	200	40,000	675
44	2·2	185	34,200	536
42	2·2	161	25,900	358
40	2·5	137	18,800	258
				per lb.
38	2·5	118	13,900	3,760
36	2·5	90·1	8,120	1,750
34	2·5	85·5	7,310	1,220
32	2·5	75.2	5,650	887
30	2·5	67·1	4,500	675
28	2·5	57·8	3,340	478
26	2·5	48·8	2,380	325
24	3	40	1,600	218
22	3	32·2	1,040	134
20	3	25·6	655	82.5
18	3	19.6	384	46·3
16	4	14·7	216	26·1

ENAMELLED.

				per oz.
50	·2	833	694,000	6,480
49	·2	714	510,000	4,510
48	·3	526	277,000	2,540
47	·3	435	189,000	1,630
46	·4	357	127,500	1,128
45	·5	303	91,800	835
44	·5	270	72,900	642
42	·6	217	47,100	411
40	·7	182	33,100	286

				per lb.
38	1·0	143	20,450	2,810
36	1·0	116	13,450	1,840
34	1·0	98	9,600	1,202
32	1·2	83·3	6,940	915
30	1·2	73·5	5,400	694
28	1·6	60·1	3,610	488
26	1·8	50·5	2,550	330
24	2·3	41·1	1,690	221
22	2·5	32·8	1,080	137
20	2·7	25·8	666	83·3
18	2·7	19·7	388	46·9
16	3·5	14·8	219	26·4

"The Broadcaster" Data

Characteristics of 1,000 valves are given in THE BROADCASTER Valve Chart below. The figures published have in every case been submitted to the manufacturers concerned for checking. The following information was, therefore, absolutely accurate at the time of going to press.

The chart is arranged in 8 sections, as follows : Frequency changers, screen grid and H.F. pentodes, diode valves, diode combination valves, general purpose triodes, power output triodes, pentode output valves, and double output valves.

In each section the types are grouped by manufacturers, and then by filament ratings, the order being : 2 volt battery, indirectly heated A.C., directly heated A.C., A.C.-D.C., and D.C.

FREQUENCY CHANGERS

Maker.	Type.	Circuit.	Fil. volts.	Fil. amps.	Anode volts.	Screen volts.	Oscillator volts.	Conv. cdt. m'hos.	Grid bias	Price.
Brimar	*15A2	Heptode	4.0	0.65	250	100	200	550	—3—40	15/-
	*15D1	Heptode	13.0	0.2	250	100	200	550	—3—40	15/-
Cossor	210PG	Pentagrid	2.0	0.1	150	80	150	1,000	0—9	14/-
	210SPG	Pentagrid	2.0	0.1	150	80	150	—	0—9	14/-
	210DG	Double Grid	2.0	0.1	—	—	—	—	—	20/-
	*41MPG	Pentagrid	4.0	1.0	250	100	100	1,200	—1½—10	15/-
	*41STH	Triode Hexode	4.0	1.15	250	100	100	—	—1½—9	15/-
	*41MDG	Double Grid	4.0	1.0	200	—	—	—	—	19/-
	*13PGA	Pentagrid	13.0	0.2	250	100	200	700	—1½—20	15/-
	*202MPG	Pentagrid	20.0	0.2	200	100	100	—	—1½—10	15/-
Dario	BK22	Octode	2.0	0.14	135	45	135	250	0	12/6
	*TK24	Octode	4.0	0.65	250	70	70	600	—1½	14/-
	*TB5013	Octode	13.0	0.2	200	70	70	600	—1½	14/-
Ever Ready.	K80A	Octode	2.0	0.125	150	70	70	240	0	14/-
	*A80A	Octode	4.0	0.65	250	90	90	600	—1½	15/-
	*A36A	Hexode	4.0	1.0	250	70	—	—	—1½—4½	15/-
	*C80B	Octode	13.0	0.2	200	90	—	—	—1½	15/-
Ferranti	VHT2A	Heptode	2.0	0.1	150	70	10.0	300	—0.3	14/-
	*VHT4	Heptode	4.0	1.0	250	100	15.0	700	—0.3	15/-
	*VHTA	Heptode	13.0	0.2	250	100	15.0	700	—0.3	15/-
	*VHT8	Heptode	13.0	0.3	250	100	15.0	700	—0.3	15/-
Hivac	TP230	Triode Pentode	2.0	0.3	150	70	150	325	0—12	14/-
Impex	1A6	Pentagrid	2.0	0.06	180	67.5	135	300	—3	11/-
	1C6	Pentagrid	2.0	0.12	180	67.5	135	325	—3	11/6
	*2A7	Pentagrid	2.5	0.8	250	100	200	520	—3	11/-
	*6A7	Pentagrid	6.3	0.3	250	100	200	520	—3	11/-
	*6A8	Pentagrid (Metal).	6.3	0.3	250	100	250	500	—3	12/6
	*6F7	Triode Pentode	6.3	0.3	250	100	—	300	—10	11/6
(Metal)	*6L7	Pentagrid	6.3	0.3	250	150	—	—	—6	13/6
Marconi	X21	Heptode	2.0	0.1	150	40	40	200	0—9	14/-
	*X41	Triode Hexode	4.0	1.2	250	70	150	640	—1½—40	15/-
	*X42	Heptode	4.0	0.6	250	100	150	490	—3—45	15/-
	*MX40	Heptode	4.0	1.0	250	80	150	500	—3—40	15/-
	*X31	Triode Hexode	13.0	0.3	250	70	150	640	—1½—40	15/-
	*X30	Heptode	13.0	0.3	250	80	150	800	—3—37	15/-
	*X32	Heptode	13.0	0.3	250	80	150	800	—3—37	15/-
Mazda	TP22	Triode Pentode	2.0	0.25	150	150	150	500	—1½—20	14/-
	*AC/TP	Triode Pentode	4.0	1.25	250	250	200	700	—5—40	15/-
	*AC/THI	Triode Hexode	4.0	1.3	250	250	250	750	—3	15/-
	*TP1340	Triode Pentode	13.0	0.4	250	250	200	700	—5—40	15/-
	*TP2620	Triode Pentode	26.0	0.2	250	250	200	650	—5—40	15/-
	*TH2620	Triode Hexode	26.0	0.2	250	250	250	750	—3	15/-
Mullard	FC2	Octode	2.0	0.125	150	70	150	240	0	14/-
	*TH4	Triode Hexode	4.0	1.0	250	70	150	1,000	—1.5	15/-
	*FC4	Octode	4.0	0.65	250	90	90	600	—1.5	15/-
(SC Base)	*FC13	Octode	13.0	0.2	200	90	90	600	—1.5	20/-
	*TH13C	Triode Hexode	13.0	0.31	250	90	150	1,000	—1.5	15/-
	*TH21C	Triode Hexode	21.0	0.2	250	90	150	1,000	—1.5	15/-
	*FC13C	Octode	13.0	0.2	250	90	90	600	—1.5	15/-
Osram	X21	Heptode	2.0	0.1	150	70	90	240	0—9	14/-
	*MX40	Heptode	4.0	1.0	250	100	150	500	—3	15/-
	*X41	Triode Hexode	4.0	1.2	250	80	150	640	—1½	15/-
	*X42	Heptode	4.0	0.6	250	100	200	490	—3	15/-
	*X30	Heptode	13.0	0.3	250	100	150	750	—3	15/-

Classified Valve Chart

The following abbreviations are used: The sign * indicates indirectly heated A.C. valves; ** indicates directly heated A.C. valves; ° indicates A.C.-D.C. valves; and † indicates D.C. valves. In the screen grid and H.F. pentode section the application of the valve is indicated in the column following the type number, S indicating screen grid; V.S. variable-mu screen grid; P, H.F. pentode; and V.P. variable-mu H.F. pentode. Elsewhere, V means variable.

This chart deals with all ordinary reception valves. Data of valve and metal rectifiers, Westectors, barretters, gas-filled relays, cathode-ray tubes and tuning indicators will be found on pages 112–116.

Maker.	Type.	Circuit.	Fil. volts.	Fil. amps.	Anode volts.	Screen volts.	Oscillator volts.	Conv. cdt. m'hos.	Grid bias.	Price.
Osram ..	*X32	Heptode ..	13.0	0.3	250	100	150	750	—3	15/-
	*X31	Triode Hexode..	13.0	0.3	250	80	150	640	—1½	15/-
Ostar-Ganz	*G5	Pentagrid ..	250.0	0.02	250	60	150	600	—1.4—30	17/6
Philco ..	1A6	Heptode ..	2.0	0.06	180	67.5	135	300	—3—22½	14/-
	1C6	Heptode ..	2.0	0.12	180	67.5	135	325	—3—14	14/-
	*2A7	Heptode ..	2.5	0.8	250	100	200	520	—3—45	15/-
	*6A7	Heptode ..	6.3	0.3	250	100	200	500	—3—45	15/-
	*6F7	Triode Pentode	6.3	0.3	T.100	—	—	—	—	13/6
					P.250	100	—	300	—3—40	
	*6C6	Triode Pentode	6.3	0.3	T.250	100	—	—	—3—7	12/-
					P.250	—	—	—	—3	
T. as triode. P. as Pentode.										
Triotron ..	O202	Octode	2.0	0.14	135	45	135	250	0	11/6
	*O406	Octode	4.0	0.65	250	70	70	600	—1½	12/-
	*O1307 ..	Octode	13.0	0.2	200	70	70	600	—1½	12/-
Tungsram	VO2	Octode	2.0	0.13	135	90	135	270	—1—25	14/-
	*TX4	Triode Hexode..	4.0	1.0	250	70	150	1,000	—1½—25	15/-
	*VO4	Octode	4.0	0.65	250	70	90	700	—1½—25	15/-
	*VO6	Octode	6.3	0.2	250	60	200	450	—2—25	18/-
	*TX21	Triode Hexode..	21.0	0.2	250	80	150	1,000	—1½—25	15/-
	*VO13	Octode	13.0	0.2	250	70	90	600	—1½—25	15/-
	*2A7	Heptode ..	2.5	0.8	250	100	250	500	—1.4—45	14/-
	*6A7	Heptode ..	6.3	0.3	250	100	250	500	—1.4—45	14/-
362.. ..	*ACFC4 ..	Heptode ..	4.0	1.0	250	80	150	—	0—10	15/-

SCREEN GRIDS AND H.F. PENTODES

Maker.	Type.	Description.	Fil. volts.	Fil. amps.	Anode volts.	Screen volts.	Grid bias.	Anode current.	Screen current	Bias res. ohms.	Slope mA/v.	Price.
Brimar ..	*8A1 ..	P ..	4.0	1.0	250	100	—1½	3.5	—	200	4.0	12/6
	*9A1 ..	VP ..	4.0	1.0	250	100	—1½—40	5.0	—	V	4.25	12/6
	*9D2 ..	VP ..	13.0	0.2	250	125	—3—40	10.0	3.5	V	1.65	12/6
Cossor ..	2158G ..	S ..	2.0	0.15	150	80	0	2.4	0.7	—	1.1	11/-
	2208G ..	S ..	2.0	0.2	150	80	0	3.1	0.7	—	1.6	11/-
	220VSG ..	VS ..	2.0	0.2	150	80	0—15	2.6	—	V	1.6	11/-
	220VS ..	VS ..	2.0	0.2	150	80	0—9	1.6	—	V	1.6	11/-
	210SPT ..	P ..	2.0	0.1	150	80	0	3.0	—	—	1.3	11/-
	210VPT ..	VP ..	2.0	0.1	150	80	0—9	2.9	0.75	V	1.1	11/-
	*41MSG ..	S ..	4.0	1.0	200	80	—1½	0.8	—	1,500	2.5	17/6
	*MSG/HA ..	S ..	4.0	1.0	200	100	—1½	2.1	—	600	2.0	12/6
	*MSG/LA ..	S ..	4.0	1.0	200	100	—1½	5.2	—	250	3.75	12/6
	*MVSG ..	VS ..	4.0	1.0	200	100	—1½—35	7.8	0.75	V	2.5	12/6
	*MS/Pen. ..	P ..	4.0	1.0	200	100	—	4.5	1.3	—	3.5	12/6
	*MS/Pen.A..	P ..	4.0	1.0	200	150	—	9.0	5.0	200	4.0	17/6
	*MVS/Pen..	VP ..	4.0	1.0	200	100	0—20	4.2	1.3	V	3.0	12/6
	*DVSG ..	VS ..	16.0	0.25	200	100	—1½—35	7.5	—	V	2.5	17/6
	*13SPA ..	P ..	13.0	0.2	200	100	—	5.0	1.3	—	2.5	12/6
	*13VPA ..	VP ..	13.0	0.2	200	100	0—30	9.0	2.2	V	1.8	12/6
	*DS/Pen. ..	P ..	16.0	0.25	200	100	—	—	—	—	3.0	17/6
	*DVS/Pen.	VP ..	16.0	0.25	200	100	0—20	—	—	V	3.0	17/6
Dario ..	TB622 ..	S ..	2.0	0.18	150	90	—½	2.0	0.5	—	1.4	9/6
	TB452 ..	VS ..	2.0	0.15	150	75	0—9	2.0	0.4	—	1.5	9/6

(Continued on next page)

VALVE DATA CHART

Screen Grids and H.F. Pentodes—continued

Maker.	Type.	Description.	Fil. volts.	Fil. amps.	Anode volts.	Screen volts.	Grid bias.	Anode current.	Screen current.	Bias res. ohms.	Slope mA/v.	Price.
Dario ..	PF462	P ..	2.0	0.18	150	150	—¼	3.0	1.0	—	1.85	10/-
	PF472	VP	2.0	0.18	150	150	—¼—16	2.5	0.5	—	1.7	10/-
	*TE424	S ..	4.0	1.0	200	100	—1.3	1.5	0.5	650	0.9	11/6
	*TE524	S ..	4.0	1.0	200	100	—2	3.0	1.0	500	2.0	11/6
	*TE554	VS	4.0	1.0	200	100	—1½—40	3.0	1.0	V	3.0	11/6
	*TE464	P ..	4.0	1.1	200	100	—2	3.0	1.5	450	3.5	11/6
	*TE474	VP	4.0	1.1	200	100	—1½—30	4.5	2.0	V	3.5	11/6
	*TF713	P ..	13.0	0.2	200	100	—2	3.0	1.0	500	2.4	11/6
	*TF313	VP	13.0	0.2	200	100	—3—50	4.5	1.0	V	2.8	11/6
Ever Ready	K40B	S ..	2.0	0.18	150	90	0	2.9	—	—	1.5	11/-
	K40N	VS	2.0	0.18	150	90	0—7	2.5	—	—	1.4	11/-
	K50M	VP	2.0	0.18	150	150	0—7	3.75	—	—	1.75	11/-
	*A40M	VS	4.0	1.0	200	110	—1½—40	6.0	—	V	2.5	12/6
	*A50A	P ..	4.0	1.0	200	100	—1½	4.5	—	—	3.0	12/6
	*A50B	P ..	4.0	0.65	250	250	—2	4.5	—	—	4.0	12/6
	*A50M	VP	4.0	1.0	200	100	—1½—22	6.0	—	V	2.5	12/6
	*A50N	VP	4.0	1.2	200	100	—1½	5.0	—	V	3.27	12/6
	*A50P	VP	4.0	0.65	250	250	—3	12.0	—	V	3.5	12/6
	*C50B	P ..	13.0	0.2	200	200	—1½	2.5	—	—	3.5	12/6
	*C50N	VP	13.0	0.2	200	200	—2	9.0	—	V	3.0	12/6
Ferranti	*SPT4A	P ..	4.0	1.0	250	100	0.002	2.0	1.0	—	2.3	12/6
	*VPT4B	VP	4.0	1.0	250	100	0.002	6.0	3.0	V	3.2	12/6
	*VPT4	VP	4.0	1.0	250	100	0.002	5.5	2.0	V	2.0	12/6
	*VPTA	VP	13.0	0.2	250	100	0.002	4.2	2.0	V	2.0	12/6
	*VPTS	VP	13.0	0.3	250	100	0.002	5.5	2.0	—	2.0	12/6
Hivac ..	XSG	S ..	2.0	0.066	120	60	0	2.2	0.5	—	0.75	15/6
	SG215	S ..	2.0	0.15	150	75	—1½	2.7	0.8	—	1.0	9/6
	SG220	S ..	2.0	0.2	150	70	—1½	2.4	0.9	—	1.5	12/6
	SG220SW	S ..	2.0	0.2	150	70	—1½	2.4	0.9	—	1.5	12/6
	VS215	VS	2.0	0.15	150	75	0—14	6.0	1.7	—	1.0	9/6
	HP215	P ..	2.0	0.15	150	70	—1½	1.5	0.3	—	1.2	9/6
	VP215	VP	2.0	0.15	150	70	0—9	3.75	0.75	—	1.25	9/6
	*AC/SL	S ..	4.0	1.0	200	80	—1	3.8	0.4	250	3.3	10/6
	*AC/SH	S ..	4.0	1.0	200	80	—1½	7.4	0.5	200	3.5	10/6
	*AC/VS	VS	4.0	1.0	200	80	—1½—40	4.4	0.6	V	3.0	10/6
	*AC/VH	VS	4.0	1.0	200	80	—1½—40	9.3	1.6	V	3.3	10/6
	*AC/HP	P ..	4.0	1.0	200	100	—2	4.2	1.4	350	3.2	10/6
	*AC/VP	VP	4.0	1.0	200	100	—1½—30	5.7	2.3	V	3.0	10/6
	*VP13	VP	13.0	0.3	200	100	—1½—30	6.3	2.0	V	3.0	10/6
Impex ..	32 ..	S ..	2.0	0.06	180	67.5	—3	1.7	0.4	—	0.65	11/-
	34 ..	P ..	2.0	0.06	180	67.5	—3	2.8	1.0	—	0.62	11/-
	*24A ..	S ..	2.5	1.75	250	90	—3	4.0	1.7	—	1.05	8/6
	*35 ..	VS	2.5	1.75	250	90	—3	6.5	2.5	V	1.05	8/6
	*57 ..	P ..	2.5	1.0	250	100	—3	2.0	0.5	—	1.225	8/6
	*58 ..	VP	2.5	1.0	250	100	—3	8.2	2.0	V	1.6	8/6
	*36 ..	S ..	6.3	0.3	250	90	—3	3.2	1.7	—	1.08	8/6
	*77 ..	P ..	6.3	0.3	250	100	—3	2.3	0.5	—	1.25	9/6
	*6C6	P ..	6.3	0.3	250	100	—3	2.0	0.5	—	1.225	9/6
(Metal)	*6J7 ..	P ..	6.3	0.3	250	100	—3	2.0	0.5	—	1.225	11/6
	*39/44	VP	6.3	0.3	250	90	—3	5.8	1.4	V	1.05	8/6
	*78 ..	VP	6.3	0.3	250	125	—3	10.5	2.5	V	1.55	9/6
	*6D6	VP	6.3	0.3	250	100	—3	8.2	2.0	V	1.6	8/6
(Metal)	*6K7	VP	6.3	0.3	250	100	—3	7.0	1.7	V	1.45	10/6
Lissen ..	SG215	S ..	2.0	0.15	150	80	—	—	—	—	1.1	11/-
	SG2V	VS	2.0	0.15	150	80	—	—	—	—	1.2	11/-
	SG410	S ..	4.0	0.1	150	80	—	—	—	—	1.25	20/-
	*AC/SG	S ..	4.0	1.0	200	80	—	—	—	—	3.25	12/6
	*AC/SGV	VS	4.0	1.0	200	80	—	—	—	—	3.5	12/6
Marconi..	S23	S ..	2.0	0.1	150	70	—1½	2.8	0.7	—	1.1	11/-
	S24	S ..	2.0	0.15	150	70	—1½	3.3	0.7	—	1.4	11/-
	VS24	VS	2.0	0.15	150	75	0—9	4.4	0.3	V	1.5	11/-
	VS24K	VS	2.0	0.15	150	75	0—9	4.4	0.3	V	1.5	12/6
	VS2	VS	2.0	0.15	150	75	0—15	5.0	2.0	V	1.25	11/-
	VP21	VP	2.0	0.1	150	60	0—9	2.9	0.7	V	1.1	11/-
	*MS4	S ..	4.0	1.0	200	70	—1½	2.4	0.3	550	1.1	12/6
	*MS4B	S ..	4.0	1.0	200	80	—2	3.4	1.2	250	3.2	12/6
	*VMS4	VS	4.0	1.0	200	80	—2—30	7.5	2.0	V	2.6	12/6
	*VMS4/B	VS	4.0	1.0	200	80	—1—15	5.0	1.2	V	2.9	12/6
	*MSP4	P ..	4.0	1.0	200	100	—2	4.0	1.0	400	4.0	12/6
	*MSP41	P ..	4.0	1.0	200	240	—4	9.0	3.2	350	3.2	15/-
	*VMP4G	VP	4.0	1.0	250	100	—2—25	8.2	5.0	V	2.7	12/6
	*VMP4/K	VP	4.0	1.0	250	100	—1—25	7.0	4.3	V	2.5	17/6
	*VMP4	VP	4.0	1.0	200	100	—1—20	5.5	1.5	V	3.5	17/6
	*W42	VP	4.0	0.6	250	125	—3—40	7.5	2.0	V	1.5	12/6
	*W30	VP	13.0	0.3	250	250	—1—35	12.0	6.0	V	4.0	12/6
	*W31	VP	13.0	0.3	200	100	—2—20	5.0	5.0	V	3.5	12/6
	†DS	S ..	16.0	0.25	200	70	—1½	2.4	0.3	600	1.1	17/6
	†DSB	S ..	16.0	0.25	200	80	—1	3.4	1.2	220	3.2	17/6
	†VDS	VS	16.0	0.25	200	80	—1—30	11.0	1.2	V	2.4	17/6
	†VDSB	VS	16.0	0.25	200	80	—1—35	5.5	0.6	V	3.0	17/6
Mazda ..	SG215	S ..	2.0	0.15	150	80	—1½	1.5	0.25	—	1.1	11/-
	S215A	S ..	2.0	0.15	150	80	—	1.9	0.3	—	1.1	11/-
	S215B	S ..	2.0	0.15	150	80	—1½	1.5	0.3	—	1.7	11/-
	S215VM	VS	2.0	0.15	150	80	0—8	1.0	0.15	—	1.4	11/-

VALVE DATA CHART

Maker.	Type.	Description.	Fil. volts.	Fil. amps.	Anode volts.	Screen volts.	Grid bias.	Anode current.	Screen current.	Bias res. ohms.	Slope mA/v.	Price.
Mazda ..	SP210	P ..	2.0	0.1	120	120	—1	1.1	0.33	—	1.2	11/-
	SP215	P ..	2.0	0.15	150	80	—1½	2.1	0.7	—	1.6	11/-
	VP210	VP ..	2.0	0.1	120	70	—1½—15	1.8	0.63	—	1.4	11/-
	VP215	VP ..	2.0	0.15	150	80	—1½—15	2.5	0.8	—	1.8	11/-
	*AC/SG	S ..	4.0	1.0	200	60	—1½	4.5	0.8	300	1.9	12/6
	*AC/S2	S ..	4.0	1.0	200	80	—1½	7.0	0.8	170	5.0	12/6
	*AC/S1VM	VS	4.0	1.0	200	100	—1½—40	5.7	1.0	V	1.1	17/6
	*AC/S2VM	VS	4.0	1.0	200	80	—2—35	5.8	0.9	V	2.0	12/6
	*AC/S2Pen	P ..	4.0	1.0	250	100	—2	6.5	2.2	250	5.5	12/6
	*AC/SP1	P ..	4.0	1.0	250	200	—3	4.9	4.1	300	3.0	12/6
	*AC/VP1	VP ..	4.0	0.65	250	250	—4—43	8.8	2.2	V	3.0	12/6
	*AC/VP2	VP ..	4.0	0.65	250	250	—4—43	8.8	2.2	V	3.0	12/6
	*SP1320	P ..	13.0	0.2	250	100	—1½	4.5	0.9	300	2.5	12/6
	*VP1320	VP ..	13.0	0.2	250	100	—1.7—23	5.0	1.25	V	2.0	12/6
	*VP1321	VP ..	13.0	0.2	250	250	—4—43	8.8	2.2	V	3.0	12/6
	*VP1322	VP ..	13.0	0.2	250	250	—4—43	8.8	2.2	V	3.0	12/6
	°SP2220	P ..	20.0	0.2	250	200	—3	4.9	4.1	300	3.0	12/6
	†DC2/SG	S ..	20.0	0.1	200	100	—1½	5.5	1.5	170	1.8	17/6
	†DC2/SGV	VS	20.0	0.1	200	100	—1—30	5.8	0.9	V	1.5	17/6
Mullard..	PM12A	S ..	2.0	0.18	150	90	0	2.9	0.5	—	1.5	11/-
	PM12	S ..	2.0	0.15	150	75	—	4.25	—	—	1.1	11/-
	PM12M	VS	2.0	0.18	150	90	0—7	2.5	0.5	—	1.4	11/-
	PM12V	VS	2.0	0.15	150	90	0	5.4	—	—	0.75	15/6
	SP2	P ..	2.0	0.18	150	150	0	3.6	1.0	—	2.2	11/-
	VP2	VP ..	2.0	0.18	150	150	0—7	3.75	0.5	—	1.75	11/-
	*S4V	S ..	4.0	1.0	200	75	—1	1.5	—	—	1.1	17/6
	*S4VA	S ..	4.0	1.0	200	110	—1½	2.75	0.7	500	2.0	12/6
	*S4VB	S ..	4.0	1.0	200	110	—1½	5.0	1.5	300	2.5	12/6
	*MM4V	VS	4.0	1.0	200	110	1½—40	6.0	2.0	V	2.5	12/6
	*VM4V	VS	4.0	1.0	200	100	1½—40	8.5	—	V	1.2	17/6
	*TSP4	P ..	4.0	1.3	250	250	—2.5	8.0	1.5	260	7.1	17/6
	*SP4	P ..	4.0	1.0	200	100	—1½	4.5	1.0	350	3.0	12/6
	*SP4B	P ..	4.0	0.65	250	250	—2	4.5	1.6	330	4.0	12/6
	*VP4	VP ..	4.0	1.0	200	100	1½—22	6.0	1.5	V	2.5	12/6
	*VP4A	VP ..	4.0	1.2	200	100	—1½	5.0	1.5	V	3.27	12/6
	*VP4B	VP ..	4.0	0.65	250	250	—3	12.0	4.3	V	3.5	12/6
(Acorn)	*AP4	P ..	4.0	0.25	250	100	— 3	2.0	0.7	—	2.6	60/-
	*SP13C	P ..	13.0	0.2	200	200	—1½	2.5	1.5	375	3.5	12/6
	°VP13C	VP ..	13.0	0.2	200	200	—2	9.0	3.5	V	3.0	12/6
SC Base	°SP13	P ..	13.0	0.2	200	100	—2	3.5	1.0	400	2.2	17/6
SC Base	°VP13A	VP ..	13.0	0.2	200	100	—2	3.5	1.0	V	2.2	17/6
	†PM13	S ..	4.0	0.1	200	100	0	4.0	—	—	0.7	20/-
	†8G20	S ..	20.0	0.18	200	100	—1½	3.0	—	—	2.0	17/6
	†8P20	P ..	20.0	0.18	200	100	—1½	4.5	1.0	250	2.7	17/6
	†VP20	VP ..	20.0	0.18	200	100	—1½	4.5	1.0	—	2.5	17/6
Osram ..	S23	S ..	2.0	0.1	150	70	—1½	1.3	0.6	—	1.1	11/-
	S24	S ..	2.0	0.15	150	70	—1½	1.4	0.8	—	1.4	11/-
	VS24	VS	2.0	0.1	150	75	0—9	4.5	0.5	—	1.5	11/-
	VP21	VP	2.0	0.1	150	60	0—9	2.8	0.7	—	1.1	11/-
	*MS4	S ..	4.0	1.0	200	70	—1½	2.4	0.3	550	1.1	12/6
	*MS4B	S ..	4.0	1.0	200	80	—1	3.4	1.2	250	3.2	12/6
	*VMS4	VS	4.0	1.0	300	80	—1—40	12.0	2.1	V	2.4	12/6
	*VMS4B	VS	4.0	1.0	300	80	—1—15	6.7	1.3	V	2.9	12/6
	*MSP4	P ..	4.0	1.0	250	100	—1.75	3.0	1.0	400	4.0.	12/6
	*MSP41	P ..	4.0	1.0	250	240	—4	8.5	3.5	—	3.2	15/-
	*VMP4G	VP ..	4.0	1.0	250	100	—2—20	8.0	5.0	V	4.0	12/6
	*W42	VP ..	4.0	0.6	250	125	—3—40	7.5	1.9	V	1.7	12/6
	°W30	VP ..	13.0	0.3	250	250	—1	12.3	6.0	V	4.0	12/6
	°W31	VP ..	13.0	0.3	200	100	—2½	8.1	5.0	V	2.78	12/6
Ostar-Ganz	°S25	S ..	250.0	0.24	250	100	—2	7.0	—	200	3.8	15/6
	°S100	S ..	250.0	0.24	250	100	—1	1.0	—	600	4.0	15/6
	°MS18	VS	250.0	0.24	250	100	—2	5.0	—	V	3.0	15/6
	°MS70	VS	250.0	0.24	250	100	—2—40	4.0	—	V	3.0	15/6
	°H3 ..	P ..	250.0	0.24	250	200	—2	1.5	0.6	700	3.5	15/9
	°V3 ..	VP ..	250.0	0.24	250	200	—2	3.5	1.5	V	3.0	15/9
Philco ..	32E	S ..	2.0	0.06	180	67.5	—3	1.7	0.4	—	0.65	11/-
	15E	P ..	2.0	0.24	135	67.5	—1½	1.85	0.6	—	0.6	13/-
	SP21	P ..	2.0	0.1	120	120	—1	1.1	0.33	—	1.2	11/-
	1A4	VP ..	2.0	0.06	180	67.5	—3—18	2.3	0.7	—	0.75	11/-
	34E	VP ..	2.0	0.06	180	67.5	—3—23	2.8	1.0	—	0.62	11/-
	VP21	VP ..	2.0	0.1	120	70	—1½	0.89	0.63	—	1.03	11/-
	*24E	S ..	2.5	1.75	250	90	—3—9	4.0	1.7	V	1.05	12/-
	*35E	VS	2.5	1.75	250	90	—3—40	6.5	2.5	V	1.05	11/-
	°36E	S ..	6.3	0.3	250	90	—3	3.2	1.7	V	1.1	12/6
	°77E	P ..	6.3	0.3	250	100	—3	2.3	0.5	—	1.25	12/6
	°78E	VP ..	6.3	0.3	250	125	—3—52½	10.5	2.6	V	1.65	12/6
	°39/44E	VP ..	6.3	0.3	250	90	—3—42½	5.8	1.4	V	1.05	12/6
	†14E	S ..	14.0	0.3	250	90	—3—9	4.0	1.7	V	1.05	13/6
Pix ..	25 ..	S ..	2.0	0.15	150	75	—1½	2.5	0.5	—	1.0	8/6
	°450/AC	S ..	4.0	1.0	200	100	—3	3.5	0.8	700	3.0	10/6
Triotron	S207	S ..	2.0	0.15	200	100	—1	3.0	0.5	—	1.0	9/6
	S215	S ..	2.0	0.18	150	90	—1	2.8	0.25	—	1.5	8/6
	S208	VS	2.0	0.15	200	100	0—20	5.0	0.5	—	0.8	9/6
	S213	VS	2.0	0.18	150	90	—½—12	3.0	0.5	—	1.2	8/6
	S218	P ..	2.0	0.18	150	150	—½	3.0	1.0	—	1.85	8/6

VALVE DATA CHART

Screen Grids and H.F. Pentodes—continued

Maker.	Type.	Description.	Fil. volts.	Fil. amps.	Anode volts.	Screen volts.	Grid bias.	Anode current.	Screen current.	Bias res. ohms.	Slope mA/v.	Price.
Triotron	S217	VP	2.0	0.18	150	150	—¼—16	2.5	0.5	—	1.7	8/6
	S408	S ..	4.0	0.06	200	100	—1	4.0	0.35	—	0.8	10/6
	*S410N	S ..	4.0	1.0	200	60	—2	4.0	1.0	400	1.0	10/-
	*S430N	S ..	4.0	1.0	200	100	—2	3.0	1.0	500	3.0	10/-
	*S415N	VS	4.0	1.0	200	100	—2—40	6.0	1.0	V	1.5	10/-
	*S431N	VS	4.0	1.0	200	70	—2—30	3.5	1.0	V	3.0	10/-
	*S435N	P ..	4.0	1.1	200	100	—2	5.0	1.0	300	3.5	10/-
	*S434N	VP	4.0	1.1	200	100	—2—35	5.5	1.0	V	3.5	10/-
	*S1328	P	13.0	0.2	200	100	—2	3.0	1.0	500	2.8	10/-
	*S1324	P ..	13.0	0.2	200	200	—2	3.0	1.0	500	2.4	10/-
	*S1323	VP	13.0	0.2	200	100	—3—50	4.5	1.0	V	2.8	10/-
	*S2035N	P ..	20.0	0.18	200	100	—2	5.0	2.0	250	3.5	10/-
	*S2034N	VP	20.0	0.18	200	100	—2—35	5.0	2.0	V	3.4	10/-
Tungsram	S8210	S ..	2.0	0.12	150	75	—.9	1.5	0.3	—	1.4	10/-
	SE211	VS	2.0	0.12	150	75	0—5	1.0	0.1	—	1.5	10/-
	SP2B	P ..	2.0	0.05	135	135	—½	1.2	0.4	—	1.2	11/-
	HP210	P ..	2.0	0.12	150	150	—1½	1.9	0.7	—	1.9	11/-
	VP2B	VP	2.0	0.05	135	135	0—15	1.0	0.3	—	0.65	11/-
	HP211	VP	2.0	0.12	150	150	0—17	2.6	0.6	—	1.7	11/-
	*AS4120	S ..	4.0	1.0	200	100	—2	3.0	0.8	500	3.0	12/6
	*AS4125	VS	4.0	1.2	200	100	—1½—40	3.0	0.8	V	3.0	12/6
	*HP4101	P ..	4.0	1.0	250	100	—3	3.5	1.8	600	3.5	12/6
	*SP4b	P ..	4.0	0.65	250	250	—3	3.2	1.5	500	4.0	12/6
	*HP4115	VP	4.0	1.1	250	100	—1½—12	4.3	1.5	V	3.4	12/6
	*VP4b	VP	4.0	0.65	250	250	—1—50	10.0	2.5	V	4.0	12/6
	*HP4106	VP	4.0	1.0	250	100	—1½—35	5.0	1.3	V	3.5	12/6
	*SP6	VP	6.3	0.2	250	100	—2	3.0	1.0	V	2.0	15/-
	*VP6	VP	6.3	0.2	250	100	—3	8.0	2.5	V	1.7	15/-
	*SP13	SP ..	13.0	0.2	250	100	—2	3.0	1.2	600	2.4	12/6
	*SP13B	SP ..	13.0	0.2	200	200	—5	2.0	1.0	—	4.0	12/6
	*HP13	VP	13.0	0.2	250	100	—3—20	8.0	2.7	200	2.8	12/6
	*VP13	VP	13.0	0.2	250	100	—3—50	8.0	2.7	V	2.8	12/6
	*VP13B	VP	13.0	0.2	200	200	—1½—50	6.0	2.0	V	4.0	12/6
	*24A	S ..	2.5	1.75	250	90	—3	4.0	1.7	300	1.0	11/-
	*35 ..	VS	2.5	1.75	250	90	—3—52	6.5	2.5	V	1.05	10/-
	*51 ..	VS	2.5	1.75	250	90	—3—52	6.5	2.5	V	1.05	12/-
	*57 ..	P ..	2.5	1.0	250	100	—7	2.3	0.5	—	1.25	12/-
	*58 ..	VP	2.5	1.0	250	100	—3—50	8.0	2.2	V	1.6	12/-
	*6C6	P ..	6.3	0.3	250	100	—7	2.0	0.5	300	1.2	12/-
	*77 ..	P ..	6.3	0.3	250	100	—1½	2.3	0.5	300	1.25	12/-
	*6D6	VP	6.3	0.3	250	100	—3—50	8.0	2.2	V	1.6	12/-
	*78 ..	VP	6.3	0.3	250	100	—3—50	8.0	2.2	V	1.6	12/-
362 ..	SG2	S ..	2.0	0.2	150	80	—3	1.5	0.3	—	1.5	7/6
	VS2	VS	2.0	0.2	150	80	0—20	5.0	1.0	—	1.2	7/6
	VP2	VP	2.0	0.2	150	80	0—9	4.0	0.8	—	1.2	9/-
	VP2C	VP	2.0	0.2	150	80	0—9	4.0	0.8	—	1.2	9/-
	*AC8G4	S ..	4.0	1.0	250	90	—3	6.0	1.2	500	2.5	10/6
	*ACVS4	VS	4.0	1.0	250	80	0—40	9.0	2.0	V	2.0	12/6
	*ACHM4	P ..	4.0	1.0	350	150	—8	15.0	3.0	500	2.5	13/-
	*ACVP4	VP	4.0	1.0	250	150	0—30	12.0	3.0	V	3.0	12/6

DIODE VALVES

Maker.	Type.	Description.	Fil. volts.	Fil. amps.	Max. diode volts.	Max. diode current.	Price.
Brimar	*10D1	DD	13.0	0.2	—	—	5/6
Cossor	220DD	DD	2.0	0.2	150	—	5/6
	*DD4	DD	4.0	0.75	—	—	5/6
Dario	*TB24	DD	4.0	0.65	200	0.8	4/6
Ever Ready ..	*A20B	DD	4.0	0.65	—	—	5/6
	*C20C	DD	13.0	0.2	—	—	5/6
Ferranti ..	*ZD	DD	7.0	0.2	60.0	1.0	5/6
	*SD	DD	5.0	0.3	60.0	1.0	5/6
Hivac	*AC/DD	DD	4.0	1.0	—	—	4/6
Impex	*6H6 .. .. (metal)	DD	6.3	0.3	100	4.0	10/-
Marconi	*D41	DD	4.0	0.3	—	—	5/6
	*D42	D	4.0	0.6	—	—	10/-
Mazda	*V914	DD	4.0	0.3	—	1.0	5/6
	*DD620	DD	6.0	0.2	—	1.0	5/6
Mullard ..	†2D2	DD	2.0	0.09	125	0.5	5/6
	*2D4A	DD	4.0	0.65	200	0.8	5/6
(Sc. Base) ..	°2D13A	DD	13.0	0.2	200	0.8	5/6
,,	°2D13	DD	13.0	0.2	200	0.8	5/6
	°2D13C	DD	13.0	0.2	200	0.8	5/6
Osram	*D41	DD	4.0	0.3	25	130 micro amps.	5/6
	*D42	D	4.0	0.6	75	15 m.A.	10/-
Ortas-Ganz ..	*B2	DD	250.0	0.024	200	15.0	9/6

VALVE DATA CHART

Maker.	Type.	Description.	Fil. volts.	Fil. amps.	Max. diode volts.	Max. diode current.	Price.
Triotron	*D400	DD	4.0	0.65	200	0.8	4/6
	*D1300	DD	13.0	0.2	200	0.8	4/6
Tungsram	*DD4..	DD	4.0	0.65	200	0.8	4/6
	*DD13	DD	13.0	0.2	200	0.8	4/6

‡ Indirectly heated battery valve.

DIODE COMBINATION VALVES

Maker.	Type.	Description.	Fil. volts.	Fil. amps.	Anode volts.	Screen volts.	Amp. factor.	Slope mA/v.	Grid bias.	Bias res. ohms.	Anode current.	Output m/w.	Price.
Brimar ..	*11A2	DDT ..	4.0	1.0	200	—	50	2.8	—2	—	3.0	—	12/6
	*11D3	DDT ..	13.0	0.2	250	—	100	1.2	—2	5,000	0.4	—	12/6
	*16D1	Coupled Double Triode.	13.0	0.4	300	—	54	—	—	—	40.0	5.000	22/6
Cossor ..	*DDT	DDT ..	4.0	1.0	200	—	41	2.4	—3	850	3.0	—	12/6
	*DD/Pen	DD Pen ..	4.0	1.0	250	200	—	2.7	-1-40	V	7.0	—	20/-
	*13DHA	DDT ..	13.0	0.2	250	—	125	1.5	—1.5	500	2.0	—	12/6
	*DDT16	DDT ..	16.0	0.25	200	—	40	2.5	—3	1,250	3.0	—	15/6
	*202DDT	DDT ..	20.0	0.2	200	—	41	2.4	—3	—	3.25	—	12/6
Dario ..	BBC2	DDT ..	2.0	0.1	135	—	16	1.5	—4½	—	2.5	—	6/6
	*TE444	Diode Tetrode.	4.0	1.1	200	33	—	0.3	—2½	800	3.0	—	13/6
	*TBC14	DDT ..	4.0	0.65	250	—	27	3.6	—7	1,500	4.0	—	11/-
	*TBC113	DDT ..	13.0	0.2	200	—	27	3.6	—5	1,000	4.0	—	11/-
Ever Ready	K23A	DDT ..	2.0	0.1	150	—	16.5	1.4	—5½	—	2.5	—	9/-
	K23B	DDT ..	2.0	0.12	150	—	30.0	1.4	—3	—	1.4	—	9/-
	*A23A	DDT ..	4.0	0.65	200	—	30.0	2.9	—3½	—	7.0	—	12/6
Ferranti ..	*H4D	DDT ..	4.0	1.0	200	—	39	2.3	2.0	500	4.0	—	12/6
	*PT4D	DD LF Pen	4.0	2.0	250	250	—	—	0.7	140	32.5	3,500	16/-
	*HAD	DDT ..	13.0	0.2	200	—	51	2.0	2.5	800	3.3	—	12/6
	*H8D	DDT ..	13.0	0.3	200	—	37	2.3	2.0	500	4.6	—	12/6
Hivac ..	DDT 220	DDT ..	2.0	0.2	150	—	20	1.6	—3	—	3.0	—	7/-
	*AC/DDT	DDT ..	4.0	1.0	200	—	35	2.3	—4	800	5.0	—	10/6
	*AC/ZDD	DD Tetrode	4.0	2.0	250	250	—	8.0	—5½	160	32.0	3,000	14/-
	*DDT13	DDT ..	13.0	0.3	200	—	35	2.3	—4	800	5.0	—	10/6
Impex ..	*2A6	DDT ..	2.5	0.8	250	—	100	1.1	—2	—	0.8	—	9/6
	*2B7	DD Pen ..	2.5	0.8	250	50	—	—	—4.5	—	0.65	—	11/-
	*55	DDT ..	2.5	1.0	250	—	8.3	1.1	—20.0	—	8.0	—	9/-
	*75	DDT ..	6.3	0.3	250	—	100	1.1	—2.0	—	0.8	—	9/6
	*85	DDT ..	6.3	0.3	250	—	8.3	1.1	—20.0	—	8.0	—	9/6
(Metal)	*6Q7	DDT ..	6.3	0.3	250	—	70	1.2	—3.0	—	1.1	—	13/6
(Metal)	*6R7	DDT ..	6.3	0.3	250	—	16	1.9	—9.0	—	9.5	—	13/6
	*6B7	DD Pen ..	6.3	0.3	250	50	—	—	—4.5	—	0.65	—	11/-
Lissen ..	L2D	D Triode ..	2.0	0.1	150	—	18	1.5	—	—	—	—	9/-
	AVC2	D Pen ..	2.0	0.15	150	150	—	1.0	—	—	—	—	17/6
	*AC/AVC	D Pen ..	4.0	1.0	200	150	—	2.0	—	—	—	—	20/-
Marconi ..	HD21	DD ..	2.0	0.2	150	—	27	1.5	—3	—	1.8	—	9/-
	HD22	DD.. ..	2.0	0.2	150	—	27	1.5	—3	—	1.8	—	9/-
	*MHD4	DDT ..	4.0	1.0	200	—	40	2.2	—3	1,000	2.4	—	12/6
	*DH42	DDT ..	4.0	0.6	250	—	70	1.2	—3	2,000	1.5	—	12/6
	*DN41	DD LF Pen	4.0	2.3	250	250	—	10.0	—3½	90	32.0	3,500	16/-
	*WD40	DD VM HF Pen	4.0	1.0	250	100	—	3.5	-1-30	V	7.7	—	20/-
	*WD30	DD VM HF Pen	13.0	0.3	200	100	—	3.5	-1-30	V	7.7	—	20/-
	*DH30	DDT ..	13.0	0.3	200	—	80	4.5	—2	800	2.8	—	12/6
	†DHD	DDT ..	16.0	0.25	200	—	40	2.7	—3	800	3.0	—	15/6
Mazda ..	HL21/DD.. ..	DDT ..	2.0	0.15	150	—	32	1.5	—2	—	2.0	—	9/-
	L21/DD	DDT ..	2.0	0.15	150	—	18	1.8	—5	—	2.3	—	9/-
	*AC/HLDD	DDT ..	4.0	1.0	200	—	36	2.6	—3	700	4.3	—	12/6
	*AC/HLDDD	Triple DT	4.0	1.0	250	—	35	2.7	—3	700	4.9	—	16/6
	*AC2/Pen DD ..	DD Pen ..	4.0	2.0	250	250	—	8.0	—5.3	150	32.0	3,500	16/-
	*HLDD1320 ..	DDT ..	13.0	0.2	200	—	30	2.0	—3	700	4'3	—	12/6
	*Pen DD 1360 ..	DD Pen ..	13.0	0.6	250	250	—	8.0	—5.3	140	32.0	3,500	16/-
	*Pen DD4020 ..	DD Pen ..	40.0	0.2	250	250	—	7.0	-7.75	150	4.3	4,100	16/-
	†DC2HLDD ..	DDT ..	25.0	0.1	200	—	30	2.0	—3	700	3.75	—	15/6
Mullard ..	TDD2A	DDT ..	2.0	0.12	150	—	31.0	1.2	—1½—3	—	1.4	—	9/-
	TDD2	DDT ..	2.0	0.1	150	—	16.5	1.4	—5½	—	2.5	—	9/-
	*SD4	D Tetrode..	4.0	1.0	200	100	—	3.0	3.0	—	7.0	—	20/-
	*TDD4	DDT ..	4.0	0.65	200	—	30.0	2.9	—3½	500	7.0	—	12/6
	†SD20	D Tetrode..	20.0	0.18	200	100	—	3.0	—1½	—	5.0	—	20/-
	†TDD25	DDT ..	25.0	0.18	200	—	30.0	2.0	—4	—	4.0	—	15/6
	*TDD13C	DDT ..	13.0	0.2	200	—	30.0	2.9	—3½	500	7.0	—	12/6
Osram ..	HD22	DDT ..	2.0	0.2	150	—	27	1.5	—3	—	1.8	—	9/-
	*MHD4	DDT ..	4.0	1.0	200	—	40	2.2	—3	1,000	3.0	—	12/6
	*DH42	DDT ..	4.0	0.6	250	—	70	1.2	—3	2,700	1.1	—	12/6
	*WD40	DD HF Pen	4.0	1.0	250	100	—	2.6	—1	100	7.7	—	20/-
	*DN41	DD LF Pen	4.0	2.3	250	250	—	10.0	—5	120	32.0	—	16/-
	*DH30	DDT ..	13.0	0.3	200	—	80	4.5	—1.7	800	3.8	—	12/6
	*WD30	DD HF Pen	13.0	0.3	250	100	—	2.6	—1	100	7.7	—	20/-

(Continued on next page)

VALVE DATA CHART

Diode Combination Valves—continued

Maker.	Type.	Description.	Fil. volts.	Fil. amps.	Anode volts.	Screen volts.	Amp. factor.	Slope mA/v.	Grid bias.	Bias res. ohms.	Anode current.	Output m/w.	Price.
Philco ..	2102 ..	DDT ..	2.0	0.06	135	—	—	—	—1½	—	—	—	13/-
	*55	DDT ..	2.5	1.0	250	—	8.3	1.1	—20	—	8.0	—	12/-
	*DD61 ..	DD LF Pen	6.3	0.3	250	250	—	8.0	—5.3	—	40.0	3,000	16/-
	*75	DDT ..	6.3	0.3	250	—	100	1.1	—2	—	0.8	—	12/6
	*85	DDT ..	6.3	0.3	250	—	8.3	1.1	—20	—	8.0	—	12/-
	*Pen 2530 ..	DD LF Pen	26.0	0.3	250	250	—	7.0	—7.75	—	43.0	3,000	16/-
Triotron ..	DT215 ..	DDT ..	2.0	0.1	135	—	16	1.5	—4½	—	2.5	—	6/6
	*DT436 ..	DDT ..	4.0	0.65	250	—	27	3.6	—7	1,500	4.0	—	10/-
	*B430N ..	Diode Tetrode	4.0	1.0	200	33	—	0.3	—2½	800	3.0	—	13/6
	*DT1336 ..	DDT ..	13.0	0.2	200	—	27	3.6	—5	1,000	4.0	—	10/-
	*B2030N ..	Diode-Tetrode	20.0	0.18	200	33	—	0.3	—2½	800	3.0	—	13/6
Tungsram	DDT2 ..	DDT ..	2.0	0.1	150	—	30	1.4	—3	—	1.4	—	7/-
	*DDT4 ..	DDT ..	4.0	0.65	250	—	40	3.6	—5	1,000	4.0	—	12/6
	*DDT6 ..	DDT ..	6.3	0.2	250	—	30	2.5	—5½	1,000	5.0	—	15/-
	*DDT13 ..	DDT ..	13.0	0.2	200	—	30	3.6	—5	1,000	4.0	—	12/6
	*2A6 ..	DDT ..	2.5	0.8	250	—	100	1.1	—2	2,500	0.8	—	12/-
	*75	DDT ..	6.3	0.3	250	—	100	1.1	—2	2,500	0.8	—	12/-
	*6B7 ..	DD Pen ..	6.3	0.3	250	125	1,120	1.2	-3-21	V	3.0	—	14/-
382 ..	*ACHL4dd ..	DDT ..	4.0	1.0	250	—	38	2.5	—3	400	7.0	—	9/-

GENERAL PURPOSE TRIODES

Maker.	Type.	Fil. volts.	Fil. amps.	Anode volts.	Amp. factor.	Impedance.	Slope mA/v.	Grid bias.	Anode current.	Bias resistance.	Price.
Brimar ..	4215A ..	1.0	0.25	45	—	25,000	0.4	—3	0.8	—	10/-
	*HLA2 ..	4.0	1.0	200	—	9,000	5.5	—2	8.0	400	9/6
	*4D1 ..	13.0	0.2	250	40	10,000	4.0	—3	5.0	800	9/6
Cossor ..	210RC ..	2.0	0.1	150	40	50,000	0.8	—1½	0.85	—	4/9
	210HL ..	2.0	0.1	150	24	22,000	1.1	—3	1.6	—	4/9
	210HF ..	2.0	0.1	150	24	15,800	1.5	—3	1.6	—	4/9
	210DET ..	2.0	0.1	150	15	13,000	1.15	—4½	3.0	—	4/9
	210LF ..	2.0	0.1	150	14	10,000	1.4	—4½	4.8	—	4/9
	*41MH ..	4.0	1.0	200	72	18,000	4.0	—1½	3.2	—	9/6
	*41MRC ..	4.0	1.0	200	50	19,000	2.6	—2	2.7	750	14/-
	*41MHF ..	4.0	1.0	200	41	14,500	2.8	—3	3.0	1,000	14/-
	*41MHL ..	4.0	1.0	200	52	11,500	4.5	—3	4.0	750	9/6
	*41MLF ..	4.0	1.0	150	15	7,900	1.9	—5½	9.0	600	14/-
	*DHL ..	16.0	0.25	200	58	13,000	4.5	—2	5.0	400	13/6
Dario ..	TB282 ..	2.0	0.1	150	28	22,000	1.3	—3	2.0	—	3/6
	TB172 ..	2.0	0.1	150	17	13,000	1.4	—4½	4.0	—	3/6
	TB102 ..	2.0	0.1	150	10	8,000	1.25	—6	5.0	—	3/6
	*TE994 ..	4.0	1.0	200	99	25,000	4.0	—1.6	0.5	2,000	8/6
	*TE384 ..	4.0	1.0	200	38	25,000	1.5	—2½	2.0	1,000	8/6
	*TE244 ..	4.0	1.0	200	24	10,000	2.4	—3½	6.0	660	8/6
Ever Ready	K30A ..	2.0	0.1	150	18	22,500	0.8	—4½	1.5	—	4/9
	K30B ..	2.0	0.1	150	11	12,000	0.9	—7½	4.0	—	4/9
	K30C ..	2.0	0.1	150	28	20,000	1.4	—3	2.0	—	4/9
	K30D ..	2.0	0.1	150	18	12,000	1.5	—4½	4.0	—	4/9
	K30E ..	2.0	0.1	135	18	12,000	1.5	—4½	2.0	—	4/9
	*A30B ..	4.0	0.65	200	75	34,000	2.2	—2	1.8	—	9/6
	*A30D ..	4.0	0.65	200	40	12,500	3.2	—3	5.0	—	9/6
	*C30B ..	13.0	0.2	200	40	12,500	3.2	—3	5.0	—	9/6
Ferranti	*D4 ..	4.0	1.0	200	40	17,300	2.5	—2.4	4.0	650	9/6
	*DA ..	13.0	0.2	200	51	20,000	2.2	—3.5	5.0	700	9/6
	*D8 ..	13.0	0.3	200	43	17,300	2.5	—2.4	4.0	600	9/6
Hivac ..	XD ..	2.0	0.066	100	16	23,000	0.75	—1½	1.1	—	10/6
	XL ..	2.0	0.066	100	12	14,000	0.85	—3	2.5	—	10/6
	H210 ..	2.0	0.1	150	25	22,000	1.15	—3	1.1	—	3/9
	D210 ..	2.0	0.1	150	16	12,000	1.35	—4½	2.4	—	3/9
	D210SW ..	2.0	0.1	150	16	12,000	1.35	—4½	2.4	—	5/6
	L210 ..	2.0	0.1	150	12	7,500	1.6	—6	4.2	—	3/9
	*AC/HL ..	4.0	1.0	200	35	10,000	3.5	—2.75	6.0	460	8/6
	*HL13 ..	13.0	0.3	200	35	10,000	3.5	—2.75	6.0	460	8/6
Impex ..	30 ..	2.0	0.06	180	9.3	10,300	0.9	—13½	3.1	—	7/-
	O1A ..	5.0	0.25	135	8	10,000	0.8	—9	3.0	—	6/-
	*26 ..	1.5	1.05	180	8.3	7,300	1.15	—14½	6.2	—	6/-
	*56 ..	2.5	1.0	250	13.8	9 500	1.45	—13½	5.0	—	7/-
	*27 ..	2.5	1.75	250	9	9,250	0.975	—21	5.2	—	7/-
(Metal)	*6F5 ..	6.3	0.3	250	100	66,000	1.5	—2	0.9	—	10/-
	*6C5 ..	6.3	0.3	250	20	10,000	2.0	—8	8.0	—	10/-
	*76 ..	6.3	0.3	250	13.8	9.500	1.45	—13½	5.0	—	7/-
	*37 ..	6.3	0.3	250	9.2	8,400	1.1	—18	7.5	—	7/-
Lissen ..	H2 ..	2.0	0.1	150	50	45,000	1.1	—	—	—	4/9
	HL2 ..	2.0	0.1	150	35	22,000	1.6	—	—	—	4/9
	L2 ..	2.0	0.1	150	20	10,000	2.0	—	—	—	4/9
	*AC/HL ..	4.0	1.0	200	40	10,000	4.0	—	—	—	9/6
Marconi ..	H2 ..	2.0	0.1	150	35	35,000	1.0	—1½	1.5	—	4/9
	HL2 ..	2.0	0.1	150	27	18,000	1.5	—3	2.0	—	4/9
	HL2/K ..	2.0	0.1	150	27	18,000	1.5	—3	2.0	—	5/6
	HL210 ..	2.0	0.1	150	24	20,000	1.2	—3	1.5	—	5/6

VALVE DATA CHART

Maker.	Type.	Fil. volts.	Fil. amps.	Anode volts.	Amp. factor.	Impedance.	Slope mA/v.	Grid bias.	Anode current.	Bias resistance.	Price.
Marconi ..	L21	2.0	0.1	150	—	8,900	1.8	—4½	4.0	—	4/9
(Deaf Aid)	H11	1.0	0.1	100	15	30,000	0.5	—	—	—	15/–
(„)	L11	1.0	0.1	100	4.4	7,700	0.57	—	—	—	15/–
	*H42	4.0	0.6	250	100	66,000	1.5	—2	1.0	200	9/6
	*MH4	4.0	1.0	200	40	11,100	3.6	—3	4.5	600	9/6
	*MH41	4.0	1.0	200	80	13,300	6.0	—2	5.0	400	9/6
	*MHL4	4.0	1.0	200	20	8,000	2.5	—6	8.0	850	13/6
(Acorn)	*HA1	4.0	0.3	180	20	11,800	1.7	—	—	—	50/–
	*H30	13.0	0.3	250	80	13,300	6.0	—2	5.0	400	9/6
	†DH	16.0	0.25	200	40	10,800	3.7	—3	6.0	500	13/6
Mazda ..	H2	2.0	0.1	150	47	59,000	0.8	0	2.5	—	4/9
	HL2	2.0	0.1	150	23	21,000	1.5	—1½	2.7	—	4/9
	L2	2.0	0.1	150	19	10,000	1.9	—3	5.3	—	4/9
	*AC/HL	4.0	1.0	200	35	11,700	3.0	—3½	5.0	700	9/6
	*AC2/HL	4.0	1.0	200	75	11,500	6.5	—1.75	4.5	400	9/6
	*HL1320 ..	13.0	0.2	250	30	10,000	3.0	—4½	7.5	650	9/6
	†DC3HL ..	25.0	0.1	200	35	11,700	3.0	—3½	5.0	700	13/6
Mullard ..	PM1A	2.0	0.1	150	50	41,600	1.2	—1	1.0	—	4/9
	PM1HF	2.0	0.1	150	18	22,500	0.8	—4½	1.5	—	4/9
	PM1HL	2.0	0.1	150	28	20,000	1.4	—3	2.0	—	4/9
	PM1LF	2.0	0.1	150	11	12,000	0.9	—7½	4.0	—	4/9
	PM2DX	2.0	0.1	150	18	12,000	1.5	—4½	4.0	—	4/9
	PM2DL	2.0	0.1	135	18	12,000	1.5	—4½	2.0	—	4/9
(Deaf Aid)	DA1	2.0	0.05	100	30	60,000	0.5	0	0.18	—	15/–
(„)	DA2	2.0	0.05	100	7	9,000	0.78	0	3.1	—	15/–
	*994V	4.0	0.65	200	125	35,000	3.6	—1½	1.35	1,000	13/6
	*904V	4.0	0.65	200	72	20,600	3.5	—2	1.8	1,000	9/6
	*484V	4.0	1.0	200	48	21,800	2.2	—3	2.8	1,000	13/6
	*354V	4.0	0.65	200	40	12,500	3.2	—4	4.0	1,000	9/6
	*244V	4.0	0.65	200	25	9,000	2.8	—5½	5.5	1,000	13/6
	*164V	4.0	0.65	200	16.4	3,640	4.5	—8½	8.5	1,000	14/–
	*154V	4.0	0.65	200	15	7,500	2.0	—7½	9.0	1,000	14/–
(Acorn)	*AT4	4.0	0.25	200	25	11,400	2.2	—6	4.5	—	50/–
(S.C. Base)	*HL13	13.0	0.2	200	40	12,500	3.2	—4	4.0	1,000	13/6
	*HL13C	13.0	0.2	200	40	12,500	3.2	—4	4.0	1,000	9/6
	†PM4DX	4.0	0.1	150	15	7,500	2.0	—6	2.5	—	8/6
	†HD20	20.0	0.18	200	—	—	2.6	—1½	1.0	—	13/6
	†HL20	20.0	0.18	200	35	14,000	2.5	—3½	3.5	1,000	13/6
Osram ..	HL2	2.0	0.1	150	27	18,000	1.5	—3	1.8	—	4/9
	L21	2.0	0.1	150	16	8,900	1.8	—6	2.2	—	4/9
	*H42	4.0	0.6	250	100	66,000	1.7	—2	1.0	2,000	9/6
	*MH41	4.0	1.0	200	80	13,300	6.0	—1½	5.2	400	9/6
	*MH4	4.0	1.0	200	40	11,000	3.6	—3	4.5	600	9/6
	*MHL4	4.0	1.0	200	20	8,000	2.5	—6	7.0	850	13/6
	*H30	13.0	0.3	250	80	13,300	6.0	—1.7	5.5	350	9/6
(Acorn)	*HA1	4.0	0.3	180	20	11,800	1.7	—6½	4.5	1,500	50/–
	*MH40	4.0	1.0	200	45	18,750	2.4	—3	2.7	1,000	50/–
	*A537	4.0	0.4	150	15.5	10,000	1.55	—6	3.3	—	50/–
Ostar-Ganz	*D130	250.0	0.24	300	100	40,000	3.5	—1	2.0	500	13/9
	*A520	250.0	0.24	300	22	8,800	2.5	—4.5	4.0	1,000	13/6
Philco ..	26	1.5	1.05	90	8.3	8,900	0.9	—7	2.9	—	6/–
	30	2.0	0.06	180	9.3	10,300	0.9	—13½	3.1	—	6/–
	*27	2.5	1.75	250	9.0	9,250	0.97	—21	5.2	—	8/–
	*56	2.5	1.0	250	13.8	9,500	1.45	—13½	5.0	—	9/–
	**X99	3.3	0.063	90	6.6	15,500	0.425	—4½	2.5	—	11/–
	**V99	3.3	0.063	90	6.6	15,500	0.425	—4½	2.5	—	16/3
	**01A	5.0	0.25	135	8.0	10,000	0.8	—9	3.0	—	6/–
	*37	6.3	0.3	250	9.2	8,400	1.1	—18	7.5	—	8/6
	*76	6.3	0.3	250	13.8	9,500	1.45	—13½	5.0	—	9/–
	†17	14.0	0.3	250	9.0	9,250	0.97	—21	5.2	—	10/–
	**40	5.0	0.25	180	30.0	150,000	0.2	—3	0.2	—	9/6
Pix ..	4..	2.0	0.1	150	33	37,000	0.9	—1½	1.0	—	2/6
	210	2.0	0.1	150	20	22,000	0.9	—4	1.2	—	2/6
	2..	2.0	0.1	150	20	12,000	0.9	—4	1.5	—	2/6
	3..	2.0	0.1	150	11	10,000	0.9	—7½	3.4	—	2/6
	*90/AC	4.0	1.0	200	40	23,000	1.7	—1½	3.0	500	8/6
	*100/AC	4.0	1,0	200	15	7,500	2.0	—6	5.0	1,200	9/6
Triotron ..	WD2	2.0	0.08	200	25	25,000	1.0	—2½	1.0	—	3/6
	W213	2.0	0.1	150	28	24,000	1.2	—2	1.5	—	3/6
	HD2	2.0	0.08	200	15	15,000	1.1	—5	5.0	—	3/6
	SD2	2.0	0.1	200	18	12,000	1.5	—5	6.0	—	3/6
	A214	2.0	0.1	150	20	10,000	2.0	—3	5.0	—	3/6
	TD2	2.0	0.08	150	9	10,000	0.9	—7	7.0	—	3/6
	*A440N	4.0	1.0	200	120	30,000	4.0	—1½	0.5	2,000	7/6
	*W415N	4.0	1.0	200	35	23,000	1.5	—3	2.5	1,000	7/6
	*A430N	4.0	1.0	200	30	8,300	3.0	—3½	6.0	600	7/6
	*A2040N ..	20.0	0.18	200	100	25,000	4.0	—1½	0.5	1,000	7/6
Tungsram ..	HR2	2.0	0.06	135	25	40,000	0.6	—1½	0.6	—	3/9
	HR210	2.0	0.1	200	30	23,000	1.3	—3	1.0	—	2/9
	LD210	2.0	0.1	150	18	14,000	1.3	—4½	3.0	—	3/9
	LL2	2.0	0.2	135	30	11,500	2.6	—3	3.0	—	3/9
	*HL4	4.0	0.65	200	40	11,000	3.5	—	4.0	1,000	9/6
	*HL13	13.0	0.2	200	40	11,000	3.5	—5½	6.0	1,000	9/6
	*27	2.5	1.75	250	9	9,000	0.97	—21	5.2	4,000	7/6
	*56	2.5	1.0	250	13.8	9,000	1.45	—13½	5.0	2,500	8/–
362	H2	2.0	0.1	150	32	32,000	1.0	—1½	2.0	—	3/6
	HL2	2.0	0.1	150	24	16,000	1.5	—3	3.0	—	3/6
	L2	2.0	0.1	150	15	12,000	1.2	—4½	3.0	—	3/6
	*ACHL4	4.0	1.0	250	33	10,000	3.3	—4	4.0	1,000	7/6

(*Continued on next page*)

VALVE DATA CHART

POWER OUTPUT TRIODES.

Maker.	Type.	Fil. volts.	Fil. amps.	Anode volts.	Impedance.	Slope mA/v.	Grid bias.	Anode current.	Bias res.	Output m/w.	Optimum load.	Price.
Brimar ..	*PA1 ..	4.0	1.0	200	1,050	12.0	—9	50.0	260	1,250	4,000	12/6
Cossor ..	215P ..	2.0	0.15	150	4,000	2.25	—7½	10.0	—	150	9,000	6/–
	220P ..	2.0	0.2	150	4,000	2.25	—7½	11.0	—	190	9,000	6/–
	220PA ..	2.0	0.2	150	4,000	4.0	—4½	10.0	—	180	9,000	6/–
	230XP ..	2.0	0.3	150	1,500	3.0	—18	22.0	—	450	3,500	6/–
	*41MP ..	4.0	1.0	200	2,500	7.5	—7½	24.0	320	1,250	3,000	10/–
	*41MXP ..	4.0	1.0	200	1,500	7.5	—12½	40.0	300	2,000	2,000	12/6
	**4XP ..	4.0	1.0	250	1,200	4.0	—22	37.0	600	2,000	2,800	12/6
	*DP ..	16.0	0.25	200	2,800	6.0	—7½	25.0	300	—	3,500	14/–
	*402P ..	40.0	0.2	200	1,330	7.5	—9½	30.0	320	—	2,500	12/6
Dario ..	TB052 ..	2.0	0.15	150	4,200	1.2	—18	7.0	—	150	11,000	4/6
	TB122 ..	2.0	0.2	150	3,600	3.5	—4½	6.0	—	350	8,000	4/6
	TB062 ..	2.0	0.33	150	3,000	2.0	—10½	13.0	—	1,550	6,000	4/6
	TB032 ..	2.0	0.2	150	2,000	1.5	—30	12.0	—	500	6,000	4/6
	*TE094 ..	4.0	1.0	200	3,000	1.3	—16	15.0	1,000	350	10,000	8/6
Ever Ready	K30G ..	2.0	0.2	150	3,600	3.5	—7	6.0	—	150	7,000	6/–
	*S30C ..	4.0	1.0	250	950	6.8	—29	48.0	600	2,700	2,500	12/6
Ferranti	**LP4 ..	4.0	1.0	250	870	5.4	—9.4	48.0	750	2,800	2,500	12/6
Hivac ..	XP ..	2.0	0.066	100	5,000	1.0	—9	4.5	—	—	—	12/6
	P215 ..	2.0	0.15	150	3,600	2.2	—12	8.0	—	150	10,000	4/9
	P220 ..	2.0	0.2	150	4,700	3.0	—7½	6.0	—	175	9,000	5/6
	PP220 ..	2.0	0.2	150	2,300	3.0	—12	12.5	—	250	5,000	6/6
	PX230 ..	2.0	0.3	150	1,850	3.5	—15	17.5	—	450	4,000	7/6
	PX230SW ..	2.0	0.3	150	1,850	3.5	—15	17.5	—	450	4,000	12/–
	*AC/L ..	4.0	1.0	200	2,350	4.25	—13½	17.0	760	675	6,300	8/6
	**PX41 ..	4.0	1.0	250	830	6.0	—40	48.0	830	2,500	3,500	12/6
Impex ..	31 ..	2.0	0.13	180	3,600	1.05	—30	12.3	2,500	375	5,700	7/–
	**45 ..	2.5	1.5	275	1,700	2.05	—56	36.0	1,560	2,000	4,500	7/–
	**2A3 ..	2.5	2.5	300	300	5.25	—62	60.0	1,000	3,500	2,500	11/–
	**71A ..	5.0	0.25	180	1,750	1.7	—40½	30.0	2,000	790	4,800	7/–
(metal)	**6L6 ..	6.3	0.9	250	225,000	6.0	—14	2.5	5,800	—	4,000	15/–
	**10 ..	7.5	1.25	425	5,000	1.6	—40	18.0	2,300	1,600	10,000	15/–
	**50 ..	7.5	1.25	450	1,800	2.1	—84	55.0	1,530	4,600	4,350	16/–
Lissen ..	P220 ..	2.0	0.2	150	4,000	1.75	—13½	7.6	—	150	—	6/–
	PX240 ..	2.0	0.4	200	1,500	3.0	—32	25.0	—	800	—	10—
Marconi..	LP2 ..	2.0	0.2	150	3,900	3.85	—6	7.0	—	150	7,000	6/–
	P215 ..	2.0	0.15	150	5,000	1.4	—9	5.8	—	150	12,000	7/–
	P2 ..	2.0	0.2	150	2,150	3.5	—10½	19.0	—	300	4,500	10/–
	*ML4 ..	4.0	1.0	200	2,860	4.2	—9	20.0	400	650	7,000	10/–
	**PX4 ..	4.0	1.0	250	835	6.0	—33	48.0	700	2,500	3,200	12/6
	**PX25 ..	4.0	2.0	400	1,265	7.5	—30	62.5	475	5,500	4,000	25/–
	**PX25A ..	4.0	2.0	400	580	6.9	—103	62.5	1,630	8,000	4,500	25/–
	**DA30 ..	4.0	2.0	500	910	3.85	—145	varies with signal.	—	44,000	3,400P	30/–
	**DA60 ..	6.0	4.0	500	835	3.0	—135	120.0	1,100	11,000	2,800	110/–
	**DA100 ..	6.0	2.7	1,000	1,410	3.9	—146	100.0	1,500	30,000	6,700	210/–
	†DL ..	16.0	0.25	200	2,666	4.5	—8	25.0	350	600	7,000	14/–
				P=Per	pair in "	lowload	" circuit.					
Mazda ..	P220 ..	2.0	0.2	150	3,700	3.4	—7	5.5	—	180	10,000	6/–
	P220A ..	2.0	0.2	150	1,850	3.5	—14	15.0	—	350	4,100	10/–
	*AC/P ..	4.0	1.0	200	2,650	3.75	—13½	17.0	750	650	6,000	10/–
	*AC/P1 ..	4.0	1.0	200	1,450	3.7	—28	24.0	1,200	1,000	5,000	12/6
	**PP5/400 ..	4.0	2.0	400	1,500	6.0	—32	62.5	510	5,900	2,700	25/–
	**PP3/250 ..	4.0	1.0	250	1,000	6.5	—29	42.0	690	2,800	2,750	12/6
	**PA20 ..	2.0	2.0	250	1,000	6.5	—29	42.0	690	2,800	2,750	12/6
	*PP3521 ..	35.0	0.2	200	600	10.0	—25	70.0	360	5,500 (in push pull.)	3,000	12/6
	†DC2/P ..	35.0	0.1	200	2,650	3.75	—13½	17.0	800	650	6,000	14/–
Mullard	PM2A ..	2.0	0.2	150	3,600	3.5	—7	6.0	—	150	7,000	6/–
	PM2 ..	2.0	0.2	150	4,400	1.7	—12	6.6	—	150	9,000	6/–
	PM202 ..	2.0	0.2	150	2,000	3.5	—15	14.0	—	350	3,700	10/–
	*104V ..	4.0	1.0	200	3,000	4.0	—12	17.0	700	650	6,000	10/–
	*054V ..	4.0	1.0	200	1,250	4.0	—28	30.0	1,000	1,000	4,000	12/6
	**AC104 ..	4.0	1.0	200	2,850	3.5	—14	11.0	—	400	6,000	16/–
	**AC064 ..	4.0	1.0	200	2,000	3.0	—21	20.0	1,000	620	5,000	16/–
	**AC044 ..	4.0	1.0	250	950	6.8	—29	48.0	600	2,700	2,500	12/6
	**AC042 ..	2.0	2.0	250	950	6.8	—29	48.0	600	2,700	2,500	12/6
	**D010 ..	6.0	0.85	400	2,850	0.85	—130	25.0	—	2,500	6,000	25/–
	**D020 ..	7.5	1.1	425	2,000	2.5	—66	40.0	1,650	5,000	5,000	30/–
	**D024 ..	4.0	2.0	400	1,390	6.5	—34	63.0	540	5,500	4,000	25/–
	**D025 ..	6.0	1.1	400	800	3.75	—112	63.0	1,780	7,000	4,000	30/–
	**D026 ..	4.0	2.0	400	600	6.3	—92	63.0	1,500	7,500	4,000	25/–
Osram ..	LP2 ..	2.0	0.2	150	3,900	3.85	—6	7.0	—	140	7,000	6/–
	P2 ..	2.0	0.2	150	2,150	3.5	—12	14.0	—	240	5,700	10/–
	*ML4 ..	4.0	1.0	200	2,860	4.2	—10	19.0	500	—	7,000	10/–
	**PX4 ..	4.0	1.0	250	830	6.0	—36	48.0	750	2,500	2,400	12/6
	**PX25 ..	4.0	2.0	400	1,265	7.5	—33	62.5	530	5,500	3,200	25/–
	**PX25A ..	4.0	2.0	400	580	6.9	—102	62.5	1,630	8,400	4,500	25/–
	**DA30 ..	4.0	2.0	500	580	6.9	—130	60.0	2,150	11,000	4,000	30/–
	**DA60 ..	6.0	4.0	500	835	3.0	—138	120.0	1,150	12,000	2,500	110/–
	**DA100 ..	6.0	2.7	1,000	1,410	3.9	—149	100.0	1,490	30,000	6,700	210/–
DA30 is	*capable of*	*11.0 wa*	*tts A.C.*	*output a*	*s a sing*	*le valve*	*and 44.*	*0 watts*	*in low l*	*oading*	*push-pu*	*ll.*
Ostar-Ganz.	*U920 ..	250.0	0.024	300	3,700	3.0	—10	12.0	800	1,000	8,000	13/6
	*L1525 ..	250.0	0.024	300	1,850	3.0	—20	20.0	1,000	1,500	4,000	13/9

VALVE DATA CHART

Maker.	Type.	Fil. volts.	Fil. amps.	Anode volts.	Impedance.	Slope mA/v.	Grid bias.	Anode current.	Bias res.	Output m/w.	Optimum load.	Price.
Ostar-Ganz.	°K2050 ..	250.0	0.044	300	1,000	5.0	—40	40.0	1,000	3,000	2,500	19/6
Philco ..	°K3560 ..	250.0	0.044	220	500	6.0	—50	50.0	1,000	3,000	1,200	19/6
	°°45	2.5	1.5	275	1,700	2.05	—56	36.0	—	2,000	4,600	8/—
	°°2A3 ..	2.5	2.5	250	800	5.25	—45	60.0	—	3,500	2,500	18/—
	°°12A ..	5.0	0.25	180	4,700	1.8	—13½	7.7	—	285	10,650	9/6
	°°71A ..	5.0	0.25	180	1,750	1.7	—40½	20.0	—	790	4,800	6/—
	°°6A3 ..	6.3	1.0	250	800	5.25	—45	60.0	—	3,500	2,500	15/6
(R.F. oscillator)	°°10 ..	7.5	1.25	425	8,000	—	[P—50	120.0	—	25,000]	—	25/—
	°°50 ..	7.5	1.25	450	1,800	2.1	—84	55.0	—	4,600	4,350	16/—
	°79	6.3	0.6	250	—	5.0	0	5.3	—	8,000	14,000	14/—
	°42E ..	6.3	0.7	250	3 000	2.3	—20	31.0	—[P.	15,000	8,000]	13/6
				P. = Two in push-pull.								
Pix ..	20	2.0	0.15	150	4,600	1.2	—14	5.0	—	150	—	4/6
	120.. ..	2.0	0.2	150	3,900	1.8	—11	12.0	—	200	—	6/6
	°AC/4P ..	4.0	1.0	200	3,600	2.5	—11	—	—	—	—	10/6
Triotron	ZD2 ..	2.0	0.15	150	5,000	1.0	—15	10.0	—	150	13,000	4/6
	YD2 ..	2.0	0.22	200	4,500	2.0	—11	16.0	—	250	10,000	4/6
	E235 ..	2.0	0.33	200	3,000	3.0	—12	18.0	—	550	8,000	4/6
	UD2 ..	2.0	0.22	150	2,000	2.0	—15	15.0	—	500	5,000	4/6
	SP2 ..	2.0	0.33	150	1,500	2.0	—28	18.0	—	500	3,500	4/6
	°E430N ..	4.0	1.0	200	3,000	3.0	—15	15.0	1,000	350	10,000	7/6
	°°E425 ..	4.0	0.3	250	2,500	2.0	—32	20.0	1,600	1,000	3,000	6/—
	°°K480 ..	4.0	2.0	550	1,250	8.0	—36	45.0	800	5,000	3,500	20/—
	°°K450/50 ..	4.0	3.0	400	1,250	4.0	—50	120.0	500	12,000	1,500	40/—
	°°K435/10 ..	4.0	0.65	250	1,000	3.5	—40	40.0	1,000	2,500	1,500	10/—
Tungsram	LP220 ..	2.0	0.2	150	7,000	3.5	—6	5.0	—	200	7,500	4/9
	P215 ..	2.0	0.15	150	7,000	1.5	—12	10.0	—	260	7,000	4/9
	SP220 ..	2.0	0.2	150	7,000	3.0	—15	15.0	—	360	6,700	4/9
	°°P12/250 ..	4.0	0.95	250	850	6.0	—33	48.0	700	2,750	2,400	12/6
	°°P15/250 ..	4.0	0.95	250	660	6.0	—44	60.0	750	4,200	2,500	14/—
	°°O15/400 ..	4.0	1.0	450	1,600	5.0	—37	40.0	900	3,500	6,000	12/6
	°°P25/500 ..	6.0	1.1	500	800	3.75	—150	53.0	2,800	8,000	8,000	20/—
	°°P60/500 ..	6.0	4.0	600	1,000	3.5	—130	110.0	1,200	15,000	2,600	88/—
	°45	2.5	1.5	275	1,750	2.0	—56	36.0	1,500	2,000	4,600	7/—
	°112.. ..	5.0	0.25	180	4,700	1.8	—13½	7.5	2,000	285	10,650	8/—
	°50	7.5	1.25	450	1,800	2.1	—85	55.0	1,800	4,600	4,350	22/6
	°PX2100 ..	7.5	1.25	425	5,000	1.6	—39	18.0	2,000	1,600	10,200	22/6
362 ..	LP2 ..	2.0	0.2	200	5,000	3.0	—9	8.0	—	500	10,000	4/—
	P2	2.0	0.2	200	3,000	3.0	—15	13.0	—	1,000	6,000	4/6
	°ACPX4 ..	4.0	1.0	250	2,000	4.0	—18	30.0	600	2,500	3,000	9/—
	°°ACPX4a ..	4.0	1.0	250	1,200	5.0	—25	50.0	500	3,000	2,500	9/—
	°°PX25 ..	4.0	2.0	400	1,000	6.0	—50	65.0	800	7,000	3,000	20/—
	°°P625 ..	6.0	0.25	350	2,000	2.5	—50	50.0	1,000	1,500	5,000	8/—
	°°PX50 ..	6.0	2.0	500	800	5.0	—70	100.0	700	13,000	7,500	50/—
	°°PX100 ..	6.0	3.0	1,000	1,200	5.0	—140	100.0	1,400	35,000	7,000	100/—

OUTPUT PENTODES

Maker.	Type.	Fil. volts.	Fil. amps.	Anode volts.	Screen volts.	Slope mA/v.	Grid bias.	Bias res. ohms.	Anode and screen current.	Output m/w.	Optimum load.	Price.
Brimar ..	Pen B1 ..	2.0	0.2	150	150	2.5	—4½	—	9.8	500	18,000	11/—
	°7A2 ..	4.0	1.2	250	250	3.2	—17	330	40.0	3,000	8,000	13/6
	°7A3 ..	4.0	2.0	250	250	10.0	—6	150	40.0	3,800	8,500	13/6
	°°Pen A1 ..	4.0	1.0	250	250	3.0	—16½	450	40.0	2,800	8,000	13/6
	°7D8 ..	13.0	0.6	250	250	10.0	—6	150	40.0	3,800	8,500	13/6
	°7D3 ..	40.0	0.2	150	150	3.8	—20	500	48.0	2,000	4,000	13/6
	°7D6 ..	40.0	0.2	250	250	10.0	—6	150	40.0	3,800	8,500	13/6
Cossor ..	220PT ..	2.0	0.2	150	150	2.5	—9	—	9.5	500	17,000	11/—
	220HPT ..	2.0	0.2	150	150	3.5	—4½	—	17.0	1,000	10,000	16/6
	230PT ..	2.0	0.3	150	150	2.0	—15	—	16.0	3,100	10,000	13/6
	°MP/Pen ..	4.0	1.0	250	250	3.5	—16	450	36.0	3,400	8,000	13/6
	°42MP/Pen ..	4.0	2.0	250	250	7.0	—5½	140	38.0	2,600	8,000	13/6
	°°PT41 ..	4.0	1.0	250	200	3.0	—12½	350	36.0	3,600	8,000	22/6
	°°PT41B ..	4.0	1.0	400	300	2.25	—40	1,200	36.0	3,600	8,000	18/6
	°DP/Pen ..	16.0	0.25	250	250	3.5	—10	300	36.0	3,000	10,000	13/6
	°40PPA ..	40.0	0.2	150	150	4.0	—25	600	42.0	2,250	4,000	13/6
	°402/Pen ..	40.0	0.2	250	250	7.0	—6.7	—	—	—	5,500	13/6
Dario ..	TC432 ..	2.0	0.2	150	150	2.0	—4½	—	11.5	350	15,000	10/—
	°TE634 ..	4.0	1.1	250	250	3.5	—15	650	29.0	2,000	7,500	12/6
	°TE634 ..	4.0	1.35	250	250	4.0	—22	500	42.0	3,500	7,000	12/6
	°TL34 ..	4.0	1.1	200	200	9.5	—6	200	33.3	3,500	7,000	12/6
	°TB4320 ..	20.0	0.2	200	100	8.0	—19	400	40.0	3,500	5,000	12/6
	°TL413 ..	33.0	0.2	250	250	7.5	—13	320	40.5	4,000	7,000	12/6
Ever Ready.	K70B ..	2.0	0.2	150	150	2.5	—4½	—	9.5	425	16,000	11/—
	K70D ..	2.0	0.3	150	150	3.0	—2.4	—	5.0	—	24,000	11/—
	°A70B ..	4.0	1.5	250	250	3.5	—22	500	32.0	—	8,000	13/6
	°A70C ..	4.0	1.95	250	250	10.0	—5.8	145	32.0	3,800	8,000	13/6
	°A70D ..	4.0	1.95	250	250	10.0	—5.8	—	—	—	8,000	13/6
	°C70D ..	35.0	0.2	250	250	7.0	—5.8	165	32.0	3,200	7,000	13/6
Ferranti	PT4D ..	4.0	2.0	250	250	7.5	0.7	150	39.5	3,500	6,500	16/—
	°PTA ..	13.0	0.3	250	250	4.0	0.6	250	37.5	3,200	7,000	13/6
	°PTZ ..	40.0	0.2	200	200	7.5	0.8	120	47.0	3,500	6,000	13/6
	°PT8A ..	26.0	0.3	200	200	7.5	0.8	120	4.7	3,500	6,000	13/6
Hivac ..	XY ..	2.0	0.14	100	100	1.25	—6	—	6.6	—	15,000	15/6
	Y220 ..	2.0	0.2	150	150	2.5	—4½	—	11.8	500	11,500	9/6
	Z220 ..	2.0	0.2	150	150	2.5	—6	—	20.1	1,000	7,500	9/6

VALVE DATA CHART

Output Pentodes—continued

Maker.	Type.	Fil. volts.	Fil. amps.	Anode volts.	Screen volts.	Slope mA/v.	Grid bias.	Bias res. ohms.	Anode and screen current.	Output m/w.	Optimum load.	Price.
Hivac ..	*AC/Y	4.0	1.0	250	250	3.5	—10	300	36.3	3,000	6,500	11/6
	*AC/YY	4.0	2.0	250	250	7.5	—10	140	78.0	5,000	3,000	25/6
	*AC/Z	4.0	2.0	250	250	8.0	—5½	160	36.3	3,000	6,500	11/-
	**FY	4.0	1.0	250	250	5.0	—10	250	38.0	3,000	6,000	11/6
	*Y13	13.0	0.3	250	250	4.0	—22	550	39.5	3,000	4,000	11/6
	*Z36..	26.0	0.3	250	250	8.0	—11	250	44.0	3,000	4,000	11/6
Impex ..	33	2.0	0.26	180	180	1.7	—18	660	27.0	1,400	6,000	9/6
	*2A5	2.5	1.75	250	250	2.2	—16½	420	39	3,000	7,000	9/6
	*47 ..	2.5	1.75	250	250	2.5	—16½	450	37	2,700	7,000	8/6
	*59 ..	2.5	2.0	250	250	2.5	—18	410	44	3,000	6,000	11/-
	*38 ..	6.0	0.3	250	250	1.2	—25	1,000	25.8	2,500	10,000	8/6
	*41 ..	6.3	0.4	250	250	2.2	—18	500	37.5	3,400	7,600	8/6
	*42 ..	6.3	0.7	250	250	2.2	—16½	400	40.5	3,000	7,000	9/6
	*6F6	6.3	0.7	250	250	2.5	—16½	400	40.5	3,000	7,000	10/6
(Metal)	*25A6	25.0	0.3	180	135	2.5	—20	440	45.5	2,750	5,000	13/6
	*43 ..	25.0	0.3	180	135	2.3	—20	440	45.5	2,750	5,000	9/6
Lissen ..	PT225	2.0	0.2	150	150	1.6	—6	—	10.0	300	—	11/-
	PT240	2.0	0.4	200	150	2.3	—	—	—	1,000	—	11/-
	PT2A	2.0	0.2	150	150	2.5	—10	—	21.0	1,100	—	11/6
	PT425	4.0	0.25	200	150	2.3	—	—	—	1,000	—	17/6
	*AC/PT	4.0	1.0	250	250	4.0	—8	230	35.0	2,500	—	13/-
	†PT611	6.0	0.11	150	150	1.4	—7	500	15.0	300	—	16/-
Marconi..	PT2	2.0	0.2	150	150	2.5	—4½	—	8.5	500	20,000	11/-
	*MPT4	4.0	1.0	250	200	3.0	—10½	280	37.5	2,900	8,000	13/6
	*N41	4.0	2.0	250	250	10.0	—3½	90	40.0	3,500	7,800	13/6
	*N42	4.0	1.0	250	250	2.5	—16½	420	37.5	3,200	7,000	13/6
	**PT4	4.0	1.0	250	250	2.9	—16	400	40.0	2,500	7,500	18/6
	**PT25H	4.0	2.0	400	400	6.5	—16	240	75.0	10,000	5,000	45/-
	*N30/K	13.0	0.3	250	250	3.9	—15	375	39.5	3,200	7,500	13/6
	*N30G	13.0	0.3	250	250	3.9	—15	375	39.5	3,200	7,500	13/6
	*N31	26.0	0.3	200	180	10.0	—4.4	90	50.6	2,500	5,500	13/6
	†DPT	16.0	0.25	200	200	3.0	—10	220	46.5	2,000	8,000	18/6
	N43	4.0	2.0	250	250	10.0	—4.5	90	50	4,500	7,000	25/-
Mazda ..	Pen 2S1	2.0	0.3	120	120	2.3	—2½	—	6.0	370	19,000	11/-
	Pen 220	2.0	0.2	150	150	2.5	—4½	—	10.6	600	14,000	11/-
	Pen 220A	2.0	0.2	150	150	2.5	—9	—	21.0	1,100	6,000	16/6
	*AC/Pen	4.0	1.0	250	250	2.5	—15½	400	37.0	3,400	7,500	13/6
	*AC2/Pen	4.0	1.75	250	250	8.0	—5.3	140	38.0	3,500	6,700	13/6
	*Pen 1340	13.0	0.4	240	240	6.5	—8.6	175	49.0	4,000	5,500	13/6
	*Pen 3520	35.0	0.2	200	200	7.0	—8	165	48.0	3,200	4,400	13/6
	†DC2/Pen	35.0	0.1	250	200	2.5	—10	300	35.0	2,300	10,000	18/6
Mullard	PM22	2.0	0.3	150	150	1.3	—10	—	19.0	600	8,000	16/6
	PM22A	2.0	0.14	150	150	2.5	—4½	—	12.0	425	20,000	11/-
	PM22C	2.0	0.3	150	150	3.0	—20	—	27.0	1,450	8,000	13/6
	PM22D	2.0	0.3	135	135	4.0	—2.4	—	5.8	300	24,000	13/6
	*Pen 4VA	4.0	1.5	250	250	3.5	—22	500	—	3,400	8,000	13/6
	*Pen 4VB	4.0	1.95	250	250	10.0	—5.8	145	—	3,800	8,000	13/6
	*Pen A4	4.0	1.95	250	250	10.0	—5.8	145	—	3,800	8,000	13/6
	**PM24	4.0	0.15	150	150	1.75	—11	650	—	—	8,000	17/6
	**PM24A	4.0	0.275	300	200	2.0	—22½	1,250	—	—	10,000	18/6
	**PM24M	4.0	1.0	250	250	3.0	—18	500	37.0	3,000	8,000	13/6
	**PM24B	4.0	1.0	400	300	2.1	—40	—	37.5	4,000	8,000	22/6
	**PM24C	4.0	1.0	400	200	3.0	—28	—	37.0	4,000	12,000	22/6
	**PM24D	4.0	2.0	500	200	4.0	—35	750	59.0	10,000	7,000	45/-
(Sc. Base)	*Pen 26	24.0	0.2	200	100	8.0	—19	420	—	3,500	9,000	18/6
	*Pen 13C	13.0	0.5	250	250	6.5	—11.9	185	—	3,600	6,400	13/6
	*Pen 36C	35.0	0.2	200	200	8.0	—9	165	—	3,200	4,000	13/6
	†Pen 20	20.0	0.18	200	200	2.5	—15	—	—	1,500	8,000	18/6
	†PM25	6.0	0.1	150	150	1.6	—15	—	—	—	8,000	17/6
Osram ..	PT2	2.0	0.2	150	150	2.5	—4½	—	9.5	550	17,000	11/-
	*MPT4	4.0	1.0	250	200	3.0	—11	300	37.0	2,200	8,000	13/6
	*MPT4 (Catkin).	4.0	1.0	250	250	3.0	—13	340	38.0	3,400	8,500	18/6
	*N41	4.0	2.0	250	250	10.0	—4.4	90	50.0	4,200	5,400	13/6
	*N42	4.0	1.0	250	250	2.5	—16.5	420	39.5	—	7,000	13/6
	*N43	4.0	2.0	250	250	10.0	—4½	90	50.0	—	5,400	25/-
	**PT25	4.0	2.0	400	200	4.0	—22	330	73.1	10,000	6,000	45/-
	**PT25H	4.0	2.0	400	400	6.5	—18	288	75.0	10,000	4,000	45/-
	*N30	13.0	0.3	250	250	3.9	—15	375	40.0	3,200	7,500	13/6
	*N30G	13.0	0.3	250	250	3.9	—15	375	40.0	—	7,500	13/6
(C.T. heater)	*N31	13.0 or 26.0	0.6 or 0.3	200	180	10.0	—4.4	90	50.6	2,500	6,000	13/6
Ostar-Ganz.	*PT3	250.0	0.024	250	250	3.5	—16	600	28.0	2,000	10,000	16/-
	*M43	250.0	0.028	250	200	3.2	—26	600	44.0	3,500	6,000	16/9
	*M44	250.0	0.032	250	250	10.0	—4½	900	46.0	3,800	5,000	17/6
Philco ..	33E	2.0	0.26	180	180	1.7	—18	—	27.0	1,400	6,000	12/-
	2101E	2.0	0.12	135	135	1.7	—4½	—	10.6	450	1,500	11/-
	Pen 23	2.0	0.3	120	120	5.5	—2½	—	6.0	370	—	16/6
	*59 ..	2.5	2.0	250	250	2.5	—18	—	44.0	3,000	6,000	18/-
	*41E	6.3	0.4	250	250	2.2	—18	—	37.5	3,400	7,600	13/6
	*42E	6.3	0.7	250	250	2.2	—16½	—	40.5	3,000	7,000	13/6
	**46	2.5	1.5	250	250	3.35	—33	—	22.0	1,250	6,400	12/-
	**47E	2.5	1.75	250	250	2.5	—16½	—	37.0	2,700	7,000	13/6
(As pen)	*89 ..	6.3	0.4	250	250	1.8	—25	—	37.5	3,400	6,750	12/-
	*38E	6.3	0.3	250	250	1.2	—25	—	25.8	2,500	10,000	12/6
	*21G1	24.0	0.3	250	250	—	—	—	—	—	—	13/6
	†18E	14.0	0.3	250	250	2.2	—16½	—	41.0	3,000	7,000	13/6
	†43E	25.0	0.3	135	135	2.3	—20	—	41.0	2,000	4,000	13/6
Pix ..	220..	2.0	0.2	150	100	2.5	—7½	—	8.0	200	—	9/6

VALVE DATA CHART

Maker.	Type.	Fil. volts.	Fil. amps.	Anode volts.	Screen volts.	Slope mA/v.	Grid bias.	Bias res. ohms.	Anode and screen current.	Output m/w.	Optimum load.	Price.
Triotron	P215	2.0	0.25	150	150	1.5	—15	—	19.5	580	10,000	8/6
	P225	2.0	0.2	150	150	2.0	—4½	—	10.0	500	15,000	8/6
	*P440N	4.0	1.1	250	250	3.5	—15	650	28.0	2,000	7,500	11/-
	*P441N	4.0	1.1	250	250	4.0	—22	500	37.0	3,800	7,000	11/-
	*P495	4.0	1.5	200	200	9.5	—5.8	175	35.0	3,500	7,000	11/-
	**P435	4.0	1.1	250	250	3.0	—15	400	42.0	2,800	7,000	11/-
	**P440	4.0	2.0	550	200	4.0	—40	900	52.0	7,600	14,000	30/-
	**P460	4.0	2.0	550	200	6.0	—40	800	52.0	8,000	10,000	30/-
	*P2020N	20.0	0.18	200	200	2.5	—18	1,000	19.0	1,350	9,000	11/-
	*P2460	24.0	0.18	200	100	8.0	—18	500	36.0	3,500	6,000	11/-
	*P2080	24.0	0·2	200	100	8.0	—19	450	40.0	3,550	5,000	11/-
	*P3580	33.0	0·2	250	250	7.5	—13	—	—	—	—	11/-
Tungsram	PP2	2.0	0.14	135	135	2.7	—5	—	7.5	450	—	10/-
	PP222	2.0	0.22	150	150	3.0	—6	—	8.0	600	16,000	10/-
	PP230	2.0	0.3	200	150	2.0	—16	—	20.0	600	11,000	10/-
	PP225	2.0	0.26	135	135	2.0	—12	—	18.0	1,000	6,000	11/-
	*APP4120	4.0	1.2	350	250	3.5	—16½	400	40.0	3,000	7,500	13/6
	*APP4A	4.0	1.2	250	250	3.5	—16½	400	40.5	3,000	7,000	13/6
	*APP4B	4.0	2.0	250	250	10.0	—6	140	40.0	3,600	7,000	13/6
	*APP4C	4.0	2.0	250	250	10.0	—6	140	40.0	3,600	7,000	13/6
	*APP4D	4.0	2.0	250	250	7.0	—16½	200	80.0	7,500	3,500	16/6
	*PP6C	6.3	1.2	250	250	9.5	—6	150	40.0	4,400	7,000	14/9
	*PP6D	6.3	1.2	250	250	7.0	—16	200	79.5	8,000	3,000	20/-
	**PP4	4.0	1.1	250	250	4.0	—15	400	42.0	3,000	7,500	13/6
	*PP6A	6.3	0.2	250	250	2.8	—18	500	37.0	3,000	8,000	16/-
	*PP24	24.0	0.2	200	100	8.0	—19	400	45.0	3,000	10,000	13/6
	*PP35	35.0	0.2	200	200	10.0	—6½	150	45.0	3,000	4,400	13/6
	*PP36	35.0	0.2	200	200	10.0	—6½	150	45.0	3,000	5,000	13/6
	*2A5	2.5	1.75	250	250	2.2	—16½	400	40.5	3,000	7,000	12/-
	*33 ..	2.0	0.26	150	150	2.0	—12	750	16.0	1,400	6,000	10/-
	*42 ..	6.3	0.7	250	250	2.2	—16½	400	40.5	3,000	7,000	12/-
	*18 ..	14.0	0.3	250	250	2.2	—16½	400	40.5	3,000	7,000	12/-
	*43 ..	25.0	0.3	180	135	2.3	—20	500	41.0	2,750	4,000	12/-
	**47..	2.5	1.75	250	250	2.5	—16½	450	37.0	2,700	7,000	12/-
362 ..	ME2	2.0	0.2	200	200	2.0	—12	—	—	1,000	7,000	10/-
	ME2a	2.0	0.2	200	200	2.0	—12	—	—	1,000	7,000	10/-
	*ACME4	4.0	1.0	250	250	2.5	—16	400	—	3,000	5,000	10/6
	*ACME4c	4.0	2.0	250	250	4.5	—16	300	—	3,500	3,000	13/-
	**ACME4a	4.0	1.0	250	250	3.0	—22	500	—	3,500	3,000	10/6
	**ACME4b	4.0	1.0	250	250	3.0	—22	500	—	3,500	3,000	10/6
	**ME25	4.0	2.0	400	400	4.0	—4.0	700	—	9,000	6,000	30/-

DOUBLE OUTPUT VALVES

Maker.	Type.	Circuit.	Fil. volts.	Fil. amps.	Anode volts.	Screen volts.	Quiescent current.	Peak current.	Grid bias.	Power output. m.w	Optim'm load.	Price.
Cossor ..	220B ..	Class B ..	2.0	0.2	120	—	1.25	35.0	0	1,250	12,000	11/-
	240B ..	Class B ..	2.0	0.4	150	—	1.5	50.0	0	2,000	8,000	11/-
Dario ..	TB402 ..	Class B ..	2.0	0.2	150	—	3.0	35.0	0	1,200	15,000	9/6
Ever Ready	K33A ..	Class B ..	2.0	0.2	150	—	3.0	—	—	1,450	14,000	11/-
	K33B ..	Class B ..	2.0	0.2	150	—	—	—	4.5	1,500	14,000	11/-
	K77A ..	QPP ..	2.0	0.5	150	150	4.0	—	13.5	2,000	16,000	17/6
Hivac ..	B230 ..	Class B ..	2.0	0.3	150	—	2.5	32.0	0	1,250	14,500	9/6
	DB240 ..	Class B and driver	2.0	0.4	150	—	2.5	32.0	0	1,250	14,500	15/6
	QP240 ..	QPP ..	2.0	0.4	150	150	8.0	32.0	—18	1,400	14,500	17/6
Impex ..	19 ..	Class B ..	2.0	0.26	135	—	5	—	—	2,100	10,000	9/6
	*53 ..	Class B (twin triodes)	2.5	2.0	300	—	17.5	—	—	10,000	10,000	11/-
	*6N7 ..	Class B ..	6.3	0.8	300	—	—	—	—	—	—	11/6
Lissen ..	B2 ..	Two in Class B	2.0	0.1	150	—	3.0	—	0	2,000	—	8/-
	BB240A	Class B ..	2.0	0.4	150	—	2.0	—	0	2,400	—	11/-
Marconi ..	B21 ..	Class B ..	2.0	0.2	150	—	2.2	—	—6	1,500	12,000	11/-
	QP21 ..	QPP ..	2.0	0.4	150	150	3.0	—	—9	1,200	24,000	17/6
Mazda ..	QP230 ..	QPP ..	2.0	0.3	110	110	5.3	—	—8.6	700	17,000	17/6
	QP240 ..	QPP ..	2.0	0.4	150	130	4.9	—	—11½	2,250	15,000	17/6
	PD220 ..	Class B ..	2.0	0.2	150	—	0.9	45.0	—1.15	2,850	15,000	11/-
	PD220A	Class B ..	2.0	0.2	150	—	2.5	50.0	—6	2,900	10,000	11/-
Mullard ..	PM2B ..	Class B ..	2.0	0.2	150	—	—	—	0	1,250	14,000	11/-
	PM2BA..	Class B ..	2.0	0.2	150	—	—	—	—4½	1,250	14,000	11/-
	QP22A ..	QPP ..	2.0	0.45	150	150	4.0	—	—13½	1,400	16,000	17/6
Osram ..	QP21 ..	QPP ..	2.0	0.4	150	150	3.2	—	—9	1,000	29,000	17/6
	B21 ..	Class B ..	2.0	0.2	150	—	2.2	—	—6	2,000	12,000	11/-
Philco ..	19 ..	Class B ..	2.0	0.26	135	—	5.0	50.0	0	2,100	10,000	11/-
	2103 ..	QPP ..	2.0	—	—	—	—	—	—	—	—	17/6
	*6A6 ..	Class B ..	6.3	0.8	300	—	—	125.0	0	10,000	10,000	15/6
	53 ..	Class B ..	2.5	2.0	300	—	—	—	0	10,000	10,000	16/-
	*79 ..	Class B ..	6.3	0.6	250	—	10.6	90.0	0	8,000	14,000	14/-
Triotron ..	E220B ..	Class B ..	2.0	0.3	150	—	3.0	32.0	0	1,350	18,000	9/6
Tungsram..	CB215 ..	Class B ..	2.0	0.15	135	—	—	—	0	1,700	—	11/-
	CB220 ..	Class B ..	2.0	0.25	150	—	2.5	—	—3	2,000	10,000	11/-
	19 ..	Class B ..	2.0	0.25	150	—	—	—	—3	2,000	—	11/-
362.. ..	BA2 ..	Class B ..	2.0	0.2	150	—	1.5	30.0	0	1,500	10,000	9/-
	BX2 ..	Class B ..	2.0	0.4	180	—	2.5	50.0	0	3,000	7,000	9/-

TELEVISION TUBES

Rectifiers, Tuning Indicators and Barretters

Sections given below include H.T. rectifying valves, metal rectifiers, Westectors, barretters, tuning indicators, cathode ray tubes and gas-filled relays.

The various types are listed alphabetically under the maker's trade name. Abbreviations used are : * indicating indirectly heated A.C. types ; ** indicating directly heated types ; ° indicating A.C.-D.C. types ; and VD in the rectifier section indicating voltage doubler.

H.T. RECTIFYING VALVES

Maker.	Type.	Fil. volts.	Fil. amps.	Anode volts max. (RMS).	Output mA.	Price.
Brimar	*R1 ..	4.0	1.0	250+250	60	10/6
	*R2 ..	4.0	2.5	350+350	120	10/6
	*R3 ..	4.0	2.5	500+500	120	15/-
	*1A7 ..	4.0	2.5	350+350	120	10/6
	*1D5 ..	40.0	0.2	250	75	10/6
(Mercury)	**4037A ..	4.0	2.0	300	250	22/6
	**VL361 ..	2.0	1.2	6,000	3	20/-
Cossor	**506BU ..	4.0	1.0	250+250	60	10/6
	**442BU ..	4.0	2.5	350+350	120	10/6
	**460BU ..	4.0	2.5	500+500	120	15/-
	°408UA ..	40 0	0.2	250	75	10/6
	**44SU ..	4.0	0.4	200	20	15/-
	**412SU ..	4.0	1.0	250	70	15/-
	**660SU ..	6.0	4.5	1,000	150	63/-
	**408BU ..	4.0	1.0	250+250	30	12/6
	**412BU ..	4.0	1.0	250+250	70	20/-
	**612BU ..	6.0	0.4	250+250	50	20/-
	**624BU ..	6.0	2.0	500+500	60	20/-
	**625BU ..	7.5	2.0	500+500	120	22/6
	**SU2103 ..	2.0	1.0	5,000	2.0	20/-
Dario	*1FW1 ..	4.0	2.0	500+500	120	10/6
	**FW1 ..	4.0	1.0	300+300	75	7/6
	**FW2 ..	4.0	2.0	350+350	120	9/6
	**FW3 ..	4.0	2.0	500+500	120	10/6
	**SW1 ..	4.0	1.0	400	60	6/6
	*TW2 ..	30.0	0.2	125+125	120	10/6
	*TW1 ..	20.0	0.2	250	80	9/6
Ediswan	**U235 ..	2.0	3.5	30+30	2,000	10/6
	**U600 ..	2.0	8.0	40+40	6,000	37/6
(Mercury)	*MU1 ..	4.0	2.5	1,500	60	25/-
(Mercury)	*MU2 ..	2.0	1.0	4,000	25	20/-
(Mercury)	*ESU75 ..	2.0	8.0	3,000	900	45/-
Ever Ready ..	*A11B ..	4.0	2.4	350+350	120	10/6
	*A11D ..	4.0	2.0	350+350	120	10/6
	*A11C ..	4.0	2.4	500+500	120	15/-
	**S11A ..	4.0	1.0	250+250	60	10/6
	*C10B ..	20.0	0.2	250	75	10/6
Ferranti	**R4 ..	4.0	2.5	350+350	120	10/6
	**R4A ..	4.0	2.5	500+500	120	15/-
	*RA ..	13.0	0.3	250+250	50	10/6
	*RZ ..	20.0	0.2	250	75	10/6
	*RS ..	13.0	0.3	250	75	10/6
Hivac	*UU 60/250 ..	4.0	1.25	300+300	75	8/6
	*UU 120/350 ..	4.0	2.5	350+350	120	10/6
	*UU 120/500 ..	4.0	2.5	500+500	120	12/6
	*U 26 ..	13.0 or 26.0	0.6 or 0.3	250	120	12/6
	**MR1 ..	4.0	3.0	1,000	250	20/-
Imper	*5Z4 (Metal).	5.0	2.0	400+400	125	12/6
(Mercury)	*84.. ..	6.3	0.5	350+350	60	11/-
(Metal)	*6X5 ..	6.3	0.6	350+350	75	12/6
	*1V ..	6.3	0.3	350	50	8/6

H.T. Rectifying Valves—continued

Maker.	Type.	Fil. volts.	Fil. amps.	Anode volts max. (RMS).	Output mA.	Price.
	**5W4 ..	5.0	1.5	350+350	110	—
	**5Z3 ..	5.0	3.0	500+500	250	8/6
(Mercury)	**83 ..	5.0	3.0	500+500	250	8/6
	**80 ..	5.0	2.0	550+550	135	6/-
	**81 ..	7.5	1.25	700	85	15/-
	*12Z3 ..	12.5	0.3	250	60	9/6
(Metal)	*25Z6 ..	25.0	0.3	125+125	85	12/6
	*25Z5 ..	25.0	0.3	125+125	100	9/6
Lissen	**UU41 ..	4.0	1.0	300+300	80	10/6
	**U650 ..	6.0	0.5	300	40	12/6
Marconi	*MU12 ..	4.0	2.5	350+350	120	10/6
	*MU14 ..	4.0	2.5	500+500	120	15/-
	**U10 ..	4.0	1.0	250+250	60	10/6
	**U12 ..	4.0	2.5	350+350	120	10/6
	**U14 ..	4.0	2.5	500+500	120	15/-
	**U16 ..	2.0	0.25	5,000	2	20/-
	**U17 ..	4.0	1.0	2,500	30	20/-
	**U18 ..	4.0	3.75	500+500	250	25/-
(Mercury)	**GU1 ..	4.0	3.0	1,000	250	25/-
(Mercury) ..	**GU5 ..	4.0	3.0	1,500	250	25/-
	*U30 ..	26.0	0.3	250	120	15/-
Mazda	*UU4 ..	4.0	2.2	350+350	120	10/6
	*UU5 ..	4.0	2.3	500+500	120	8—
	**UU120/500	4.0	2.5	500+500	120	15/-
	*U4020 ..	40.0	0.2	250	75	10/6
(Mercury)	**MU2 ..	2.0	2.4	4,000	5	20/-
Mullard	**DW2 ..	4.0	1.0	250+250	60	10/6
	**DW3 ..	4.0	2.0	350+350	120	10/6
	**DW4 ..	4.0	2.0	500+500	120	15/-
	*IW2 ..	4.0	1.2	250+250	60	10/6
	*IW3 ..	4.0	2.4	350+350	120	10/6
	*IW4/350	4.0	2.0	350+350	120	10/6
	*IW4 ..	4.0	2.4	500+500	120	15/-
(Sc. Base)	*UR1 ..	20.0	0.2	250	75	12/6
(Sc. Base)	*UR3 ..	30.0	0.2	250+250	120	15/-
	*UR1C ..	20.0	0.2	250	75	10/6
	*UR3C ..	30.0	0.2	250+250	120	15/-
	**HVR1 ..	2.0	0.3	6,000	5	20/-
Osram	*MU12 ..	4.0	2.5	350+350	120	10/6
	*MU14 ..	4.0	2.5	500+500	120	15/-
	**U10 ..	4.0	1.0	250+250	60	10/6
	**U12 ..	4.0	2.5	350+350	120	10/6
	**U14 ..	4.0	2.5	500+500	120	15/-
	**U18 ..	4.0	3.75	500+500	250	25/-
	*U30 ..	26.0	0.3	180 Half Wave	120	15/-
(Mercury)	**GU1 ..	4.0	3.0	1,000	250	25/-
(Mercury)	**GU5 ..	4.0	3.0	1,500	250	25/-
	U16 ..	2.0	0.25	5,000	2	20/-
	U17 ..	4.0	1.0	2,500	30	20/-
Ostar Ganz ..	*EG50 ..	250.0	0.026	250	50	9/6
	*EG100 ..	250.0	0.026	250	120	12/9
	*NG50 ..	100–150	0.044	150 (V.D.)	100	15/-
	*NG100 ..	100–150	0.044	150 (V.D.)	100	17/6
Philco	*84 or 6Z4	6.3	0.5	350+350	60	10/6
(Mercury)	**82 ..	2.5	3.0	500+500	125	11/-
	**80 ..	5.0	2.0	350+350	125	8/-
	**5Z3 ..	5.0	3.0	500+500	250	11/-
	**83 ..	5.0	3.0	500+500	250	10/6
	**81 ..	7.5	1.25	700	85	15/-
	*12Z3 ..	12.6	0.3	250	60	10/6
	*25Z5 ..	25.0	0.3	125+125 V.D	100	10/6
	*25RE ..	25.0	0.3	275+275V.D.	100	10/6
	35RE ..	—	0.3	—	—	14/-
Philips	*1881 ..	4.0	1.2	250+250	60	10/6
	*1881A ..	4.0	2.4	250+250	60	12/6
	*1867 ..	4.0	2.4	350+350	120	10/6
	*1861 ..	4.0	2.4	500+500	120	15/-
	**1018 ..	1.8	1.8	16	200	15/-
	**1002 ..	1.8	2.8	160	100	15/-
	**2504 ..	1.0	0.08	13	—	9/9
	**1821 ..	4.0	1.0	250+250	60	10/6
	**1801 ..	4.0	0.6	250+250	30	12/6
	**1560 ..	5.0	2.0	300+300	125	22/6
	**1807 ..	4.0	2.0	350+350	120	10/6
	**1561 ..	4.0	2.0	500+500	120	15/-
	**373 ..	4.0	1.0	220	40	15/-
	**505 ..	4.0	1.0	400	60	15/-
(Side contact)	*CY1 ..	20.0	0.2	250	75	12/6
	*CY1C ..	20.0	0.2	250	75	10/6
	*CY2 ..	30.0	0.2	250+250	120	15/-
Pix	**250/60 ..	4.0	1.0	250+250	60	2/6
	**350/120 ..	4.0	2.0	350+350	120	3/6
	**500/120 ..	4.0	2.0	500+500	120	4/6
Triotron	*G4120N ..	4.0	2.0	500+500	120	9/6
	**G431 ..	4.0	0.6	250+250	30	5/6
	**G470 ..	4.0	1.0	300+300	70	7/6
	**G4120 ..	4.0	2.0	500+500	120	9/6
	**G429 ..	4.0	0.3	250	30	6/-
	**G4100 ..	4.0	2.0	750	100	14/6
	**G4150 ..	4.0	3.0	750	150	48/-
	*G2080 ..	20.0	0.2	250	80	9/6
	*G3060 ..	30.0	0.2	125+125	120	10/6
	*G3412 ..	33.0	0.18	125+125	120	10/6

TELEVISION TUBES, Etc.

H.T. Rectifying Valves—continued

Maker.	Type.	Fil. volts.	Fil. amps.	Anode volts max. (RMS).	Output mA.	Price.
Tungsram ..	*APV4200	4.0	2.0	350+350	120	10/-
	*APV4	4.0	2.0	350+350	120	10/-
	**PV495	4.0	1.0	350+350	80	10/-
	**PV4	4.0	2.0	350+350	120	10/-
	**PV4200	4.0	2.0	500+500	120	15/-
	**PV4201	4.0	2.0	600+600	180	15/-
	**PV75/1000 ..	10.0	1.0	1,000+1,000	75	—
	**PV100/2800 ..	4.0	2.2	2,000+2,000	100	168/-
(Mercury)	**RG250/1000 ..	4.0	3.0	1,000	250	—
	**V20/7000 ..	4.0	2.3	7,000	20	16/-
	*V30	30.0	0.2	275	120	10/-
	**80	5.0	2.0	400+400	125	7/-
	**81	7.5	1.25	750	110	17/6
	*25Z5	25.0	0.3	125	100	13/-
	*2575	25.0	0.3	250	120	13/-
362	**RB350/80 ..	4.0	1.5	350+350	80	7/6
	**RB500/120 ..	4.0	2.0	500+500	120	10/-
	**RB650/250 ..	4.0	4.0	650+650	250	15/-

METAL RECTIFIERS—H.T. TYPES

Maker.	Type.	Max. smoothed. D.C. output.		Max. current output mA.	Max. A.C. input.				Condensers.		Price.
					Half wave.		Full wave.				
		Volts.	mA.		Volts.	mA.	Volts.	mA.	Capacity of each (V.D.)	Working voltage, D.C.	
Westinghouse ..	HT5	120	20	30	135	30	80	60	4 mfd.	200	12/6
	HT8	250	60	60	375	90	200	200	4 mfd.	350	18/6
	HT9	300	60	60	—	—	240	200	4 mfd.	400	21/-
	HT10	200	100	100	250	150	150	300	8 mfd.	250	21/-
	HT11	500	120	150	—	—	300	550	6 mfd.	500	35/-
	HT12	200	30	40	250	80	140	120	4 mfd.	200	17/6
	HT13	150	25	40	150	40	—	—	Res. condr. 8 mfd.	350	17/6
(May be used in series for high voltage work.)	H1	3.6	10	10	3.5	15	—	—	100mfd.	12	4/2
	H10	36	10	10	35	15	—	—	10 mfd.	50	4/6
	H50	180	10	10	175	15	—	—	2 mfd.	250	7/10
	H100	360	10	10	350	15	—	—	1 mfd.	500	12/4
	H176	650	10	10	620	15	—	—	0.5mfd.	1,100	20/-
	J10	80	2	2	74–80	3	—	—	10 mfd.	250	4/6
	J50	400	7	2	370–400	3	—	—	2 mfd.	650	7/10
	J100	800	2	2	740–800	3	—	—	1 mfd.	1,250	12/4
	J176	1,400	2	2	1,300–1,400	3	—	—	0.5mfd.	2,000	20/-

WESTECTORS

Maker.	Type.	Class.	Max. safe input voltage.	Max. Current output.	Price.
Westinghouse ..	W4	Half-wave	24v. peak carrier ..	0.25 mA	5/-
	W6	Half-wave	36v. peak carrier ..	0.28 mA	5/-
	WX6	Half-wave	36v. peak carrier ..	0.12 mA	5/-
	WM24 ..	Full-wave centre tapped	24v. each side of C.T. ..	0.5 mA	10/-
	WM26 ..	Full-wave centre tapped	36v. each side of C.T. ..	0.5 mA	10/-

BARRETTERS

Maker.	Type.	Current (amps.).	Voltage range.	Price.
Ediswan	24	1.8	7–21	5/- (net)
	19	0.75	20–45	6/- (net)
	25	1.15	12–28	5/- (net)
	18	1.9	14–40	6/- (net)
	17	2.8	12–32	7/6 (net)
	26	5.8	3–9	7/6 (net)
	27	12.0	5–15	17/6 (net)
Marconi	301	0.3	138–221	8/6
	302	0.3	112–195	8/6
	303	0.3	86–129	8/6
	304	0.3	95–165	8/6
Osram	251	0.25	100–180	12/6
	301	0.3	138–221	8/6
	302	0.3	112–195	8/6
	303	0.3	86–129	8/6
	304	0.3	95–165	8/6
	202	0.2	120–200	8/6
Philco .. — ..	301	—	—	12/6
Philips	1904	0.1	40–70	12/6
	1933	0.1	50–160	15/-
	1927	0.18	60–120	12/6
	1928	0.18	100–210	15/-
	C1	0.2	90–230	10/-
	1920	0.25	40–70	12/6
	1934	0.25	85–195	15/-
	1941	0.3	100–240	15/-

TUNING INDICATORS

Maker.	Name.	Type.	Operation characteristics.	Price.
Brimar ..	Tunograph	Cathode ray ..	Fil. 1.0 amp., .6 volts; min. plate volts, 180	17/6
Cossor ..	3180 ..	Neon	145-160 volts to maintain striking	4/-
	3184 ..	Neon	145-160 volts to maintain striking	4/-
Mullard ..	TV4 ..	Electron beam	Heater 4v, .2 amp; max. live and target volts, 250; —Vg 0–10 volts.	17/6
Osram ..	Tuneon	Neon	Striking volt., 165 approx.; cover volt., 180 approx.; current at commencement of glow, 0.15 mA approx.; normal operating current, 1.4 mA approx.	4/-
	Button-Tuneon	Neon	Striking volt, 180 approx.; extinguishing volt., 165 approx.; normal operating current, 0.5 mA approx.	2/6

CATHODE RAY TUBES

Maker.	Type.	Heater volts.	Heater amps.	Deflection.	Max. anode volts.	Screen colour.	Screen dia. mm.	Price.
Cossor ..	3232 ..	0.6	1.25	Double electrostatic ..	3,000	Five alternatives	133	£7 10
	3233 ..	0.6	1.25	Do.	3,000	to all models.	133	7 10
	3236 ..	0.6	1.25	Do. Split deflector plates	3,000	These are types	133	7 10
	3234 ..	0.6	1.25	Single electrostatic with one split deflector plate	1,500	J, light blue; E, red; G, long	100	4 15
	3237 ..	0.6	1.25	Double electrostatic with one X and one Y plate split	1,500	delay blue-green; H, sepia; and K, black and	100	4 15
	3271 ..	0.6	1.25	Double electrostatic ..	3,000	white.	150	8 8
	3276 ..	0.6	1.25	Do.	3,000		150	8 8
	3274 ..	0.6	1.25	Do.	4,000		240	12 12
	3272 ..	0.6	1.25	Do.	4,500		325	15 15
	3273 ..	0.6	1.25	Single electrostatic ..	6,000		133	12 12
Ediswan	5H ..	2.0	1.0	Double electrostatic ..	1,000	Blue or white ..	140	8 8
	7H ..	2.0	1.0	Do.	3,500	Do. ..	170	10 10
	10H ..	2.0	1.0	Do.	3,500	White	250	12 0
	12H ..	2.0	1.0	Do.	6,000	White	300	15 15
Mullard	6001 ..	4.0	1.0	Double electrostatic ..	6,000	Green	220	12 12
	4002 ..	4.0	1.0	Do.	1,000	Green	95	6 15
	4002A ..	4.0	1.0	Do.	1,000	Blue	95	6 15
	4001 ..	4.0	1.0	Do.	2,000	Green	160	8 8
	4001A ..	4.0	1.0	Do.	2,000	Blue	160	8 8
	E42/G6	4.0	1.0	Do.	2,000	Green	160	8 8
	E42/B6	4.0	1.0	Do.	2,000	Blue	160	8 8
	E46/12 ..	4.0	1.0	Do.	6,000	White	300	15 15
	E40/G3	4.0	1.0	Do.	800	Green	70	4 15
Philips ..	3957 ..	4.0	1.0	Double electrostatic ..	1,000	Yellow-green ..	95	5 0
	3958 ..	4.0	1.0	Do.	1,000	Blue	95	5 0
	3951 ..	4.0	1.0	Do.	2,000	Yellow-green ..	160	7 0
	3952 ..	4.0	1.0	Do.	2,000	Blue	160	7 0
	3953 ..	2.5	2.1	Do.	1,000	Yellow-green ..	80	7 10
	3954 ..	2.5	2.1	Do.	1,000	Blue	80	8 10
	3962 ..	4.0	1.0	Do.	6,000	Yellow-green ..	220	15 15
	3955 ..	2.5	2.1	Single electrostatic ..	4,600	Yellow-green ..	130	24 0
	3956 ..	2.5	2.1	Double magnetic	7,000	Yellow-green ..	230	42 0
Standard	4050AG	0.75	.85—1.1	Double electrostatic ..	1,000	Green	100	5 5
	4050AB	0.75	.85—1.1	Do.	1,000	Blue	100	5 5
	4050AD	0.75	.85—1.1	Do.	1,000	Long delay	100	5 5
	4050BG	0.75	.85—1.1	Do.	1,000	Green	175	6 10
	4050BB	0.75	.85—1.1	Do.	1,000	Blue	175	6 10
	4050BD	0.75	.85—1.1	Do.	1,000	Long Delay	175	6 10

GAS-FILLED RELAYS

Maker.	Type.	Fil. volts.	Fil. amps.	Anode volts.	Anode current.	Price.
Cossor	GDT4	4.0	1.5	500	20 mA	50/-
Marconi	GT1	4.0	1.3	1,000	0.3 amp.	40/-
	GT1A	4.0	1.3	300	0.2 amp.	50/-
Mazda	T11	4.0	1.2	700	300 mA	35/-
	T21	4.0	1.2	200	300 mA	60/-
	T31	4.0	1.5	400	300 mA	35/-
Osram	GT1	4.0	1.3	1,000	.3 amp.	40/-
	GT1A	4.0	1.3	300	.2 amp.	60/-
	GT1B	4.0	1.35	120	2 mA	20/-
Standard	4039A	4.0	1.0	500	100 mA	40/-

CALCULATING MAINTENANCE INSURANCE PREMIUMS

What "premium" should dealers charge for undertaking to service for 12 months the sets bought by their customers? To fix an excessive premium may mean loss of set sales as well as service work. Too low a premium will involve loss of profit.

The average sum spent on set maintenance by regular customers for the previous year is the soundest basis on which to found an insurance premium.

A dealer should total the sums paid for set maintenance during the previous 12 months by all his regular customers. This figure should represent a profit on the work undertaken. If experience has shown it to be uneconomic, an addition should be made to bring it up to a profitable level.

An allowance should also be added for the cost of repairs and renewals which customers ought to have put in hand but did not. When customers pay cash for set maintenance, they have only the most urgent jobs attended to. If they are taking service on a subscription basis, they will expect their sets to be maintained in first-class fettle.

The total joint expenditure on set maintenance must be divided by the number of customers it covers, to ascertain the average spent by individuals.

This number must not include customers who had sets but did not call for service. To include them would greatly reduce the average, and we shall see that the profits from the scheme would be endangered.

Suppose a dealer had 400 customers, of whom 300 required set maintenance of various kinds during the year, and that the total they spent was £195. That would be 13s. a year per customer, or 3d. a week; and 3d. a week is the minimum premium which the dealer should charge in order to make his insurance scheme profitable.

I do not suggest that 3d. per week is a safe premium for all dealers to charge. It is merely an illustration.

If the dealer retains his 400 customers he will actually receive in maintenance premiums next year 400 × 13s., or £260. This additional income, as compared to the £195 received in the previous year, is necessary in case customers are more exacting next year than last, and to enable him to give a no-claim bonus.

To take 3d. per week—or any other premium—from new set buyers may make them feel that they are paying for a benefit which they should have no cause to require. A "no claim" bonus is the solution.

To offer such a bonus will also discourage customers from claiming on the service insurance fund for trivial items.

What should the bonus be? Another formula is required.

Deciding the Bonus

This formula is provided by multiplying the average annual customer-expenditure on service by the number of customers whose sets during that year needed *no* maintenance and dividing the product by the *total* number of customers, including those whose sets needed attention and those whose sets did not.

In computing the figure of 13s. average expenditure quoted above, the dealer included 300 customers who called in his service during the year, and he had 100 who did not. To ascertain the rate of no-claim bonus he should multiply 13s. by 100 and divide by 400. That gives him a no-claim bonus figure of 3s. 3d., or 25 per cent. of the premium.

This, again, is only an illustrative figure. Only the individual using this formula can determine his own rate of bonus.

In the example we have taken, if the whole 400 customers came into the insurance scheme, there would be a maintenance income of £260. And if the same proportion as formerly required no service and made no claim on the insurance fund, then no-claim bonuses amounting to 100 × 3s. 3d. would be paid, i.e., £16 5s.

When this is deducted from £260, it still leaves the dealer an ample margin to cover a very possible rise in the average cost of maintaining customers' sets.

If a customer should express dissatisfaction with the no-claim bonus, the dealer should point out that, with possible valve replacements, the actual cost of maintenance during the next year may easily be considerably more than the premium.

In the Books.

In his books, the dealer should keep a separate record of his maintenance insurance fund. This will show all premiums received and the cost of all "claims."

At the end of the year he will then be able to see whether or not the scheme is showing a fair margin of profit.

The premium should only be lowered, or the no-claim bonus raised, when computations on the basis of the formulæ quoted above show that the figures are no longer in tune with the cost of maintaining sets.

SIMPLE SERVICE COSTING

Does service pay? Does your service department pay? You can find out quite simply, without complicated records and hours of extra work. You need only a job sheet for every job, and an analysis book.

The engineer, in making out his report, puts down all the information necessary. It only has to be sorted out.

On page 118 is a job sheet that provides all the facts for costing, invoicing, analysis and future reference, but is still simple and straightforward.

The customer may have to be shown the sheet, so the firm's name is at the top with a sheet serial number. There follow, of course, spaces for the customer's name, address and 'phone number, the make and type of the set, and service instructions.

All that part is filled in by the assistant who takes the customer's service order.

Then follows the engineer's section. On one side he puts down the date and his times, and the number of journeys made, and extends the total hours and minutes of each time to the time column, totalling it at the end of the job. Town dealers may not require the journeys column, but in the country mileage has to be charged, and it is not possible to do every job with only one journey.

Side by side with the time and journeys space is one for materials, also filled up by the engineer, and priced by him or by the office, as suits your organisation.

Lastly there is the office section. The total cost to the customer has four parts: labour and journeys, materials (wire, etc.), replacements (valves, batteries, components), and outside work (builders' or manufacturers' charges). If an outside firm has been employed their name and charge is entered, and the cost to the customer put in.

It is well to use code for the outside firm's charge to you. The figures are entered under their correct sections and totalled; an invoice is made out and sent and its number recorded on the job sheet.

That completes the matter as far as the customer is concerned. The job is finished, he has received an invoice setting out what he has had done, and what he has to pay. If he does not approve you will hear about it quickly, and you can clear the query up right away.

Before we go on to the analysis, this is what happens to the sheet after the office has finished with it. It is returned to the service room, and is kept there in an ordinary double arch file.

Sheets are filed alphabetically under customers' names, and all sheets belonging to one customer are held together by an ordinary wire paper clip on the outer edge. The latest sheet is always on top, and so at a moment's notice the whole history of a set is available, right back to when it came from stock.

At the same time as the job is priced, it is allocated, either as a chargeable job, or one done for sales (a demonstration, or work on a stock receiver), or as a guarantee job for which no charge is to be made to the customer, or as an unchargeable one. This category covers, in general, work which has to be done at no charge for reasons of goodwill, and is a useful guide to the reliability of your service men's work. Ideally, of course, it would never be used.

Allocation is effected simply by putting a stroke through the appropriate letter of the four (C., S., G., U.) at the bottom of the form.

The analysis is shown on page 119. Eleven columns are used, and the headings are those we already have on the job sheet. As the sheets are completed they are sent to the office and eventually entered in the analysis, the page number being put on the sheet to show that it has not been missed.

At the end of the week the columns are totalled and a balance made up in this way :—

Gross receipts are :—

(*a*) Total receipts for labour and journeys.

(*b*) 33⅓ per cent. of receipts for material.

(*c*) 25 per cent. of receipts for replacements.

(*d*) Total charges for outside work.

Of course, if it is desired, the gross profit on material and replacements may be ascertained more accurately, but for the ordinary business it is questionable whether the extra time required is justified. The approximation has been found to be very close.

Outgoings are :—

(i) Wages.

(ii) Charges to service department for electricity, depreciation, use of car or van.

(iii) Expenses, including postages, fares and outside work.

The difference between these two tells you whether you have made a profit or loss in actual cash on the week's completed work. The hang-over of uncompleted work from one week to the next is ignored. To adjust for it each week would take too much time, but it can readily be done at the end of an accounting period.

The figures reached above are the actual cash figures, but the service department should receive full credit for the work it does for the sales side. After all, if you

SERVICE COSTING

had no service men you would have to pay outsiders for the work they do on stock receivers.

Eventually charges should be so adjusted that the whole of the service department's costs are borne by the receipts for work done for customers.

Once you have this analysis in being, you will find an hour or so a week sufficient time to give you a reliable picture of your service department's profits. A very little experience will suggest modifications to suit your individual business, and it will not be long before you find ways and means of making your service department a permanent financial asset, instead of an intermittent liability.

SPARKS & CRACKLES, LTD., WIRETOWN.

Name..... Sheet No.....

Address.....

Make and Type of Set..... Phone No.....

SERVICE INSTRUCTIONS Date.....

Date.	Morning.	Afternoon.	Journeys.	Total Time.	Materials.			

	£ s. d.		
Labour and Journeys		Outside Work	
Replacements		Name	
Materials		Cost to Us	
Outside Work		Cost to Customer	
		Expenses	
C. S. G. U.		Invoice No. Analysis	

The job sheet upon which the simple service costing scheme, outlined in this and the previous page, is based. Both the invoice and the analysis are made out from the information collected on this sheet. For details of analysis, see opposite.

Service Costing (*cont.*)—Weekly Analysis

WEEK ENDING FEB. 17.

Date.		Total charge.	Labour and journeys.	Replacements.	Materials.	Outside work.	Expenses including outside work costs.	Total time.	Time chargeable.	Time sales.	Time guarantee.	Time unchargeable.
		£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.					
12	Smith, 1234 ...	15 9	2 3	12 6	—	—	—	30	30	—	—	—
12	Jones, 1237 ...	—	—	—	—	—	—	1.35	—	1.35	—	—
12	Brown, 1231 ...	1 2 3	7 9	—	8 3	7 3	5 0	2.35	2.35	—	—	—
13	Green, 1235 ...	—	—	—	—	—	—	45	—	—	45	—
13	Smith, 1240 ...	—	—	—	—	—	—	—	30	—	—	—
		15 17 9	8 16 3	4 8 5	2 5 10	7 3	8 7	61.45	42.10	15.20	3.10	1.05

Receipts.

	£ s. d.
Labour and Journeys	8 16 3
25 per cent. replacements	1 2 1
33⅓ per cent. materials...	15 3
Outside work	7 3
	£11 0 10
	7 12 11
	£8 7 11 profit on week.

Outgoings.

	£ s. d.
Wages	5 18 4
Electricity	3 6
Depreciations	7 6
Van	15 0
Expenses	8 7
	£7 12 11

Here is the ruling for a week-by-week analysis of what service is costing you. The entries are made from the job sheet (shown on previous page) and at the end of the week the Receipts and Outgoings are balanced, as shown below the analysis, to ascertain whether or not a profit is being made.

DRAFT SALES LETTERS

A sales letter for every week of the year is included in the following budget of 52 draft circulars. Many are absolutely fresh; some are new versions of tried and tested favourites that are proved pullers. At the end (page 126) are half-a-dozen debt-collecting letters.

Accumulator Delivery.

DEAR SIR,—Carrying that heavy accumulator to a shop to have it charged is finished. Let us know by 'phoning, calling personally or by means of the enclosed postcard, and we shall be pleased to collect your battery at any time you wish.

A badly handled accumulator wears out much more quickly than one that is properly looked after. So you see it pays to go to a reliable man, and as I am specialising in battery recharging I think I can claim to be able to deal efficiently with your battery if you will give me a trial.

Now when can we call for your accumulator? We can redeliver it properly charged in three days, and you cut out all the carrying.

All-Wave Sets for Winter.

DEAR SIR,—With the autumn and winter before us, indoor entertainment takes a prominent place in our thoughts. The cheapest and most enjoyable form is listening to the radio.

This is more than ever the case now that all-wave sets literally bring the broadcast programmes of the whole world into the home.

The new 1937–38 sets, many of them including the short wavelengths, are so remarkably efficient, cost so little, and can be purchased on such easy terms, that I feel sure you would be glad to hear one in your own home.

During the next few days I hope to call upon you and to be able to give you a demonstration of the treats in store for every listener who owns a modern set.

I should also like to draw your attention to the fact that a large range of components, batteries, etc., is always in stock at my shop, and also that repairs are carried out well and at little cost.

Bargains for Special Customers.

DEAR SIR,—As a privileged customer, you should certainly have the chance of a bargain when we have some going.

Accordingly, we are sending you with this letter a list of the decontrolled and second-hand bargains which you can examine, reserve or purchase any time this week. *The general public will not see them until Monday next.*

Everything listed is in working order; your money back if it is not. Of course, absolutely new apparatus is better, but the condition of the bargains is accurately given in the list.

We only have a clear-out like this at long intervals; we prefer to sell fixed quality goods at a fixed price. So if you want any of the few odd pieces we have accumulated, it is "now or never."

P.S.—Some of the new stuff we are making room for is worth seeing. In particular, the new . . . should interest you.

Best Sets for the Best People.

DEAR SIR,—Have you noticed that the best things in the world are always very cheap and reasonable? Air, water, sunshine, radio— everyone enjoys them.

The wise man, however, is he who sees that he gets the best quality possible in these things that are admittedly among the major blessings. Are you one of these—if you don't mind a personal question?

One way to judge is to take a look at your radio set. Is it constantly used? Is it one of the latest models? Does it bring you everything you could desire that is available in the world of ether?

Worth thinking about, because there is no doubt that an hour's radio—the cheapest entertainment you can have—provides fare which, whether it be simple or rich, is very often absolutely incomparable.

Is your set—let's face it—the best possible for bringing this repast of entertainment to your home? Perhaps the best way to decide is to compare it with another. Well, when may I bring one along to do this?

Buy Locally.

DEAR SIR,—Have you reckoned out how much extra it would cost you to buy radio in Blanktown than the same set locally? Of course, the list price is the same.

There are fares to Blanktown and back. If you take advantage of the hire-purchase system, these are extra to every instalment you go into town to pay.

Apart from this, we give full servicing during the guarantee period and two days' free trial of any set, mains or battery.

May we have the pleasure of leaving a set for your approval, free, for two days? Modern radio is a great boon in the home, especially in winter time.

Car Radio Demonstration.

DEAR SIR,—It is hard to stay indoors this weather. You want to be out driving, delighting in the countryside and the cool breeze.

The trouble is that so often there is something good on the wireless. If you go out you have to miss it.

Why not enjoy both pleasures at once? I have just fitted my own car with radio, and I have been amazed at the increased delight the family and I obtain from motoring.

As a fellow motorist, I would like you to know what a boon car-radio is. May I take you for a little run round one evening and demonstrate it? Let me know when it is convenient and I will call and collect you.

Christmas Selling.

DEAR MR. . . .,—This little letter is sent by me to wish you a very happy Christmas and a prosperous New Year.

As I walk through the streets and see the brightly lighted shops with their seasonable displays, the spirit of Christmas grips me more and more. I expect that you are feeling in just the same way about it and looking forward to a thoroughly enjoyable time.

There is to be great revelry on the radio, you know. The festive season programmes are too good to be missed. How about your radio? Are you all set for making the most of all these treats?

There are two exceptionally good ranges of radio receivers_____and_____ each of which are stocked and serviced by myself. They are a revelation of what splendid results can be obtained with modestly priced radio.

Can I demonstrate a set from one of these ranges to you? If you would call, or drop a line, I shall be pleased to arrange to bring a set to your home at your convenience.

Christmas Set Sales.

DEAR SIR,—When you are busier than ever at Christmas, as many of us are, the pleasant task of thinking out a gift to suit each member of the family becomes sometimes a worrying task.

It is easy enough for a woman with time to do a lot of shopping. But what is a man to do ?

My solution is that he should buy something to suit the whole family. One gift for all of them. A radio set or a radiogram answers this purpose admirably, and they not only give pleasure at Christmas, but all the year round.

Can you spare a few moments to look in at our showroom ? Or would you like to phone or write us, and then let us bring you along a set to be demonstrated in your own home.

Either way will ensure your getting what we are wishing you—a Merry Christmas and a Happy New Year.

Club Method of Buying.

DEAR SIR,—The hours of enjoyment and instruction radio brings—of course you want it. What you do not want is a hole in your pocket after you have paid for a new set.

This is the reason our Home Entertainment Club has been formed—to enable you to promise yourself the Christmas present you want and know that you will not miss the money.

On becoming a member of the Entertainment Club you choose the set, gramophone, radiogram, records or whatever you want. Particulars of these are then placed on our special register and you are given a Payment Card.

Odd sixpences and shillings are paid in on this card from time to time so that at Christmas you have very little if anything more to pay. If there is anything to pay, we can always arrange easy terms.

The sooner you enrol the better, for you will have more money in the Club when the time comes if you join early.

Coronation.

DEAR SIR,—The broadcasts of a life-time will take place next month when King George VI is crowned.

This is an historic occasion. It is the first Coronation ever to be broadcast. It is something you must listen to, or feel always that you missed the biggest radio programme ever.

Now, how are you fixed for receiving the programmes. Is your set reliable ? Is it a new one or are you thinking of getting something new ?

Frankly I want you and everybody in this area to have an unparalleled radio service next month, so this is what I am offering.

1.—A Coronation Service Overhaul. This means that your set is thoroughly cleaned and brightened up for 7s. 6d. Any repair work is, of course, extra—but at a moderate charge.

2.—Coronation Hire-Purchase Scheme. A brand new set which will bring you in everything that can be desired. The first payment on this can be low, the weekly instalments only a few shillings. Probably the part exchange value of your old set will pay the first deposit for you.

Now which of these plans will you adopt ? Let me know early, please, because there is not much time now and there is plenty to be done.

Coronation Television.

DEAR MADAM,—You can see the Coronation Procession next month, even if you cannot go to London.

It is being televised, you see. And we are making special arrangements to receive the television broadcasts of the procession in our shop (or special hall) on day at a.m.

To a special few of our customers we are extending an invitation to come and see this unique programme. Would you like to be one of those who do ?

Please fill in the postcard herewith, or call or phone during the next few days.

D.C.-A.C. Changeover.

DEAR SIR,—There is no need to wait unti the changeover in electricity supply before getting that new radio set you have been promising yourself so long.

Some of the best sets to-day work equally well off either A.C. or D.C. So you can have a brand new set and laugh at the electricity supply people's antics.

To fit the immediate needs of the people of this district, I have got in a big selection of these universal sets, and I would very much like you to see them.

A few shillings down, a few shillings a week and you not only have a new set, but you can forget all about the changeover worry. Now, won't you come along and pick out the set you want one evening soon ?

D.C. to A.C. Changeover Trouble.

DEAR SIR,—Are you one of them ? A number of people have been wondering what to do about the recent announcement that our local electricity supply is to be changed from D.C. to A.C. at some future but indeterminate date.

You see, they wish to buy mains radio receivers, but, very reasonably, they do not wish to spend good money on something that may be rendered useless shortly afterwards. A D.C. set may be useless in a week or so ; an A.C. set may be no good for months yet. What are they to do ?

The complete solution to the problem lies in the universal mains sets which work off either A.C or D.C. equally well.

One of these receivers would give you the benefit of mains reproduction now, and would work just as well after the changeover. If you moved or went away to stay anywhere, it would suit any district you went to—provided there was electricity there.

The date of the changeover here is very indefinite, but you can quite easily make a definite date to have one of these universal A.C./D.C. sets demonstrated in your home.

Demonstration Invitation.

DEAR SIR,—The question of distance is a funny thing really, isn't it ? As you sit by your fireside, and I sit by mine, we may be only a mile or two—even a matter of yards—apart, and be as separate as though the world divided us. Yet each of us may be listening to the same Radio programme sent from thousands of miles away.

"All the world's our stage" to-day. Modern radio, by a simple turn of a knob, brings station after station flooding into the room. Drama, humour, symphony or swing—what you wish for is yours to command.

And you get this for a few pence a week. As little as 12s. a month will buy this receiver.

The leaflets enclosed will give you some idea of the possibilities of 1937 radio. These receivers are not only most efficient in their selectivity and tonal qualities, but are really beautiful pieces of furniture.

May we demonstrate some of them to you in your own home? We can promise you some enjoyable entertainment—and you will not be under the slightest obligation.

Demonstration. Follow-up 1

DEAR SIR,—We are sorry not to have heard from you yet with reference to the letter we sent a short time ago.

If you realised the special treats which you have missed in the interim, we are sure that you would not have delayed in sending off to us for a demonstration of the wonderful 1937 radio.

Do not imagine that it would place you under any obligation. Naturally, when you hear the music of Europe flooding into your room, we hope that new radio will find a permanent place in your home—especially as it costs so little to run, and can be bought for as low as 12s. a month.

A card from you, or a call at our showrooms, will easily arrange for a demonstration at your convenience. Why not write for it *now* ?

Demonstration, Follow-up 2.

DEAR SIR,—Why ? That was the question which flashed across my mind this morning, when I saw that you have not yet replied to our offers of a free demonstration, in your own home, of modern radio.

You incur no liabilities by arranging for one. We have Demonstration Engineers always on the road. They are always ready at your call. And this new radio offers so many advantages at very small cost, both as to outlay and maintenance.

When may we call and show you by actual demonstration what treats you are missing ? Please write, or call, speedily.

Die-hards With No Radio Set.

DEAR SIR,—There's radio for the rich, for the poor, for the ordinarily well-off ; there's radio for the bedridden, for the blind, and even for the deaf ; there's large and small radio, there's loud and soft radio. Millions have it in their homes, yet one or two folk in every town are still without.

Every year radio becomes a bigger and better bargain. The B.B.C. last year broadcast a total of 70,000 hours of programmes. Thousands of people enjoyed every hour !

Think, too, of all the special historical occasions that were the subject of broadcasts. Think of the famous people who spoke at the microphone, from members of the Royal Family downwards. There is hardly a figure in public life who does not broadcast ; hardly one who does not listen, too.

You have probably heard all this before ; perhaps sometimes even decided to have a set—nearly. Well, actions speak louder than words. What do you say to the offer to loan you one for an evening ? I shall be pleased to do this if you will allow it.

Perhaps next time I am passing you will tell me a time when I can bring the receiver along for you to try.

Electrification Follow-up.

DEAR SIR,—What a wonderful convenience you must find your newly installed electric light to be. And what pleasurable and labour-saving opportunities having electricity in the house opens up for you !

Best of all is that you can have your radio regularly without any messing about with accumulators. The reproduction will be always of the best—never fading out "because the battery is running down." There will be no need for new H.T.s and you will be able to switch on at any moment you please. *That is if you take your chance of getting a mains set now the opportunity has at last arrived.*

This does not mean that you will lose the value of your present receiver. If it is any use at all, it probably means that you now have the chance of getting a new mains set at a replacement price by part-exchanging your existing instrument. The sooner you do this, of course, the better allowance you will get for your old receiver.

A wide range of the best mains sets are available for you to see any time at our showrooms. Come and select one you think the family would like, and we will willingly give you a demonstration in your own home.

Enquiring Answer.

DEAR SIR,—Very many thanks for your kind enquiry, in response to which we have pleasure in forwarding printed matter dealing with some of the finest radio on the market to-day.

These models bring you the pick of the world's entertainment. By just the flick of a finger you can range at will, selecting a programme to match your mood.

May we prove this to you by giving you a free demonstration in your own home ? If you will write or call, we shall be pleased to do this at any time convenient to yourself.

Trusting to have the pleasure of hearing from you shortly,

Extension Speaker.

DEAR SIR,—Radio programmes are like politics—they are always the subject of argument. But the biggest argument of all with wireless is when one person wants to listen and another wants quiet.

A solution which you have probably thought about occasionally is to have an extension-speaker in another room. You are quite right, it is a practical idea and well worth the small expense involved.

Just think for a moment how convenient it would be if you could listen in another room downstairs, or in your bedroom, or even in the garden in warm weather. You could get away from the rest of the family and concentrate (or laze) just as you pleased.

We do not want to swamp you with literature, but here is one leaflet which gives all the "dope." We shall be pleased for you to hear one of the speakers illustrated, if you care to call.

Foreign Travel by Radio.

DEAR SIR,—Travel broadens the mind, we are told ; what the wiseacres do not mention is that it also shrinks the purse.

Nevertheless, we all long for the adventure of foreign travel. And because of this, we feel you will be interested in our offer of a free world tour—a tour that can be made from your arm-chair and repeated whenever you wish.

An all-wave radio receiver is both the passport and transport. Here's a specimen itinerary :—

At 8 p.m., Rudy Vallee will play to you in America. 8.30, Songs from Russia. At 9, a trip to Holland for European news in English. 9.30, how about a visit to Milan for the opera ? Then Eastern News (in English again) from Tokio. Later, back to England for dance music and Big Ben telling us it's bed-time.

Would you like to try it ? Well, we are willing to lend you an all-wave set for an evening's home demonstration any time you like, without any obligation.

Come into the shop and let us know when we can arrange it for you.

Goodwill Letter to Follow Complaint.

DEAR SIR,—Are you quite happy now over the trouble with your . . . that was annoying you so much when you called us in recently ?

Naturally, I personally want to see any customer of ours absolutely satisfied with his radio, mainly because I think it is dishonest to sell anybody something that does not do its job. But apart from that, a satisfied customer is the best advertisement a business can have, *and I want you to be one of the assets of this business.*

From this you will see that I really mean it when I say that I shall be grateful if you will call in immediately if you have any further trouble. I hope and trust, however, that this will not be necessary. Your present installation should be good for . . . months, and maybe even more. But that is just a tip, not a guarantee.

P.S.—If you are going to replace a thing, do so while it is still in good going order. That is a rule of mine ; it means that you can get a useful part-exchange allowance.

Holiday Overhauls.

DEAR SIR,—When you come back from holiday you'll be feeling fine. How will your radio set be looking ?

Radio is so much an everyday service that it is difficult to find an occasion to have your set overhauled without being inconvenienced by its absence. But your holiday provides the ideal opportunity.

We are doing a special holiday overhaul at a moderate fee of 00s. This includes all the tuning, cleaning and polishing possible on a radio set, but obviously any big repairs are extra.

May we collect your set the day you go away and return it refurbished when you return ? If it is working now, this should put it on its feet for the winter, and is well worth doing.

Of course, we shall not rush you into any big charge. No job outside the overhaul will be done without your O.K.

H.P. Advantages.

DEAR SIR,—You can have the newest and most luxurious radio set or radio-gramophone whenever you like to say so—that is what it amounts to.

You see this "painless extraction" business of hire-purchase only means three or four shillings a week, and an initial payment of about a pound. So why should one not have the ideal instrument for making the most of the 10s. bargain the B.B.C. offers us in a year's programmes?

Something down, and then a few shillings per week. Think of that when next you pass our windows, come in if you wish, and hear one of the latest all-wave sets working.

It is an all-wave receiver that brings in distant countries—America, Australia—as well as the ordinary broadcasts which you should get. May I bring one to your home to demonstrate, or will you call at the shop?

H.T. Reminder, Plus a Suggestion.

DEAR SIR,—The H.T. is getting a bit low! No; we did not overhear you, but your battery is three months old this week, and that is a respectable age for a radio battery.

We can supply you with a new one from stock. Pleased to deliver it, if you wish. But if you can call, you will have a chance to see the new extension speakers we have just received.

They give you radio in every room. They give it to your wife, too, and surely she likes to house-work to music?

Anyhow, ask to see and hear them. We will demonstrate you one here in the shop or in your own home—just as you like.

Local Radio Show.

DEAR SIR,—All roads lead to the . . . Radio Exhibition on September —, yet there is only *one* road that will take you to the stand showing—

A COMPLETE RANGE OF SO-AND-SO RECEIVERS.

That stand is Stand No. (?)—bearing the name of . . . —your local So-and-so agent.

In order that you may hear and enjoy these peerless instruments, we take pleasure in enclosing complimentary tickets for the Exhibition.

When you arrive, make straight for our stand, where we shall be delighted to demonstrate any model in our private demonstration room.

Please accept this invitation without any obligation whatever on your part. But please come along and see us at the Show.

Mains Set to Replace Battery Set.

DEAR SIR,—Your accumulator had to be "spring-cleaned" last time you sent it in for charging; frankly, it is getting a bit old. There are weeks of life in it yet, with luck. But we thought we would break it to you gently that something will shortly have to be done.

Another accumulator is the cheapest way out of the trouble. We shall be pleased to supply one fully charged and ready to use when and if you want it.

But, as you have probably been thinking, the cheapest way in this case may not be the wisest. Well, why not look closer into that idea of having a mains receiver now this opportunity has arisen?

Call in with the accumulator yourself sometime and have a look round some of the snappy instruments in our showrooms which run without fuss off the mains. One of them installed in your home would give a new brightness to the drawing-room, and a new interest to your evenings indoors.

You can have a "sample" if you like! Not a sample set, of course; they are not packets of tea. But a sample evening with a receiver on no-obligation demonstration for the night.

National Sporting Broadcasts.

DEAR SIR,—Is your set in good working order for the broadcast of the Boat Race (Grand National, Big Fight) on —— day at —— o'clock in the afternoon?

This is one of the most thrilling radio events of the year, and one which I am sure you will want to hear unless you are lucky enough to be going to the actual event.

We can get your set going in 24 hours if you are in urgent need of service.

If you have no receiver you are welcome to come along to the shop to listen. We will loan you a set for the occasion for a moderate fee. Or better still, why not have one on demonstration with the idea of purchasing it if it pleases you?

Best of all, of course, is to buy a receiver now. If you pay the first instalment in the next two days, we can have it installed and working for you in time for the big broadcast.

Now what are you going to do? You certainly must not miss this outstanding broadcast.

New House Owners.

DEAR MADAM,—Your new house looks very nice indeed, if you do not mind my mentioning the fact. I have frequently noticed it when passing.

Now that you are settled in, have you got time to consider a suggestion? It is this: have a radio set to do justice to your home. It is even possible to match up the set with existing furniture if you wish. And the newest of sets only cost a few shillings weekly now.

Second, have an aerial system to do justice to your set. Many good sets are handicapped by having only a poor aerial to "feed." them. Many smart houses are made to look less smart because of a ramshackle aerial.

Think it over, and come along and see the picked sets in our showroom. Then if you decide to get a set to come up to the level of smartness of your new home, we will arrange it all on hire-purchase (aerial as well) so that it will be almost "painless extraction"!

New Management.

DEAR SIR,—If you have been a friend of this shop in the past, we would like to say that, although the management has changed, we would like to keep you as a friend in future.

If you have never had much to do with this business, then maybe we can get on more friendly terms to our mutual advantage.

I could say all sorts of things about our new policy (specially made to fit our new premises!) but perhaps it is best expressed in this way:

We are not going to try "salesmanship" on you. But if you are thinking about buying (not being sold) radio, then we should be pleased to put our knowledge and experience at your disposal and to advise you on any radio problem you may have.

New Premises.

DEAR SIR,—I am feeling very flattered!

Ever since I moved from my old shop, customers have been saying nice things about the roominess of my new headquarters at . . .

What with these congratulations and the knowledge that this removal was necessitated by the growth of my business, I'm starting off with a happy heart.

Many of my old customers have already been to see me, and I take this opportunity of assuring you of a warm welcome if you, too, will pay me a visit.

You will find the same willing service awaiting you—plus the added efficiency of better accommodation, and an even wider range of radio goods.

Part-Exchange Offer.

DEAR SIR,—How would your family like a complete new . . . radio set, with the new . . . and the . . . features, all complete but at a partial price?

No ; this is not a fairy story, nor a catch, nor a disreputable "price-slashing" offer of goods that will not sell. It is the proposal of a perfectly straightforward part-exchange deal.

Your present receiver has a second-hand value. Later it will only have a junk value. if you wish to part-exchange it. So the obvious thing is to "do a deal" now, and have a brand new up-to-date receiver at a very reasonable price.

Naturally, we shall benefit, too. As one of our best customers, you are a real asset. You remain so as long as you are satisfied with your receiver. What we want is for you to have the latest and best set, so that you are a positive advertisement for us !

Everyone wins in this little game seemingly. Can't we do something about it ?

P.A. in Summer.

DEAR SIR,—A bright commentator, helped with music, will always brighten almost any occasion, as you no doubt know by experience.

I am certain, therefore, that I can be of service to you in connection with your forthcoming (fete, garden party, carnival, sports meeting, etc.).

I can supply apparatus which will broadcast speeches, provide record music, or relay the music of a band—all at a very reasonable figure.

May I have the pleasure of giving you a quotation please ? I shall be pleased to give you further details without obligation at any time you like to get in touch with me.

P.A. for Social Functions.

DEAR SIR,—How would you like to have Roy Fox and his Band, or Jack Hylton and his Boys playing for you at your social (dance) this year ?

The tunes on the best gramophone records, when reproduced by a first-class public address equipment, are ideal for dancing. Very often, too, such a "Radio Orchestra" is cheaper than an actual band.

So may I quote you a figure for bringing along all the best dance bands to provide the music ? Please write, or 'phone, or call and talk the matter over without obligation at any time to suit yourself.

Part-Exchange Suggestion.

DEAR SIR,—How long have you had your present radio receiver ? You probably have not realised it, but I believe it is correct to say that you bought it from us as long ago as. . . .

Radio receivers depreciate very quickly in value, but your present model still commands quite a reasonable figure. Next year, it will really start on the downward path, and it will fetch only a nominal figure in the second-hand market.

Whether you hang on to a receiver to the bitter end, or whether you replace it early by part-exchanging it for another set and so have the latest model in your home—these things are for you to decide. You will not mind my mentioning this matter to you, I hope.

If the notion does appeal to you, and I believe it does, then I shall be very pleased to show you one of the new . . . sets about which you have probably heard. The only true way to try a new set is, of course, to hear it in your own home. Why not do this, and hear the new instrument against your present model ? You could not have a fairer test than that, could you ?

Programme Points.

DEAR SIR,—Have you seen in the "Radio Times" that . . . is broadcasting next Friday night, and that there is a musical show called . . . at 10 o'clock.

On the Saturday there will be a running commentary on . . . and in the evening a Music Hall programme at . . . o'clock.

How's your radio set for these occasions ? Is it in good working order ? If you are thinking of having it brightened up, we will willingly overhaul it for 7s. 6d.

Just a little bit more than this, and you will be able to take away a new receiver. And probably the part-exchange value of your old set will pay this for you and leave only a few shillings a week to be paid in instalments.

With all these star programme items coming, why not make a new set part of your personal programme ?

Radio for Children.

DEAR MADAM,—Children to-day have one big advantage over ourselves and the way we started to learn. They have many things to help them and make learning more attractive—and the biggest of these is radio.

When we were at school, there was little chance to listen to world experts, was there ? But now radio brings the most authoritative and interesting speakers to everybody's fireside.

Are your children getting every chance to benefit by this wonderful service ? Have you a set which works well and to which they may listen ?

An idea which many people are adopting now is to have an inexpensive receiver especially for the nursery.

Is it not worth the small expense of such an instrument to enable your children to benefit to the full from the B.B.C.'s wonderful educational system of to-day ?

Radiograms and Records.

DEAR SIR,—Have you probably often wished at the end of some particularly tuneful item in the evening's programme that you could hear it again ?

A gramophone gives you that power. It will give you command performances all your own, for your favourite orchestras, singers and humorists have all recorded their best selections.

It is great fun to mingle gramophone and wireless and so make a programme exactly to your personal taste and mood.

There are three ways of doing this. You can buy a radio-gramophone (we have some in stock at only £ . . .) ; you can add a playing desk to your radio set and listen to records from your loudspeaker (£ . . . to £ . . .) ; or you can have a portable acoustic gramophone which will do also for the garden and picnics in summer.

Come and listen to all three and see which you would like.

Radio in the Garden.

DEAR SIR,—Delightful, isn't it, to spend these summer evenings in the garden with the evening paper, a pipe, perhaps a drink, and . . . Yes, something is missing—the radio.

What you need is an extension loud-speaker that you can take out into the garden and connect up in about two seconds. Other times you can use the speaker in different rooms in the house.

In effect an extension speaker is the same as a second receiver—the difference is it costs under half the price of a set !

I hope to call on you one evening with a demonstration speaker, if I may. Is there any special time you would like me to come along ?

Radiolympia Follow-up.

DEAR SIR,—The National Radio Exhibition at Olympia is ending and may have left you wondering which of the new sets are suitable for this district.

Accordingly we have prepared a special display of new instruments all suitable for this district and chosen with careful attention to local needs.

If you saw a set at Radiolympia, or have heard or read about one, please come in and examine it at your leisure. You will not be bothered about buying anything. If you have friends interested in radio, bring them along as well.

By the way, if you think of purchasing, hire-purchase brings the terms down to only a few shillings weekly—even on the most luxurious of instruments.

Recital Invitation.

DEAR SIR,—Just look at the list of artists who will be entertaining the people who come to

my concert at the . . . Hall on . . . day at . . . o'clock.

(*List of artists here.*)

There is £5,000 of talent there. They will be heard via the latest de luxe radiogram. And in addition, . . . , the famous . . . , will appear in person.

Among those who have decided to be present are . . . (names of Mayor, Mayoress, and the local celebrities). How would you like to come too?

In the hope that you will accept, I am enclosing two tickets herewith. There is no charge, but we are making a collection for the . . . Hospital, and two rows of the best seats are being sold at . . . each for the hospital. If you wish to take advantage of this, please return the enclosed tickets with the cash for the others.

Alternatively, retain the present ones, whether or not you take any of the reserved seats. But in any case, do your best to come along. It will be well worth it.

Recommendation Follow-Up.

DEAR SIR,—To be perfectly frank, I have been asking my customers for the names and addresses of friends who they know would be interested to hear the new radio sets.

You will appreciate that I cannot mention any names—but one of them has put me on to you.

When can I bring along one of the latest sets and demonstrate it in your home? If you will tell me some of the kinds of music you are interested in, I will pick out a special broadcast for you.

Out of fairness to yourself I think you ought to hear one of the new sets. Yes, even if you have already got a receiver. What about it?

Records for Christmas Presents.

DEAR SIR,—What would make a better present this Christmas (most people give themselves presents, too!) than gramophone records.

It is foolish to attempt to describe the new discs in a letter. But I am enclosing the latest lists, which will give you some idea of the riches of music that await the music lover.

You can have a single record costing only shillings, or an album which is expensive but which justifies the expense.

If there is any special kind of record you want, we shall be pleased to make some suggestions. If you care to call in, you can play any of these discs in our audition room before buying.

Romance of All-Wave Sets.

DEAR SIR,—There is a new version of the "Modern Magic Carpet." It allows the owner to "fly through the air with the greatest of ease" over enormous distances at terrific speed.

Quite right, we are talking about all-wave radio receivers—the new sets which bring in not only the long and medium-wave programmes, but also all sorts of broadcasts on the short waves.

You can listen to liners talking to the shore; you can hear amateurs speaking to Australia! and aerodromes instructing aeroplanes. Trawlers in the North Sea will reveal their secrets to you.

Then in a flash, you can skip round the globe, listening to broadcast programmes from such romantic-sounding places as Klipkeuval, Bangkok, Tokio, San Domingo, La Paz.

We could go on like this for hours, but in radio hearing is believing. Would you like a demonstration here in the shop—or in your own home?

Let us know, please, and we will arrange it as quickly as you wish.

Service and Maintenance.

DEAR SIR,—How would you like to insure your set against breakdown? Yes, just like a car has to be insured against accidents.

We have started a scheme like this and for a fixed premium—which can be paid in pence per week if you wish—we guarantee to repair anything that goes wrong with your set (even if it costs more than the premium) for the whole of the period covered by the insurance.

Supposing nothing goes wrong? In that case, you get a "no-claim" bonus off the next year's premium. And ten to one you get a repair job in the second year which more than puts you level again.

All the advantages of this plan cannot be explained in a letter. But it means trouble-free radio for you and steadier work for me. May I call in one evening and explain it to you?

Service—General Goodwill.

DEAR SIR,—This letter is just to call your attention to a little fact that escapes many people's notice.

It is just that, as you will see from our letter heading, we are Radio *Engineers*.

This means that our interest doesn't stop when we have sold something from our shop.

Of course, when something actually goes wrong, you would naturally call for expert aid. We hope that you would come to us.

But how about the annoyance and trouble when the set works, but somehow doesn't work quite right? That also is a time when you should call us in—it would save you money in the long run.

The writer would be glad to give you his personal advice and help on any matter of this sort.

Short-wave Attractions.

DEAR SIR,—I should be glad if you would consider this as a little friendly chat with . . . himself—the radio man whom you know, and, I hope, appreciate.

I was thinking, as I listened to one of the new sets, how much more enjoyable they are, and what huge advance has taken place.

Short waves, the main new feature of this year's radio sets, have not only greatly increased the actual number of stations which can be received, but bring America, and sometimes even Australia, into the range of home listening.

I feel that I should like you to share this pleasure, too—to know that you, from the comfort of your favourite chair, can switch on to programmes which are being performed thousands of miles away.

During the course of the next few days I hope to call on you and let you hear one of these new sets for yourself.

Show at Shop.

DEAR SIR,—For the ten days from Wednesday next, our shop will be a Radio Exhibition.

We could, of course, take a big hall for this. But if we did, it would probably be necessary to charge you an entrance fee. As it is, the Show at the shop is free.

. . . (film star, band-leader, or other celebrity) will be there every day, and there will be . . . receivers all specially chosen for their suitability for the conditions in this district. You can see or hear any of them, and then arrange to have a demonstration in your own home.

You will be very welcome whenever you call.

Television Demonstration.

DEAR SIR,—How would you like to see a demonstration of television? Whether or not you want a television set—I am *not* trying to sell you one at this juncture—you certainly should see what it is like.

All next week I am arranging demonstrations. If you can arrange a party, I shall be pleased to set an evening aside for you. Alternatively, if there are only two or three including yourself, I will fit you in with a few others.

Fill in the postcard herewith and I will fix up for you as early as I can. Better still, call or telephone and we will fix on a definite date straight away.

This modern development of television is something you should not miss. And when you get your television set in two or three years' time, I want you to come to me for it.

Trial Overhaul at Low Rate.

DEAR SIR,—This is a special offer. You can have your receiver thoroughly overhauled and tested during the next ten days for the nominal sum of 2s. 6d. This spring-cleaning includes :—

Testing valves.
Cleaning all switch contacts.
Removing all dust, etc., from interior.
Checking speaker gap.
Cleaning and polishing cabinet.

The advantage of such an overhaul needs little explanation. It puts your set back on top of its form. It checks troubles before they arise. It is an insurance against bigger bills later. It makes certain that you are getting full value for money from your purchase.

It is also offered at a bargain rate. The reason is that, to offer the maintenance service to customers which we do, we have to maintain a well-equipped and manned service workshop. Just now it is slack, so to keep the men at work we are making you this special offer. *It only lasts for the next ten days as from the date of your receiving this.*

P.S.—If, after trying out our service work in this way, you feel you would like to have your receiver kept permanently in trim by our engineers, we shall be pleased to give you full details about our maintenance insurance.

Visit to National Show.

DEAR SIR,—We are going to Radiolympia, and I am wondering whether you would like to join the party.

With cheap rail fares which I am arranging, the cost should not exceed . . . for the trip, the entrance fee, meals and seeing the Radio Theatre Show. I am providing entrance tickets to the Exhibition as a gift to any of my customers who come.

This is an opportunity that does not come along every day. Frankly it is worth thinking over. Would you like to add your name to the list of probables so that I can send you final details later ? Drop in at the shop, or write or 'phone me, and I will be pleased to put you down.

Naturally, I am hoping to get a party of people who want to get a new set soon and wish to see Radiolympia partly for this reason. But I assure you I am not going to pester you to buy.

Wedding Present Radio.

DEAR SIR,—After the music of the wedding bells, what could sound sweeter than a radio set in the new home of the newly weds ?

Quite so. And that is why we confidently suggest that if any of your friends are entering matrimony in this month of marriages, radio would be the ideal gift from you.

Not that a new radio set would not be welcome in many established homes. When is your wedding anniversary, or that of your parents for example ? Radio is just the gift to commemorate the occasion.

Maybe you can think of a better excuse than this for getting yourself a new set ? If you can, we shall be pleased to see you.

Debt Collection Letters

Debt Collection.—1.

DEAR MR. ——,—Why ? The question flashed through my mind to-day when I found upon looking through my books that you have overlooked the little matter of your account.

You'll agree, I'm sure, that we performed our part of the bargain satisfactorily ; and, therefore, I feel certain that it is only through a slip of your memory that the account has not yet been paid.

It would be great to find a remittance from you in the post within the next day or two. Why not send it off to-day, before you forget ?

Debt Collection.—2.

DEAR MR. ——,—You have doubtless heard the expression 'The luck of the Irish," but have you heard the definition of it ?

I did recently, and consider that it really describes "the luck of the Scotsman" (*Dealer, fill in your own nationality*).

The definition was that the Irish work hard and talk little—and if those aren't Scots attributes I don't know what are.

Certainly I've been hard at work lately ; and when making up the books after the shop is shut, I noticed that your account is somewhat in arrears. Doubtless this is because you, too, have been busy, and the matter has escaped your notice.

So to-day I'm pinning my faith to "Scotsman's luck," and have a feeling that I shall receive your remittance for . . . within the next day or two.

Debt Collection.—3.

DEAR SIR,—I still believe in my luck. But I have not yet heard from you regarding the little account of . . . which is owed to us by you, I am sure that, now you realise that this is considerably overdue, you will make every effort to rectify the matter quickly.

To get outstanding accounts satisfactorily squared up in our books means so much more smoothness in the running of a retail business that I am quite sure that you will help us by settling your account at once.

Debt Collection.—4.

DEAR SIR,—One—two—and now a third, which is marked

URGENT.

I am naturally disappointed that you have not replied to my two previous letters drawing your attention to your overdue account of. . . . I hope that your silence is only due to oversight, but I am compelled to tell you that, unless the account is settled WITHIN 7 DAYS from this date, I shall have to take steps either to obtain the money due or to remove the property on which hire payments are overdue.

H.P. Overdue.—1.

DEAR SIR,—As you know, it is impossible to run a business without keeping things in shipshape order.

Our books, for instance. They must be balanced from month to month ; and Hire Purchase accounts involve such a lot of extra work that we feel sure you will appreciate the necessity of ensuring prompt payment of instalments.

Unfortunately, your account for . . . has not yet been settled. In all probability this is just an oversight on your part, and so we look forward to receiving your settlement of the matter within the next few days.

Every account that is promptly settled means not only more business in the town, but so much less work and worry for us.

H.P. Overdue.—2.

DEAR SIR,—We really hoped that our letter sent to you recently would have had results, but our books still show your instalments as overdue. In the meantime, of course, the amount you owe to us is increasing as further unpaid instalments are added to it.

We are sure that you appreciate the necessity of a prompt settlement ; because we ourselves have to pass the money on in the shape of wages, new stock ordered, rates and rent.

A statement of your account is enclosed, and we trust to receive payment in the course of a few days.

MAINS AND BATTERY SET MARKET SURVEY

By courtesy of "Electrical Trading"

	Total No. of Homes	WIRED HOMES		Unwired Homes
		On A.C.	On D.C.	
Great Britain	11,382,212	5,607,639	990,404	4,784,169
England	9,476,586	4,943,447	843,884	3,689,255
Wales (and Monmouth) ...	651,850	270,337	47,215	334,298
Scotland	1,253,776	393,855	99,305	760,616

Town-by-town statistics are given overleaf on pages 128–132.

How many people in your town can listen on mains receivers and how many have to use battery sets? What proportion are there of people who must use D.C. or A.C.-D.C. receivers.

The answers to these questions form sound market statistics of considerable value in enabling you to approach your public in the right way. For instance, they might indicate that you have not given sufficient attention to the creation of battery set sales.

The table overleaf on pages 128–132 gives details of homes wired and unwired in about 600 supply areas. Only in a very small number of cases has it been found impossible to get either official figures or well-informed estimates of local development.

For quick reference the returns are grouped under county headings.

Time-Controlled

This year, for the first time a set of references has been introduced with a view to defining more closely the system of supply in the various districts covered.

Those homes which are supplied at the standard recommended (230/400 volts 50 cycles) and are time controlled are marked thus. (†).

Other references used in the tables are:

A. Partly standard voltage and all time-controlled frequency.

B. Party standard voltage and partly tme-controlled.

C. Non-standard voltage, [time-controlled.

D. Non-standard voltage, not time-controlled.

E. Inclusive figure for consumers on A.C. and D.C. mains, those on A.C. being supplied at standard voltage, time controlled.

F. Inclusive figure for consumers on A.C. and D.C. mains, those on A.C. being supplied at non-standard voltage, time-controlled.

G. Inclusive figure for A.C. and D.C. consumers, those on A.C. being standard voltage, but not time controlled.

H. Inclusive figure for A.C. and D.C. consumers, those on A.C. being partly standard voltage and all time-controlled.

Official Figures

In the few cases where the A.C. supply is 230 volts but the frequency is not controlled no reference mark is used.

All figures given in these tables are official, with the exception of those marked with a star (*). In the latter case estimates have been made, based on other published statistics.

Figures of the total number of households (given in the first column) mostly relate to the number of structurally separate dwellings in the supply areas concerned. In a few cases, however, a figure of the number of families is substituted on the basis of four persons per family. Such cases are indicated thus (§).

SET MARKET SURVEY

Name of Supply Authority.	Total No. of Households in Area.	Number of Households on A.C.	on D.C.	Without Supply.
LONDON.				
Battersea Cpn. ..	37,718§	25,612E		12,106
Bermondsey Cpn. ..	25,000§	12†	15,775	9,213
Bethnal Green Cpn. ..	26,575§	11,709c	—	14,866
Brompton & Kensington E. S. Co.	11,425	14,200†*	—	—
Charing Cross E.S. Co., Ltd.	Negligible residential area.			
Chelsea E.S. Co., Ltd.	14,750	9,100E		5,650
City of London E.S. Co.	Residential consumers negligible : total consumers 19,776.			
County of London E.S. Co.	425,000*	226,750*		198,250
[The wired homes in the County of London Co.'s area, which covers a large part of Essex and Surrey in addition to districts in London, are nearly all on A.C. mains. The only exceptions are Camberwell, Southwark and Bermondsey, parts of which have D.C. supply.]				
East Ham Cpn. ..	33,850§	26,461E		7,389
Fulham Cpn.	33,400§	39,000c	—	—
Hackney Cpn.	53,833§	3,500†	37,458	12,875
Hammersmith Cpn. ..	32,500§	20,000† / 10,900c	—	1,600
Hampstead Cpn. ..	22,237§	19,550c	3,450	—
Hornsey Cpn.	25,000	—	20,903	4,097
Islington Cpn.	76,025§	38,892c	—	37,133
Kensington & Knightsbridge Co.	7,713	2,215†	3,656	1,842
Notting Hill E.L. Co.	23 000§	3,100*†	11,550*	8,350
Poplar Cpn.	3,877§	600	25,997	12,174
St. James and Pall Mall E. L. Co., Ltd. ..	(Not a residential area.)			
St. Marylebone Cp. ..	24,405§	7,482†	10,103	6,820
St. Pancras Cpn. ..	46,325§	3,600†	28,079	14,646
Shoreditch Cpn.	22,100§	—	19,640	2,460
South London E.S. Cpn.	70,000§	22,400c	—	47,600
South Met. E. L. & P. Co.	—	—	—	—
Southwark Cpn.	26,923§	—	7,004	19,919
Stepney Cpn.	54,775§	—	34,853	19,922
Stoke Newington Cpn.	12,552	2,391†	9,485	676
Westminster E.S. Cpn.	—	—	—	—
Woolwich Cpn. ..	37,220§	17,863c	76	19,261
BEDFORDSHIRE.				
Bedford Cpn.	27,569	18,425A	—	9,144
Beds, Cambs & Hunts E. Co.	49,000	9,433c	—	39,567
First Garden City, Ltd.	(See Hertfordshire.)			
Luton Cpn.	32,300§	21,000c	—	11,300
BERKSHIRE.				
Abingdon E.S. Co., Ltd.	4,392	2,383†	—	2,009
Ascot Gas & E. Co. ..	9,463	1,923D	952	6,588
Cookham & Dist. E. Cpn., Ltd.	5,242	2,385†	—	2,857
Maidenhead Cpn. ..	7,390	3,060†	753	3,577
Reading Cpn.	30,819	7,490F		23,329
Thames Valley E.S. Co.	(See Oxfordshire.)			
Wantage E.S. Co., Ltd.	1,690	567†	—	1,123
BUCKINGHAMSHIRE.				
Aylesbury Cpn. ..	15,396	10,306D	—	5,090
Cookham & Dist. E. Cpn., Ltd.	(See Berkshire.)			
Luton Cpn.	(See Bedfordshire.)			
Northampton E.L. Co.	(See Northants.)			
Wycombe E. L. & P. Co., Ltd.	12,389	3,242†	5,400	3,747
CAMBRIDGESHIRE.				
Beds, Cambs & Hunts E. Co.	(See Bedfordshire.)			
Cambridge E.S. Co. ..	21,000	14,894D	—	6,106
Newmarket E. L. Co., Ltd.	2,650	630c	—	2,020
Peterborough Cpn. ..	(See Northamptonshire.)			
Wisbech E. L. & P. Co., Ltd.	4,620	—	933	3,687
CHESHIRE.				
Alderley Edge & Wilmslow Bd.	4,383	2,799†	350	1,234
Altrincham E.S. Co. ..	14,752	9,404D	—	5,348
Birkenhead Cpn. ..	55.627	15,870†	23,699	16,058
Bredbury & Romily U.D.C.	4,400	4,200†	—	200
Cheadle & Gatley U.D.C.	7,600	6,500†	—	1,100
Chester Cpn.	20,718	13,465†	—	7253
Congleton Cpn. ..	4,400	2,400†	—	2,000
Crewe Cpn.	12,647*	7,500†	3,226	1,921
Hazel Grove & Bramhall U.D.C.	4,550	3,990*†	—	560
Hoylake U.D.C. ..	7,000*	6,130†	—	870
Macclesfield Co. ..	17,750§	3,926†	5,245	8,579
Marple U.D.C. ..	1,951§	1,294†	—	557
Mersey Power Co. ..	(See Lancashire.)			
Mid-Cheshire E.S. Co.	21,498	7,923c	2,025	11,550
N.W. Midlands J.E.A.	(See Staffordshire.)			
Sale U.D.C.	10,106	7,890†	—	2,216
Stalybridge Board ..	(See Lancashire.)			
Stockport Cpn. ..	36,500	17,297†	3,200	16,003
Wallasey Cpn. ..	25,474	23,386A	—	2,088
Warrington Cpn. ..	(See Lancashire.)			
CORNWALL.				
Cornwall E. P. Co. ..	63,987	19,652A	—	44,335
Delabole E L. & S. Co., Ltd.	375	—	260	115
Falmouth (E.S. Cpn.)	4,147	—	1,360	2,787
St. Austell & Dist. E. L. & P. Co.	13,026	3,387†	—	9,639
CUMBERLAND.				
Carlisle Cpn.	22,073	12,552†	1,082	8,439
Keswick E. L. Co., Ltd.	1,870	627D	—	1,243
Mid Cumberland E. Co., Ltd.	21,833§	4,300†	—	17,533
Millom R.D.C. ..	2,000	1,080†	—	920
Penrith E.S. Co., Ltd...	2,540	980†	—	1,560
South Cumberland E.S. Co., Ltd.	6,231§	2,270†	—	3,961
Whitehaven Cpn. ..	6,625§	500†	4,162	1,963
Workington Cpn. ..	7,849	2,272A	—	5,577
DERBYSHIRE.				
Ashbourne U.D.C. ..	2,000	530†	—	1,470
Barlborough E. S. Co., Ltd.	500	420c	—	80
Bolsover U.D.C. ..	2,696*	1,900c	—	196
Burton-on-Trent Cpn.	(See Staffordshire.)			
Burton Cpn.	4,855	450†	2,035	2,370
Chesterfield Cpn. ..	17,550§	8,640c	5,500	3,410
Clowne E.S. Co., Ltd.	1,600	70† / 780D	—	750
Derby Cpn.	48,779	1,200† / 39,909c	—	7,670
Derbyshire & Nottinghamshire E.P. Co. ..	125,000*	32,000*†	1,600*	91,400
Glossop (Urban E. S. Co.)	5,950	809†	—	5,141
Killamarsh & Dist. E.S. Co., Ltd.	1,200	796c	—	404
Leicestershire & Warwickshire E.P. Co. ..	(See Leicestershire.)			
Long Eaton U.D.C. ..	7,218	2,079c	4,400	739
Mansfield Cpn.	16,662	4,400†	5,570	6,692
Staveley E.S. Co., Ltd.	—	1,600c	—	—
Trent Valley & High Peak E. Co., Ltd. ..	10,275	4,451†	—	5,824
Worksop Cpn.	(See Nottinghamshire.)			
DEVONSHIRE.				
Barnstaple Cpn. ..	4,220*	—	2,725*	1,495
Bideford & Dist. E. S. Co., Ltd.	10,090	2,537	—	7,553
Braunton E.L. & P. Co., Ltd.	—	—	—	—
Brixham Gas & E. Co.	3,000	60†	1,490	1,450
Chudleigh E. L. & P. Co., Ltd.	600	280†	—	320
Culm Valley E. S. Co., Ltd.	3,376*	1,050†	—	2,326
Dartmouth & Kingswear (U.E.S. Co.) ..	1,900§	682c	—	1,218
Dawlish E. L. & P. Co., Ltd.	1,922§	1,393†	—	529
East Devon E. Co., Ltd.	13,309*	1,250*†	—	12,059
Exe Valley E. Co. Ltd.	13,200	2,280†	80	10,804
Exeter Cpn.	19,841	1,535† / 14,215c	—	4,091
Holsworthy E. S. Co., Ltd.	350	220	—	130
Ilfracombe E. L. & P. Co.	3,661	290†	356	3,015
Lynton & Lynmouth E. L. & Co., Ltd. ..	700*	403D	—	297
Paignton E. L. & P. Co., Ltd.	5,590	4,180†	—	1,410
Plymouth Cpn. ..	50,900§	46,192A	850	3,858
Plympton St. Mary R.D.C.	9,200§	5,067†	—	4,133
Salcombe Gas & E. Co., Ltd.	1,600*	333†	—	1,267
Seaton & Dist. Co. ..	2,000*	1,035†	—	965
Teignmouth E. L. Co., Ltd.	6,870	3,211†	—	3,659

Name of Supply Authority.	Total No. of Households in Area.	Number of Households on A.C.	on D.C.	Without Supply.
Tiverton Cpn.	2,500	—	1,007	1,493
Torquay Cpn.	25,303§	12,853c	—	12,450
West Devon E.S. Co.	10,000*	3,337†	80	6,583
DORSETSHIRE.				
Blandford Forum & Dist. E.S. Co., Ltd...	1,540	470†	—	1,070
Bournemouth Co. ..	(See Hampshire.)			
Bridport Cpn.	4,120	1,575	—	2,545
Dorchester Cpn. ..	2,625§	1,144†	—	1,481
Lyme Regis Cpn. ..	850	—	757	93
Portland U.D.C. ..	3,050§	1,170†	—	1,880
Weymouth & Melcombe Regis Cpn.	10,900*	6,257c		4,643
DURHAM.				
Annfield Plain U.D.C...	4,000§	3,500c	—	500
Crook U.D.C.	2,767§	1,600D	—	1,167
Darlington Cpn. ..	21,099	12,576†	1,500	7,023
North Eastern E.S. Co., Ltd.	(See Northumberland.)			
Seaham Harbour U.D.C.	5,500*	4,200*c	—	1,300
South Shields Cpn. ..	29,605	29,574D	—	31
Stockton-on-Tees Cpn.	17,525§	10,517c	—	7,008
Sunderland Cpn. ..	40,750§	14,959†	—	25,791
Tanfield U.D.C. ..	2,375	2,200D	—	175
West Hartlepool Cpn.	17,875§	7,263†	4,000	6,612
ESSEX.				
Barking Cpn.	20,943§	11,000†	3,000	6,943
Brentwood Dist. E. P. Co., Ltd.	5,000*	4,100*c	—	900
Brightlingsea (Frinton Co.)	1,320	763†	—	557
Clacton U.D.C. ..	8,300	4,545†	3,545	600*
	[Figures in two centre columns above refer to all consumers, nearly all of whom are domestic consumers.]			
Colchester Cpn. ..	29,000*	22,367E		6,633
County of London E.S. Co.	(See London.)			
Frinton-on-Sea & Dist. Co. (Frinton Section)	800	—	740	60
Grays (Thurrock U.D.C.)	4,859	3,266†	855	738
Harwich Cpn.	3,525§	3,032c	—	493
Ilford Cpn.	39,778	17,078†	19,828	2,872
Leyton Cpn.	30,875§	20,900†	2,150	7,825
North Metropolitan E. P. S. Co.	(See Hertfordshire.)			
Southend-on-Sea ..	33,750§	29,600†	1,000	3,150
Tilbury (Thurrock U.D.C.)	4,212§	2,313†	—	1,899
Walthamstow Cpn. ..	33,773§	21,962†	4,500	7,311
West Ham Cpn. ..	73,521§	43,574c	—	29,947
Wickford & Dist. E. S. Co.	1,700*	1,071†	—	629
GLOUCESTERSHIRE.				
Bristol Cpn.	(See Somerset.)			
Cheltenham Cpn. ..	16,427	520† / 9,142c	—	6,765
Chepstow E. L. & P. Co., Ltd.	(See Wales and Monmouth.)			
Cirencester E. S. Co., Ltd.	1,950§	649†	—	1,301
Gloucester Cpn. ..	20,450	8,000†	800	11,650
Northleach E. S. Co., Ltd.	223	—	185	38
Stroud E.S. Co., Ltd. ..	2,336*	1,100*†	—	1,236
Tewkesbury E. L. Co., Ltd.	(See S.W. & S. Co., Shropshire.)			
Thornbury & Dist. E. Co., Ltd.	1,075	231†	—	844
Warmley R.D.C. ..	2,250§	1,843†	—	407
West Gloucestershire P. Co.	37,797	10,628†	—	27,169
HAMPSHIRE.				
Aldershot Cpn. ..	8,570§	2,944E		5,626
Basingstoke Cpn. ..	8,250§	3,028E		5,222
Bournemouth & Poole E.S. Co., Ltd. ..	72,779	36,293A	1,000	35,486
Fareham U.D.C. ..	3,773	2,561c	—	1,212
Gosport & Alverstoke E. L. Co.	10,900	—	4,601	5,399
Lymington E. L. & P. Co.	3,600	1,112A	—	2,488
Portsmouth Cpn. ..	83,103	56,510A	—	26,593
Ringwood E.S. Co. ..	2,019	1,763†	—	256
Southampton Cpn. ..	58,636	35,448A	6,862	16,326
Whitchurch Gas & E. Co., Ltd.	625§	250c	—	375
Winchester Cpn. ..	6,824	3,400†	—	3,424
HEREFORDSHIRE.				
Ledbury E.S. Co., Ltd.	(See S.W. & S. Co., Shropshire.)			

Name of Supply Authority.	Total No. of Households in Area.	Number of Households on A.C.	on D.C.	Without Supply.
Leominster E. S. Co., Ltd.	1,425*	545†	—	880
S. W. & S. Co. ..	(See Shropshire.)			
HERTFORDSHIRE.				
Aylesbury Cpn. ..	(See Buckinghamshire.)			
Colne Valley E.S. Co., Ltd.	(See Middlesex.)			
First Garden City, Ltd. (Letchworth) ..	10,000	6,000c	1,000	3,000
Hitchin U.D.C. ..	4,000	1,360c	—	2,640
Luton Cpn.	(See Bedfordshire.)			
North Met. E.P.S. Co.	251,140	173,934c	2,485	74,721
Northwood E.L. & P. Co.	(See Middlesex.)			
Watford Cpn.	30,049	17,189c	—	12,860
Welwyn Garden City E.S. Co., Ltd. ..	2,948	2,834c	—	114
HUNTINGDONSHIRE.				
Beds, Cambs & Hunts E. Co.	(See Bedfordshire.)			
Peterborough Cpn. ..	(See Northamptonshire.)			
KENT.				
Ashford U.D.C. ..	8,500	6,493†	—	2,007
Beckenham U.D.C. ..	15,000*	14,710c	—	290
Bexley U.D.C. ..	26,000	23,229c	—	2,771
Bromley Cpn.	13,763	10,601A	—	3,162
Canterbury Cpn. ..	6,225	1,000†	3,046	2,179
Chislehurst E.S. Co. ..	2,500*	1,300*D	—	1,200
Dartford Cpn.	7,860§	1,110†	4,004	2,746
Dover Cpn.	11,390§	5,000† / 2,627c	—	3,763
Erith U.D.C.	8,940§	8,274c	—	666
Faversham Cpn. ..	3,520	—	1,178	2,342
Foots Cray E. S. Co. (Sidcup)	3,250*	1,010A	—	2,240
Gillingham Cpn.	18,413	13,507†	—	4,906
Gravesend Cpn. ..	15,506	11,359E		4,147
Herne Bay & Dist. E.S. Co.	6,000	1,800†	—	4,200
Isle of Thanet E.S. Co	14,228	790D	6,742	6,696
Kent Electric Power Co.	53,094§	16,481†	—	36,663
Maidstone Cpn. ..	17,000	9,221†	2,000	5,779
Sevenoaks Dist. E. Co.	14,000	2,415† / 5,631c	—	5,954
South East Kent E. P. Co.	19,768	3,210†	—	16,558
Tonbridge U.D.C. ..	6,700	3,640c	260	2,800
Tunbridge Wells U.D.C.	13,126§	9,000c	—	4,126
Weald E.S. Co. ..	28,073	10,000†	—	18,073
Whitstable E. Co. ..	5,000*	4,200*†	—	800
LANCASHIRE.				
Accrington Cpn. ..	19,038	12,922	—	6,116
Ashton-in-Makerfield U.D.C.	5,015§	759	—	4,256
Ashton - under - Lyne Cpn.	15,700	6,600c	2,000	7,100
Atherton U.D.C. ..	5,100*	2,700*c	—	2,400
Bacup Cpn.	5,654	3,280†	—	2,374
Barrow-in-Furness Cpn	22,650§	3,413A	8,700	10,537
Blackburn Cpn. ..	39,711§	17,256†	1,400	21,053
Blackpool Cpn. ..	38,697	30,808D	—	7,889
Bolton Cpn.	48,308	5,013† / 20,331c	3,268	19,696
Brierfield U.D.C. ..	2 500	1,326†	—	1,174
Burnley Cpn.	28,249	17,302E		10,947
Bury Cpn.	15,000	10,500†	—	4,500
Cark & Dist. E. Co. ..	1,000	400†	—	600
Clitheroe Cpn.	6,185	2 199†	—	3,986
Colne Cpn.	9,867	2,634†	1,664	5,569
Darwen Cpn.	10,394	1.367	4,300	4,727
Eccles Cpn.	11,299	6,506†	—	4,793
Farnworth Cpn. ..	7,802	5,658†	950	1,194
Fleetwood Cpn. ..	6,480	4,445	1,467	568
Formby U.D.C. ..	2,402	1,938†	—	464
Grange U.D.C... ..	750*	660*†	—	90
Haslingden Cpn. ..	5,780	4,011†	—	1,769
Heywood Cpn.	9,370	3,136†	718	5,516
Hindley U.D.C. ..	6,025§	1,563†	—	4,462
Horwich U.D.C. ..	4,300	2,086†	—	2,214
Lancashire E.P. Co. ..	76,624	34,920†	—	41,704
Lancaster Cpn. ..	17,251	8,921†	—	8,330
Leigh Cpn.	11,667	4,933†	500	6,234
Littleborough U.D.C.	3,580*	1,400*†	—	2,180
Liverpool Cpn... ..	266,612	97,600†	11,000	158,012
Lytham St. Annes Cpn.	7,858	6,008c	400	950
Manchester Cpn. ..	213,750§	98 628†	2,333	112,789
Mersey Power Co. ..	26,828§	18,151c	—	8,677
Middleton Cpn. ..	10,000	4,200†	600	5,200
Morecambe & Heysham Cpn.	13,200	9,420†	—	3,780
Nelson Cpn.	11,900*	9,500*†	—	2,400
Newton-in-Makerfield U.D.C.	5,300	3,500†	—	1,800

SET MARKET SURVEY

Name of Supply Authority.	Total No. of Households in Area.	Number of Households on A.C.	on D.C.	Without Supply.
Oldham Cpn.	62,685	39,000†	1,128	22,557
Ormskirk E. S. Co. ..	1,906	853†	—	1,053
Padiham U.D.C. ..	3,886	1,500†	—	2,386
Preston Cpn.	50,000	29,147†	—	20,853
Radcliffe U.D.C. ..	7,750	3,420†	861	3,469
Rawtenstall Cpn. ..	8,298	4,625†	—	3,673
Rochdale Cpn.	32,095	18,190†	—	13,905
St. Helens Cpn. ..	29,947§	10,707†	2,950	16,290
Salford Cpn.	61,830§	29,901† / 3,067c	107	28,755
Southport Cpn. ..	18,301	12,230D	—	6,071
Stalybridge, Hyde, Mossley & Dukinfield Tramways & E. Bd.	27,500	17,954†	—	9,546
Stretford & Dist. E. B.	25,554	18,855†	4,318	2,381
Swinton & Pendlebury U.D.C.	10,431*	6,500*†	400*	3,531
Thornton Cleveleys U.D.C.	3,900	3,200†	—	700
Turton U.D.C.	3,400*	2,050*†	—	1,350
Ulverstone U.D.C. ..	2,500	1,200†	—	1,300
Warrington Cpn. ..	28,904	20,306c	—	8,598
Westmorland & Dist. E. S. Co.	(See Westmorland.)			
Whitworth U.D.C. ..	2,564	1,630†	—	934
Wigan Cpn.	35,200	12,429†	100	22,671
Windermere & Dist. E. S. Co.	(See Westmorland.)			
LEICESTERSHIRE.				
Kettering U.D.C. ..	(See Northamptonshire.)			
Leicester Cpn. ..	75,000	59,381c	—	15,619
Leicestershire & Warwickshire E. P. Co. ..	71,468§	42,690c	—	28,778
Loughborough Cpn. ..	8,302	3,684†	2,900	1,718
Melton Mowbray E. L. Co.	3,515	225†	1,371	1,919
Tamworth Dist. E. S. Co.	11,250§	8,391c	—	2,859
LINCOLNSHIRE.				
Boston & Dist. E. S. Co.	15,750	2,500† / 2,216c	—	11,034
Cleethorpes U.D.C. ..	7,600	5,370†	—	2,230
Gainsborough U.D.C. ..	4,639	2,313†	—	2,326
Grimsby Cpn.	30,834§	17,730	—	13,104
Lincoln Cpn.	17,857	9,333†	150	8,374
Louth Cpn.	3,200	803†	—	2,397
Mid-Lincolnshire E. S. Co.	45,638	12,584†	—	33,054
Scunthorpe & Frodingham U.D.C. ..	10,025	8,152D	—	1,873
Sleaford U.D.C. ..	2,000	600†	475	925
Spalding U.D.C. ..	8,063	2,393†	—	5,670
Stanford (Urban E. S. Co.)	2,772	—	706	2,066
MIDDLESEX.				
Brentford & Chiswick Cpn.	11,250§	3,000†	5,300	2,950
Colne Valley E. S. Co...	11,200	14,557c	—	—
	(Above figures include all consumers.)			
Ealing Cpn.	21,000§	17,450†	—	3,550
Finchley Cpn.	16,000§	—	13,478	2,522
Harrow E. L. & P. Co.	11,211	1,100c	8,292	1,819
Hendon E. S. Co. ..	36,616	32,035c	—	3,581
Heston & Isleworth Cpn.	25,389	23,264E		2,125
London & Home Counties J.E.A.	114,312	82,500†	12,800	19,012
North Metropolitan E. P. S. Co.	(See Hertfordshire.)			
Northwood E. L. & P. Co.	10,000*	9,000c	—	1,000
Willesden Cpn... ..	49,608§	36,300c	282	13,026
Woking E. S. Co. ..	(See Surrey.)			
NORFOLK.				
East Anglian Co. ..	(See Suffolk.)			
East Dereham U.D.C...	1,500*	900†	—	600
Great Yarmouth Cpn...	32,213	7,148† / 19,852c	—	5,213
Kings Lynn Cpn. ..	9,293	1,991†	3,500	3,802
Norwich Cpn.	60,000*	45,386E		14,614
Wisbech Co.	(See Cambridgeshire.)			
NORTHAMPTONSHIRE.				
Kettering U.D.C. ..	23,657	13,236†	1,873	8,548
Mid-Lincolnshire E. S. Co.	(See Lincolnshire.)			
Northampton E. L. & P. Co.	59,497	31,737A	300	27,460
Oakham Gas & E. Co...	1,582	281†	—	1,301

Name of Supply Authority.	Total No. of Households in Area.	Number of Households on A.C.	on D.C.	Without Supply.
Peterborough Cpn. ..	16,000*	11,000*†	500*	4,500
Rushden & Dist. E. S.	11,035§	1,400† / 2,880c	780	5,975
Stamford (Urban E. S. Co.)	(See Lincolnshire.)			
Wellingborough E. S. Co.	8,537	2,906†	236	5,395
NORTHUMBERLAND.				
Amble U.D.C. ..	1,200	1,190c	—	10
Newcastle & Dist. E. L. Co.	40,250	15,232D	750	24,268
North Eastern E. S. Co.	423,419§	179,500A	2,000	241,919
Tynemouth Cpn. ..	17,000*	12,995c	—	4,005
NOTTINGHAMSHIRE.				
Derbyshire & Nottinghamshire E. P. Co. ..	(See Derbyshire.)			
East Retford Cpn. ..	9,200	5,200†	—	4,000
Long Eaton U.D.C. ..	(See Derbyshire.)			
Mansfield Cpn. ..	(See Derbyshire.)			
Newark-on-Trent Cpn.	4,942	3,772†	—	1,170
Nottingham Cpn. ..	101,919	46,788†	40,550	14,581
Worksop Cpn. ..	6,750§	2,210A	3,664	876
OXFORDSHIRE.				
Aylesbury Cpn. ..	(See Buckinghamshire.)			
Banbury & Dist. E. S. Co.	(See S.W. & S. Co., Shropshire.)			
Burford E. L. & P. Co.	470*	400*†	—	70
Oxford Cpn.	16,620	11,037†	—	5,583
Oxford Electric Co. ..	9,500	7,712†	—	1,788
Reading Cpn.	(See Berkshire.)			
Thames Valley E.S.Co., Ltd.	9,880	2,530†	—	7,350
Witney U.D.C. ..	1,400	1,020†	—	380
Woodstock & Dist. E. Distribution Co., Ltd.	569	319†	—	250
SHROPSHIRE.				
Market Drayton E. L. & P. Co	1,200	30†	959	211
Midland E. Corporation for P. Dist., Ltd. ..	(See Staffordshire.)			
North West Midlands J.E.A.	(See Staffordshire.)			
Oswestry Cpn. ..	6,498	1,782†	—	4,716
Shrewsbury Cpn. ..	8,305§	—	5,508	2,797
Shropshire, Worcestershire & Staffordshire E. P. Co. and subsidiaries	184,634§	83,803†	13,586	87,245
Wolverhampton Cpn...	(See Staffordshire.)			
SOMERSETSHIRE.				
Bath Cpn.	23,437	8,698†	171	14,568
Bristol Cpn.	128,137	70,442c	—	57,695
Burnham & Dist. E. S. Co.	1,200*	1,100*†	—	100
Mid-Somerset E. S. Co.	1,125	874†	—	251
Minehead E. S. Co. ..	5,976	2,636†	—	3,340
North Somerset E. S. Co.	34,500*	17,556†	—	16,944
Porlock & Dist. E. S. Co.	640	356†	—	284
South Somerset & Dist. E. Co.	11,478*	2,850†	—	8,628
Taunton Cpn.	10,775*	5,710†	—	5,065
Wellington Dist. E. Co.	4,100	1,463†	—	2,637
Wessex E. Co. ..	11,480*	3,200*	—	8,280
Weston-super-Mare & Dist. E. Co.	8,500§	4,796†	500	3,204
Yeovil E. L. & P. Co. ..	4,000*	450*	1,900*	1,650
STAFFORDSHIRE.				
Ashbourne U.D.C. ..	(See Derbyshire.)			
Burton-on-Trent Cpn.	26,500	8,900† / 10,050c	—	7,550
Cannock U.D.C. ..	12,230	6,445†	—	5,785
Chasetown & Dist. E. Co.	7,499	4,301D	—	3,198
Leek U.D.C.	5,626	324†	3,550	1,752
Lichfield Cpn. ..	4,672§	2,307†	—	2,365
Midland E. Corp. for Power Distribution	82,638§	29,111c	—	53,527
Newcastle-under-Lyme Cpn.	11,250§	1,550†	2,450	7,250
N.W. Midlands J.E.A.	29,200	4,964†	—	24,236
Shropshire, Worcestershire & Staffordshire E. P. Co.	(See Shropshire.)			
Stafford Cpn.	8,000§	4,971E		3,029
Stoke-on-Trent Cpn. ..	73,578§	27,654c	2,000	43,924
Stone U.D.C.	3,000	1,700†	—	1,300
Tamworth Co.	(See Leicestershire.)			
Trent Valley & High Peak E. Co... ..	(See Derbyshire.)			
Uttoxeter U.D.C. ..	3,090	1,370†	—	1,720
Walsall Cpn.	31,750§	18,134†	—	13,616
West Bromwich Cpn.	20,326§	8,741†	1,802	9,783
Wolverhampton Cpn...	45,821	32,807†	—	13,014

Name of Supply Authority.	Total No. of House-holds in Area.	Number of Households on A.C.	on D.C.	Without Supply.
SUFFOLK.				
Aldeburgh E. S. Co. ..	800*	—	600	200
Bungay Gas & E. Co...	800	635†	—	165
Bury St. Edmund's Cpn.	4,800	3,069†	—	1,731
East Anglian E. S. Co.	104,362	18,264†	978	85,120
East Suffolk E. Dist. Co., Ltd.	7,069	2,420†	—	4,649
Felixstowe U.D.C. ..	4,092	3,100c	402	590
Great Yarmouth Cpn.	(See Norfolk.)			
Ipswich Cpn.	31,004	22,556†	5,500	2,948
Lowestoft Cpn. ..	13,725*	3,450*	6,750*	3,525
Newmarket Co. ..	(See Cambridgeshire.)			
SURREY.				
Ascot Dist. Gas & E. Co.	(See Berkshire.)			
Barnes Cpn.	10,600*	—	9,900	700
County of London E.S. Co.	(See London.)			
Croydon Cpn.	60,150§	{ 33,750† / 11,250c }	—	15,150
East Grinstead U.D.C.	(See Sussex.)			
Epsom & Ewell U.D.C.	7,730§	1,798†	3,087	2,845
Guildford Cpn. ..	15,200	12,013†	129	3,058
Guildford Gas Co. ..	2,381	673†	—	1,708
Horley & Dist. E. S. Co.	5,500	2,261†	—	3,239
Kingston - on - Thames Cpn.	10,000§	8,151c	—	1,849
London & Home Counties J.E.A. ..	(See Middlesex.)			
Reigate Cpn.	8,500	7,500†	—	1,000
Richmond E.L. & P. Co.	8,875*	7,750*c	—	1,125
Sevenoaks & D. E. Co.	(See Kent.)			
Sussex E. S. Co. ..	(See Sussex.)			
Walton & Weybridge U.D.C.	5,511	3,782c	—	1,729
Wimbledon Cpn. ..	33,750§	34,156c	—	—
Woking E. S. Co. ..	18,878	13,662c	—	5,216
Yorktown (Camberley) & Dist. Gas & E. Co.	6,450	1,516c	—	4,934
SUSSEX.				
Bexhill Cpn.	7,300	2,185†	3,527	1,588
Bognor Gas & E. Co.	10,609	5,058†	—	5,551
Brighton Cpn. ..	43,650§	38,000E		5,650
Burgess Hill & Dist. E. S. Co...	2,227*	1,150*†	—	1,077
Chichester Cpn. ..	6,250§	6,000†	—	250
East Grinstead U.D.C.	3,150	1,150†	1,058	942
Eastbourne Cpn. ..	21,697	{ 1,725† / 13,551c }	—	6,421
Hastings Cpn. ..	28,000*	21,334A	—	6,666
Horley & Dist. E. S. Co.	(See Surrey.)			
Hove Cpn.	16,700§	6,607c	9,573	520
Lewes & Dist. E.S. Co.	2,750§	—	1,870	880
Peacehaven E. L. & P. Co.	1,500	800†	—	700
Portsmouth Cpn. ..	(See Hampshire.)			
Ringmer & Dist. E. Co.	1,806	1,501†	—	305
Shoreham & Dis. E. L. & P. Co.	6,000*	3,525*†	—	2,475
Steyning E. L. Co. ..	6,208*	2,150*†	—	4,058
Sussex E. S. Co. (Crawley)	1,500*	1,000*†	—	500
Sussex E. S. Co. (Littlehampton)	3,115	2,459†	—	656
Worthing Cpn. ..	18,000*	16,766†	—	1,234
WARWICKSHIRE.				
Birmingham Cpn. ..	273,000§	121,700†	27,000	124,300
Coventry Cpn... ..	59,448	{ 25,188† / 17,355c }	—	16,905
Leamington & Warwick E. Co.	—	—	—	—
Leicestershire & Warwickshire E. P. Co.	(See Leicestershire.)			
Midland E. L. & P. Co.	—	—	—	—
Nuneaton Cpn. ..	12,531	6,435†	3,750	2,346
Rugby Cpn.	6,250§	4,649†	—	1,601
Stratford-on-Avon E. Co.	(See S.W. & S. Co., Shropshire.)			
Sutton Coldfield Cpn...	12,000	2,900†	4,700	4,400
WESTMORLAND.				
Kendal Cpn.	5,045	1,969†	—	3,076
Westmorland & Dist. E. S., Ltd.	11,335§	3,986†	—	7,349
Windermere & Dist. E. S. Co.	4,880	1,456D	—	3,424
WILTSHIRE.				
Calne Cpn.	1,500*	—	280	1,220
Durrington E. L. Co. ..	1,000	350D	—	650
Marlborough Cpn. ..	1,250§	530†	—	720
Salisbury E. L. & S. Co.	8,447	1,178†	3,880	3,389
Swindon Cpn.	17,499	6,736c	5,700	5,063

Name of Supply Authority.	Total No. of House-holds in Area.	Number of Households on A.C.	on D.C.	Without Supply.
Tisbury E. S. Co. ..	550§	181†	—	369
West Wilts E. L. & P. Co.	28,485	11,971†	—	16,514
Wilton E. S. Co., Ltd...	819	314†	—	505
WORCESTERSHIRE.				
Kidderminster & Dist. E. S. Co.	(See S.W. & S. Co., Shropshire.)			
Malvern U.D.C. ..	4,500§	2,073B	—	2,427
Midland E. Corp. for Power Distribution—	(See Staffordshire.)			
Shropshire, Worcestershire & Staffordshire E. P. Co. ..	(See Shropshire.)			
Worcester Cpn. ..	18,900	12,419c	—	6,481
YORKSHIRE.				
Adwick-le-Street U.D.C.	4,249	3,368†	—	881
Askrigg & Reeth E. S. Co.	550*	300	—	250
Barnoldswick U.D.C. ..	3,250§	1,320†	—	1,930
Barnsley Cpn. ..	17,838§	12,425†	43	5,370
Batley Cpn.	10,246	5,168†	1,450	3,628
Bingley U.D.C. ..	6,091§	4,126†	—	1,965
Bradford Cpn. ..	83,895	38,119†	2,998	43,178
Bridlington Cpn. ..	7,561	5,528†	—	2,033
Brighouse Cpn. ..	6,277	2,306†	—	3,971
Buckrose L. & P. Co.	11,000*	2,626†	—	8,374
Clitheroe Cpn.	(See Lancashire.)			
Dearne Dist. E. B. ..	9,260	3,736†	—	5,524
Dewsbury Cpn. ..	15,800	8,952†	600	6,248
Doncaster Cpn. ..	25,525	14,212†	239	11,074
Electrical Distribution of Yorks.	213,000*	84,000*†	—	129,000
Earby U.D.C.	1,439	888†	—	551
Elland U.D.C.	3,542	1,883†	800	859
Eston U.D.C.	7,875*	2,685D	—	5,190
Guisborough U.D.C. ..	1,500*	1,200*c	—	300
Halifax Cpn.	30,653	17,039E		13,614
Harrogate Cpn. ..	19,504§	{ 1,300† / 12,061 }	—	6,143
Hawes E. L. Co. ..	400*	210*	—	190
Haworth U.D.C. ..	2,000*	450*†	—	1,550
Hebden Bridge Cpn...	2,100	1,300†	—	800
Heckmondwike U.D.C.	2,500*	—	2,200*	300
Holmfirth U.D.C. ..	2,950	2,720†	—	230
Huddersfield Cpn. ..	40,897*	31,796c	—	9,101
Hull Cpn.	112,313	38,534†	24,202	49,577
Ilkley U.D.C.	3,152	2,211†	—	941
Keighley Cpn. ..	14,564*	5,500*E		9,064
Kettlewell E. S. Co. ..	100	—	77	23
Leeds Cpn.	144,721	113,334A	—	31,387
Mexborough U.D.C. ..	3,800	500†	3,048	252
Middlesbrough Cpn. ..	36,062§	25,079†	100	10,883
Mirfield U.D.C. ..	4,550	2,196†	244	2,110
Newmill U.D.C. ..	1,240	1,110†	—	130
Normanton U.D.C. ..	4,000	1,576†	—	2,424
North Eastern E. S. Co.	(See Northumberland.)			
Pudsey Cpn.	4,890*	4,000*†	—	890
Redcar Cpn.	6,981	6,050c	—	931
Richmond Cpn. ..	1,357§	1,058†	—	299
Rotherham Cpn. ..	27,500	18,000†	—	9,500
Scarborough Cpn. ..	19,296	10,675†	—	8,621
Settle & Dist. E. Co. ..	3,710	1,321†	—	2,389
Sheffield Cpn.	134,136§	125,000c	—	9,136
Shipley U.D.C.	9,667	5,000	834	3,833
Skelton & Brotton U.D.C.	3,414§	2,678c	—	736
Skipton U.D.C. ..	4,600	2,348†	—	1,652
South East Yorks L. & P. Co.	5,500§	3,195†	—	2,305
Spenborough U.D.C. ..	3,600	1,752†	—	1,848
Stalybridge Board ..	(See Lancashire.)			
Tadcaster E. Co. ..	1,102*	—	620*	482
Wakefield Cpn. ..	15,000	{ 11,000†E / 1,000c }	—	3,000
West Riding Automobile Co. (Pontefract)	4,875§	1,185†	—	3,690
Whitby U.D.C. ..	3,700*	3,050*E		650
Whitwood U.D.C. ..	1,690*	1,075*†	—	615
York Cpn.	36,000	26,061†	600	9,339
ISLANDS.				
Douglas Cpn. (L.O.M.)	6,000*	1,300†	3,000	1,700
Guernsey States E.B.	9,000*	3,700*E		5,300
Isle of Man E.B. ..	7,000	2,257†	—	4,743
Isle of Wight E. L. & P. Co.	30,347	10,077c	—	20,270
Jersey E. Co., Ltd. ..	12,412	5,322D	—	7,090
Lerwick Cpn. (Shetland)	1,405*	—	900*	505
St. Marys (Scilly) E. S. Co.	300	108	—	192
Stornoway E. S. Co. ..	1,450	—	167	1,283

SET MARKET SURVEY

Wales and Monmouthshire

Name of Supply Authority	Total No. of House-holders in Area	Number of Households on A.C.	on D.C.	Without Supply.
Aberayron & Dist. S. E. Co.	400	—	263	137
Aberdare U.D.C.	12,452	8,700	800	2,952
Abertillery U.D.C.	7,617§	1,833D	1,700	3,984
Aberystwyth Cpn.	2,419§	—	1,500	919
Ammanford U.D.C.	1,750*	1,530*†	—	220
Bangor Cpn.	3,200*	2,960*†	—	240
Barry U.D.C.	9,484§	400*†	—	9,084
Bedwas & Machen U.D.C.	2,298§	1,707	—	591
Bedwellty U.D.C.	6,079*	5,690*†	—	389
Bethesda U.D.C.	1,500	900	—	600
Bettws-y-Coed U.D.C.	220	195D	—	25
Borth & Ynyslas E. S. Co.	500	—	252	248
Brecon Cpn.	1,695*	—	1,190*	505
Bridgend U.D.C.	5,900*	4,325*B	—	1,575
Brynamman & Dist. E. S. Co.	5,400§	2,993A	—	2,407
Caernarvon Cpn.	2,300	1,800†	—	500
Caerphilly U.D.C.	4,500*	1,410†	—	3,090
Caerswa E. S. Co.	164	120	—	44
Cardiff Cpn.	55,262§	44,803H		10,459
Cardiff R.D.C.	8,379	4,612A	—	3,767
Carmarthen E. S. Co.	3,000	1,873†	936	191
Cerrigydruidion Co.	—	60	—	—
Chepstow E. L. & P. Co.	1,718§	793†	—	925
Colwy. Bay U.D.C.	7,600	4,190†	2,794	616
Connahs Quay U.D.C.	1,500§	1,013c	—	487
Conway Cpn.	3,000*	2,650*†	—	350
Ebbw Vale U.D.C.	7,547§	—	5,469	2,078
Ely Valley L. Co.	4,000§	2,240	—	1,760
Gellygaer U.D.C.	10,221§	7,103†	—	3,118
Glantawe E. S. Co.	3,050*	—	1,500*	1,450
Gorseinon E. L. Co.	7,000*	2,987†	610	3,403
Hawarden R.D.C.	7,500§	4,900†	—	2,600
Llandrindod Wells U.D.C.	—	—	767	—
Llanelly & Dist. E. S. Co.	25,096*	6,250*A	3,000*	15,846
Llanfairfechan U.D.C.	950§	620†	—	330
Llangollen & Dist. E. L. & P. Co.	973	—	480*	493
Llanidloes E. L. Co.	720	—	480	240
Llanrwst E. S. Co.	1,108*	260*†	300*	548
Machynlleth E. S. Co.	560	425	—	135
Maesteg U.D.C.	6,085§	5,129	—	956
Menai Bridge U.D.C.	681*	400†	—	281
Merthyr E. Traction & L. Co.	17,772§	1,864D	3,254	12,654
Milford Haven U.D.C.	2,393*	—	1,800*	593
Monmouth E. Co.	1,260	654†	—	606
Mountain Ash U.D.C.	9,500§	8,175†	—	1,325
Mynyddislwyn U.D.C.	3,500*	3,225*	—	275
Neath Cpn.	8,250§	2,350C	—	5,900
Neath R.D.C.	10,137§	5,000D	904	4,233
Newport Cpn.	26,514§	12,984A	7,078	5,552
Ogmore Valley E. L. & P. S. Co.	3,325§	2,469†	—	856
Penarth E. L. Co.	4,561§	109†	1,648	2,804
Penmaenmawr U.D.C.	1,270	1,198†	—	72
Penybont R.D.C.	2,087§	1,940†	—	147
Pontardawe R.D.C.	7,000§	4,395†	—	2,605
Pontypool E. L. & P. Co.	8,236*	2,400*	—	5,836
Pontypridd U.D.C.	10,500§	2,697	2,541	5,262
Port Talbot Cpn.	10,643	1,340D	—	9,303
Porthcawl E. Co.	2,230	1,399†	—	831
Prestatyn U.D.C.	1,860	1,322†	—	538
Rhondda U.D.C.	33,650§	14,246	—	19 404
Risca U.D.C.	4,035	1,929†	—	2,106
Ruthin E. S. Co.	900	—	673	227
South Wales E. P. Co	45,072§	26,768†	—	18,304
Swansea Cpn.	41,387§	23,885C	675	16,827
Tredegar U.D.C.	5,798§	807†	—	4,991
West Cambrian P. Co.		413	—	—
Wrexham Cpn.	7,755	4,775†	200	2,780
Yale E. P. Co.	2,266§	—	1,101	1,165

Scotland

Name of Supply Authority	Total No. of House-holders in Area	Number of Households on A.C.	on D.C.	Without Supply.
Aberdeen Cpn.	46,687§	26,596G		20,091
Arbroath E. L. & P. Co.	4,375§	906C	205	3,264
Ayrshire E. B.	73,813	25,854C	1,972	45,987
Blair Atholl	—	—	90	—
Bon'ess Cpn.	2,695	—	958	1,737
Clyde Valley E. P. Co.	218,500§	96,001A	—	122,499
Crieff Electric S. Co. Ltd.	1,848	1c	285	1,562
Derry & Dunipace Cpn.	1,375§	627	—	748
Dumbarton (E. S. Cpn.)	5,400§	279C	400	4,721
Dumfries Cpn.	6,257	1,950†	1,858	2,449
Dumfriesshire C.C.	14,563§	6,290†	—	8,273
Duncans E. S. Co.	777*	—	525*	252
Dundee Cpn.	43,896§	12,854D	1,012	30,030
Dunoon & Dist. E. S. Co.	4,500	2,707	—	1,793
Edinburgh Cpn.	111,250*	53,450*F		57,800
Elgin E. S. Co.	1,000*	—	350*	650
Falkirk Cpn.	9,141§	5,171C	—	3,970
Fife E. P. Co.	56,000	14,500C	—	41,500
Fochabers E. Und.	340	—	264	76
Fort Augustus E. S.	—	—	50	—
Fort William E. L. Co.	980	—	410	570
Glasgow Cpn.	259,000	92,347D	33,699	—
Grantown-on-Spey E.S. Co.	560*	—	320*	240
Greenock Cpn.	29,218	6 801C	3,500	18,917
Hamilton Cpn.	11,057	4,300†	250	6,507
Inverness Cpn.	6,820	—	3,796	3,024
Kirkcaldy Cpn.	10,200*	2,600*	800*	6,800
Kirkcudbright C.C.	9,848	2,167†	—	7,681
Lairg E. S. Co.	—	75*	90*	—
Lossiemouth U.D.C.	1,000	—	875	125
Lothians E. P. Co.	36,581	8,214†	—	28,367
Motherwell & Wishaw Cpn.	16,225§	1,030C	8,363	6,832
Musselburgh & Dist. E. L. & Traction Co.	5,286	225†	1,173	3 888
North Berwick Cpn.	1,218	494†	—	724
North of Scotland E. L. & P. Co.	2,500*	—	750*	1,750
Paisley Cpn.	22,000	16,589C	—	5,411
Perth Cpn.	9,404	—	4,800	4 604
Peterhead E. S. Co.	3,125§	463	—	2,662
Rothesay Cpn.	2,713*	—	1,100*	1,613
Scottish Midlands E. S. Co.	—	—	—	—
Scottish Southern E. S. Co.	18,000*	2,510B	280	15,210
Skelmorlie E. S. Co., Ltd.	575§	250†	—	325
Stirling Cpn.	5,648§	—	2,600	3,048
Tobermory Cpn.	224	—	130	94
Wick Cpn.	2,084*	—	1,600*	484
Wigtownshire E. Co.	9,073	2,200†	—	6,873

H.P. AND RENTING (WITH SERVICE) AGREEMENTS

Draft Documents for Dealers

The following two draft agreements are published at the request of numerous dealers. They concern "Hire-Purchase with Maintenance" and what is known in the trade as "Renting," respectively. The latter automatically includes maintenance, as do most renting agreements in the radio business.

It is essential that any reader who plans to make use of either agreement should first consult his solicitor to make certain the agreement in question is absolutely suited to his purpose and business. BROADCASTER *accepts no legal responsibility of any kind whatsoever concerning either of the agreements below or their use.*

There are many forms of such agreements, and it is difficult, if not impossible, to prepare them in such a way that they are an absolute protection to the owners in every circumstance. Goods on hire (rented) or hire-purchase are liable to distress for rent, and the only way to prevent this is for the owners to inspect rent books, etc., periodically to see that this risk is remote. They can also be taken in execution on judgments, etc.

Hire-Purchase (with Maintenance) Agreement

Date .....

I, ...

of.....(permanent address)

hereby agree to hire from Messrs.....

of.....(hereafter called the Owners) a.....(make and model number) radio receiver (or radio-gramophone) registered number.....on the following terms and conditions :—

1. That I will pay the Owners the sum of..... on signing this Agreement and the sum of .....on the.....day of each succeeding week (or month) as long as I continue the hire.
2. That I will keep the said instrument in good order and condition and not do or permit to be done anything that will impair its value or efficiency.
3. That I will not dispose of the said instrument or any interest therein in any way or remove or allow it to be removed from my address without the previous written agreement of the Owners.
4. That I will produce to the Owners on request receipts for the rents, rates and taxes of the premises in which the instrument is kept and allow their representative to inspect the instrument at all reasonable times.
5. That if I do not punctually pay the rent mentioned in Clause 1 hereof (whether the same shall have been demanded or not), or do not observe and perform or shall commit a breach of the terms and conditions of this agreement or should any distress or execution be leviable or about to be levied upon the Owners' property or their rights be in any way endangered on account of the acts of third parties, the Owners may without any previous notice determine the hiring contracted for by this Agreement and thereupon the Owners or their servants or agents may at any time thereafter enter upon my premises and resume possession of the said instrument and seize and carry away the said instrument or should the Owners deliver to me at my address notice in writing terminating this Agreement I undertake and agree to return immediately the said instrument to them at the address they stipulate.
6. That if this Agreement be terminated under Clause 5 I shall still be liable for any arrears of hire and damages for breaches of this Agreement or any injury to or deterioration of the instrument—fair wear and tear excepted.
7. That I may terminate the hiring at any time by returning the said instrument in good condition to the Owners, and paying any sum due for hire to date of return plus any sum in addition that may be necessary to make my total payments under this Agreement equal to.....per cent. of the purchase price mentioned in Clause 8.
8. That when I have paid the sum of..... by such deposit and instalments as specified in Clause 1 the said instrument shall become my sole and absolute property.
9. That until such total sum has been paid the said instrument remains the property of the Owners.
10. That I may complete the purchase of the said instrument at any time by paying the amount necessary to bring my total payments under the Agreement up to the sum mentioned in Clause 8, less a reasonable deduction for interest on the remaining instalments so prepaid by lump sum.
11. That the terms of this Agreement include free installation (except erection of outdoor aerials, fitting power points, etc.), service and maintenance (except when resulting from misuse, tampering, accident, etc.).

Signed .....

Address .....

Witness .....

Address .....

[*Continued on next page*]

We, Messrs. .....

of .....

agree to supply the above-mentioned instrument on the terms and conditions herein specified.

Signed .....

Address .....

Witness .....

Address .....

Radio Renting Agreement

Date.....

I .....

of ..... (permanent address)

hereby agree to rent from Messrs.....

of ..... (hereafter called

the Owners) a..... (make and model number) radio receiver (or radio-gramophone) on the following terms and conditions :—

1. That I will pay the Owners the sum of .....on signing this Agreement and the sum of.....punctually on the.....day of each succeeding week (or month) until this Agreement is terminated.
2. That I will keep the said instrument in good order and condition and not do or permit to be done anything that will impair its value or efficiency.
3. That I will not dispose of the said instrument in any way or remove or allow it to be removed from my address as above without the previous written consent of the Owners.
4. That the Owners may terminate this Agreement at any time should I fail to observe all its terms and conditions, do anything that may endanger the Owner's property or rights, or if any distress or execution is leviable or about to be levied on my property. In such event the Owners or their servants or agents shall have the right of entry to my premises to remove the instrument.
5. That should this Agreement be terminated under Clauses 4 or 6 I shall still be liable for my arrears of rent and for injury to or deterioration of the instrument—fair wear and tear excepted.
6. That I may terminate this Agreement at any time by returning the instrument in good condition—fair wear and tear excepted. I agree to give the Owners one month's notice of such termination, or a month's rent in lieu thereof.
7. That under this Agreement the instrument remains the property of the Owners.
8. That I may at any time purchase the instrument for cash or by hire-purchase, in which event all payments made for rent up to date of purchase shall be credited against the purchase price.
9. That so long as I perform all the Terms and Conditions of this Agreement the Owners will maintain the said instrument in working order, including the supply of new valves or parts necessary to do so, free of charge, and that they, their servants or agents, shall have free access to my premises at all reasonable times to inspect, examine or repair the instrument.
10. That any repairs or service required as the result of tampering, accident or misuse shall be charged for.

Signed .....

Address .....

Witness .....

Address .....

We, Messrs. .....

of .....

agree to rent the above-mentioned instrument

to .....

of .....

on the Terms and Conditions specified herein.

Signed .....

Address .....

Witness .....

Address .....

Points to Note

Any agreement of the type outlined above must, of course, bear a sixpenny stamp to make it a legal document when it is signed and completed.

In the case of a non-householder or a person under 21 years of age or a married woman signing such agreements, it is usual to ask for a guarantor who is a householder.

Besides the questions to elicit the above facts, some owners ask whether the customer is married, occupation, business address, and name and address of employer (not for reference).

It is usual to provide the customer with a duplicate of the agreement for reference.

In the second (Renting) agreement given above, some retailers may like to make use of such clauses as 4, or the "return" portion at the end of 5, both from the first "H.P. and Maintenance" agreement, in order to provide further security for themselves.

Damage by fire and theft are not mentioned in these agreements. Some retailers add this to their "service and maintenance" liabilities as an added inducement to custom. If this is done it should be added to the agreement in question at the appropriate clause.

Alternatively, a clause can be inserted making it necessary for the customer to insure against such contingencies and also making it necessary for him to produce the policy of such insurance to the owners if required.

How to arrive at economic maintenance "premiums" is given in an article on page 116. In financing their own hire-purchase, dealers must observe the minimum terms set out in the Set Makers' Association's "H.P. Schedules" for dealer-financed transactions.

PUBLIC PERFORMANCE AND P.A.

P.R.S. and Phonographic Performance Licence Tariffs

The use of P.A. equipment, radio apparatus or gramophone records for public entertainment, but not for ordinary selling demonstrations, raises certain points in copyright law.

In the first place the result of the action brought by the Performing Right Society against the Hammond Brewery makes it clear that a holder of the ordinary B.B.C 10s. licence is not entitled, without permission, to reproduce broadcast programmes in any public place.

In the second place, the case of the Gramophone Co. *v.* Stephen Carwardine establishes the fact that the maker of a gramophone record has a special copyright in the record itself (apart altogether from the composer's copyright in the words or music) which entitles him to a royalty.

The present position, therefore, is that the P.R.S. (who represent the authors' performing rights) can claim royalty on this footing, both for radio and gramophone reproduction in public, while the record-makers have a separate and independent claim for royalty whenever a record is played publicly.

In addition, there is the B.B.C. copyright in certain of their broadcasts.

In the case of national events, this copyright is sometimes waived by the B.B.C., and it is also possible for dealers to obtain permission to reproduce copyright broadcasts on special occasions sometimes.

The P.R.S. licence (which covers the copyright of the words and music in both radio and record) is issued by the Performing Right Society, Ltd., of Copyright House, 33, Margaret Street, London, W.1 (Langham 3864).

The following tariffs of fees (payable annually in advance) are those most likely to be required for reference by radio dealers.

Tariff "H"—Restaurants, Cafés, etc.

Premises seating not more than 15 persons :

Ordinary non-amplified gramophone : Class A, 16s. ; Class B, 13s. ; Class C, 10s. 6d.

Radio only : Class A, £2 2s. ; Class B, £1 11s. 6d. ; Class C, £1 1s.

Amplified gramophone, or radio plus ordinary gramophone : Class A, £3 19s. ; Class B, £2 15s. ; Class C, £1 11s. 6d.

Radiogram, or radio plus amplified gramophone : Class A, £6 6s. ; Class B, £4 4s. ; Class C, £2 2s.

For each additional 10 (or part) persons capacity up to 75, and thereafter for each additional 25 (or part) persons capacity :—

Ordinary non-amplified gramophone : Class A, 16s. ; Class B, 13s. ; Class C, 10s. 6d.

Radio only : Class A, £1 1s. ; Class B, 16s. ; Class C, 10s. 6d.

Amplified gramophone, or radio plus ordinary gramophone : Class A, £1 6s. ; Class B, 18s. ; Class C, 10s. 6d.

Radiogram, or radio plus amplified gramophone : Class A, £1 11s. 6d. ; Class B, £1 1s. ; Class C, 10s. 6d.

Note.—Class A.—High-class restaurants, cafés, tea-rooms, road-houses, etc., including those with facilities for dancing.

Class B.—Medium-class restaurants, cafés and tea-rooms.

Class C.—Other smaller establishments, such as ice-cream parlours, coffee shops, refreshment chalets, etc.

Tariff "R.H."—Residential Hotels and Boarding Houses.

Tariff does not apply where premises have dance hall, restaurant or other place open to the public.

Radio sets or gramophones, other than radiograms : £1 6s. (not more than 15 bedrooms). For each additional 15 bedrooms (or part), £1 6s.

Radiograms or radio sets, plus gramophones : £1 19s. 6d. (not more than 15 bedrooms). For each additional 15 bedrooms (or part), £1 19s. 6d.

Rebates will be granted if the premises are only open for part of the year, or in other special cases.

Tariff "P"—Public-Houses.

Premises with rateable value not exceeding £30 :—

Ordinary non-amplified gramophone, 10s. 6d. ; radio only, £1 1s.

Amplified gramophone, or radio plus ordinary gramophone, £1 11s. 6d.

Radiogram or radio plus amplified gramophone, £2 2s.

For each additional £35 (or part) rateable value up to £100, 10s. 6d.

For each additional £25 (or part) rateable value up to £200, and thereafter for each £50 (or part) rateable value, 10s. 6d.

P.R.S. fees for temporary outdoor P.A. engagements such as small flower shows and bazaars are 7s. 6d. for one speaker for one day, 10s. 6d. for two speakers, or 12s. 6d. for more than two speakers.

The record licence which must be obtained *in addition* to the P.R.S. licence if records are going to be reproduced in public is issued by Phonographic Performance, Ltd., of 144, Wigmore Street, London, W.1 (Welbeck 7806).

Manufacturers whose records are covered by the licence include :—The Gramophone Co., Ltd.; Columbia Graphophone Co., Ltd.; the Decca Record Co., Ltd.; Crystalate Gramophone Record Manufacturing Co., Ltd.; Edison Bell (1933), Ltd.; the Parlophone Co., Ltd.; the British Homophone Co., Ltd.; the British Zonophone Co., Ltd.; Brunswick, Ltd.; tbe Vocalian Gramophone Co., Ltd.; the Murdoch Trading Co.

The actual records covered are :—Ariel, Beltona, Broadcast, Brunswick, Columbia, Crystalate, Decca, Edison Bell, Eclipse, Electron, Forum, Fortune, 4 in 1, H.M.V., His Master's Voice, Homochord, Imperial, Imperial-Broadcast, Kid-Kord, Odeon, Panachord, Parlophone, Parlaphone-Odeon, Peacock, Plaza, Polydor, Regal, Regal-Zono, Rex, Solex, Sterno, Winner and Zonophone.

Phonographic Performance, Ltd., will issue to dealers a licence covering standard, or approved privately-made apparatus, not exceeding £200 in value. This costs 12 guineas for twelve months, £6 10s. for six months, and £3 10s. for three months. It covers all engagements, such as shows, dances and fêtes, and not of a permanent or semi-permanent nature.

There are special tariffs for greyhound tracks, speedways, football grounds. Terms for " occasional " licences for sports meetings, swimming galas, flower and horse shows, and similar functions, may be obtained on application.

Tariffs have been arranged for theatres and kinemas, and details are available on application.

For swimming pools, skating rinks and dance halls licences may be obtained at fees based on the rateable value, capacity of the premises, and/or the period and duration of the performance.

The licence for boarding-houses is 10s. 6d. a year if the rateable value is below £100, and one guinea if it is over.

For restaurants and cafés with seating capacity up to 40 persons, the licence for one speaker is two guineas a year; up to 60, 4 gns.; up to 80, 6 gns.; up to 100, 8 gns.; up to 200, 9 gns.; over 200, 10 gns. Seasonal terms on application. Extra speakers, 10s. 6d. each.

For hotels and public houses, when the rateable value does not exceed £100, the fee for one speaker is 2 gns. per year; up to £200, 3 gns.; up to £300, 4 gns.; up to £400, 5 gns.; up to £500, 6 gns.; up to £600, 7 gns.; up to £700, 8 gns.; up to £800, 9 gns.; up to £900, 10 gns.; up to £1,000, 11 gns. Special agreement over £1,000 rateable value. Seasonal terms on application. Every speaker extra, 10s. 6d.

Phonographic Performance is open to make arrangements whereby dealers collect fees at a commission of 5 per cent.

G.P.O. RELAY REGULATIONS

All relays have to be licensed by the P.M.G. This licence costs £1 a year, and imposes upon the licensee certain obligations. Subscribers to relay services must hold an ordinary P.O. receiving licence. The relay firm must disconnect any subscriber who ceases to hold a listening licence.

In addition the G.P.O. has to be advised monthly of new subscribers' names and addresses, of the expiry dates of their listening licences, and of the date when they became subscribers. The names and addresses of people who have ceased to be subscribers and the date when they ceased to be subscribers have also to be returned monthly.

The licensee may not originate at the station or collect by wire any programme, message or item, nor must the licensee use or allow the station to be used for the receipt of messages other than programmes.

The relay may not distribute any programme or message containing political, social or religious propaganda received in the English language from any station outside Gt. Britain and Northern Ireland.

A daily record of the programmes supplied to subscribers must be kept, with the origin of these programmes, and the time of reception. This log must be open to G.P.O. inspection at any time without notice.

The relay company must, if asked by the P.M.G., instal and maintain free a relay service at the residence of any Post Office official in the district covered by the relay. All apparatus used in relays has to be of British make, and the station and wires have to be open to Post Office inspection at any time.

The licensee must not without the P.M.G.'s consent (*a*) sublet the powers given by the licence, or (*b*) acquire shares in any other licensed relay concern.

The P.M.G., on the determination of the agreement (for which six months' notice is necessary) may, after giving three months' notice, purchase the whole station.

POSTAL REGULATIONS

LETTERS.

Not exceeding 2 oz.	1½d.
For every additional 2 oz. ...	½d.
Postcards { Single	1d.
Postcards { Reply paid	2d.

Maximum size, 2 ft. long, 1 ft. wide or 1 ft. deep; or in roll form 2 ft. 6 in. long and 4 in. diameter. There is no limit of weight.

PARCELS.

Up to 3 lb....	6d.
3 lb. to 4 lb.	7d.
4 lb. to 5 lb.	8d.
5 lb. to 6 lb.	9d.
6 lb. to 7 lb.	10d.
7 lb. to 8 lb.	11d.
8 lb. to 15 lb.	1s. 0d.
Registration fee	3d.
Proof of Posting	½d.

The greatest length allowed is 3 ft. 6 in. and the greatest length and girth combined 6 ft. Parcels for the Irish Free State are accepted under the same conditions of rate and size, with a maximum weight of 11 lb., but a declaration of contents for customs purposes must be made.

PRINTED PAPERS.

For every 2 oz. up to 2 lb. ... ½d.

To be dispatched on the day of posting, printed papers must be posted before 4.30 p.m. in London and not later than the special time announced at provincial post offices. Printed papers must be posted in wrappers which allow easy examination of contents by postal officials.

MONEY AND POSTAL ORDERS.

Inland money orders can be obtained for any sum, not comprising a fraction of a penny, up to £40. The poundage rates charged for the orders are :—

Up to £3	4d.
£3 to £10	6d.
£10 to £20	8d.
£20 to £30	10d.
£30 to £40	1s.

Money orders can be telegraphed from 1s. plus an extra fee of 2d.

Single postal orders can be purchased from amounts in sixpenny stages from 6d. to 21s. Poundage charges range from 1d. to 2d. respectively.

SAMPLES.

The sample post was re-introduced recently. Inland rates are :

Up to 4 oz.	1d. (minimum)
4–6 oz.	1½d.
6–8 oz.	2d. (maximum)

Size limitations are 12 ins. long, 8 ins. wide and 4 ins. deep.

BUSINESS REPLY SCHEME.

Instead of stamping all reply envelopes or postcards enclosed in mailing shots dealers may make use of this scheme by which they only pay postage for the replies delivered to them. An account has to be opened with the local post office and the envelopes or cards must be of the approved pattern. The charge of all replies delivered is the normal postage plus ½d. Charges are debited against the account.

REGISTRATION.

The registration fee of 3d. for inland post only covers any postal packet, subject to certain conditions, to compensation for loss or damage not exceeding £5. Higher fees covering higher compensation are 4d. covering up to £20, and a further £20 compensation for every additional 1d. of fee up to a maximum of £400 at 1s. 11d. fee. Packets for registration must be handed in at a post office. Knots in string must be sealed. The maximum limit of compensation for unregistered parcels is £2.

TELEGRAMS.

Inland telegrams are charged at 6d. for 9 words (minimum) and 1d. for every additional word.

There are special rates for batches of telegrams sent, for instance, as a special publicity shot. Addresses are not charged for and the message costs 1d. per 4 words (minimum 4d.).

Night telegraph letters may be telephoned or sent from any Post Office open at such hours up to midnight. The message is then written out as a letter and reaches the addressee in the morning's post. The charge is 1s. for 36 words, and 1d. per 3 words above this.

Telegrams to the Irish Free State cost 1s. 6d. for 12 words and 1d. a word above this.

EXPRESS DELIVERY.

Packets will be delivered by special messengers under five services.

All the way, on weekdays only, 6d. a mile plus a weight fee of 3d. on packets weighing more than 1 lb.

After transmission by ordinary postal service to office in district of delivery, 6d. in addition to ordinary postage. This is at sender's request.

Same service at addressee's request, 6d. a mile.

Sunday service letters and postal packets only will be expressed between certain post offices at additional fees according to distance.

POSTAL REGULATIONS

Express letters may be dictated by telephone to the office nearest to the addressee where they will be written down and sent by messenger. Fees are usual telephone charge, writing fee 3d. for 30 words and 1d. for every additional 10, and 6d. a mile for delivery.

CASH ON DELIVERY.

The cash on delivery fees which are in addition to the ordinary postage and registration fees are :—

Amount to be collected not exceeding :—	Fees.
10s.	4d.
£1	6d.
£2	8d.
£5	10d
£10	1s. 0d
£15	1s. 2d.
£20	1s. 4d.
£25	1s. 6d.
£30	1s. 8d.
£35	1s. 10d.
£40	2s. 0d.

The value of an article sent by registered letter or parcel post or unregistered parcel post, can on certain conditions be collected from the addressee by the Post Office and remitted to the sender. The service does not apply to the Irish Free State in either direction. Packets may be posted at any Money Order Post Office.

This service also operates on railways, when the sender must obtain from a Money Order Post Office a combined address label and receipt form for every parcel sent.

The package must be handed to the railway company and the receipt portion signed by the company official sent to the consignee. This must be handed over on delivery. Railway company's charge, 3d. in addition to the usual rail charges.

IMPERIAL AND FOREIGN

LETTERS.

To the British Empire generally, to H.M. Ships of war abroad, Egypt, U.S.A. and the British Post Office at Tangier.	1½d. first oz. and 1d. each oz. after.
To all other places including Iraq and Transjordan.	2½d. first oz. and 1½d. each oz. after.

Maximum size for British Dominion Colony or Possession, 2 ft. long by 18 in. wide or deep. For foreign countries limit of size is 18 in. in either direction. In either case a letter in the form of a roll must not exceed 30 in. long and 4 in. in diameter. Weight limit is 4 lb.

POSTCARDS.

Single	1½d.
Reply paid	3d.

Same size and conditions as inland.

SMALL PACKETS.

Limited to certain places. Maximum dimensions 18 in. by 8 in. by 4 in., or in roll form 18 in. long by 6 in. diameter. Weight limit 2 lb.

PRINTED PAPERS, COMMERCIAL PAPERS AND SAMPLES.

Each 2 oz. ½d., minimum for commercial papers 2½d., and samples 1d.

Conditions similar to Inland. Commercial papers may be hand produced or typewritten but must not be in the nature of correspondence.

SAMPLES.

Service restricted to bona fide samples not for sale. Size limit 2 ft. long by 1 ft. wide or deep to British Dominions, etc., and 18 in. long, 8 in. wide and 4 in. deep for foreign countries. In roll form for foreign countries size limit is 18 in. long and 6 in. diameter. Weight limit 5 lb. to British Empire generally and 1 lb. to foreign countries.

PARCELS.

Rates vary considerably. General size limit is 3½ ft. any dimension or 6 ft. combined length and girth. Weight limit varies up to 22 lb. Declaration of contents to be made on posting for customs purposes.

CASH ON DELIVERY.

Special rates available.

REGISTRATION.

Fee for letters, printed papers, etc., but not parcels, 3d.

INSURANCE.

Parcels sent to certain countries can be insured.

AIR MAIL.

Full particulars of this service for letters and parcels given on periodical leaflets available at post office.

GENERAL INFORMATION.

Full particulars of postal services together with general regulations concerning types of goods accepted in certain cases are given in the Post Office Guide available at post offices.

LISTENING LICENCE

Most people think that the yearly charge of 10s. made by the Post Office for a listener's "licence" is merely a convenient way of collecting the cost of the programmes provided each day by the B.B.C. To a certain extent this is perfectly true, but it is not the full story.

The use of the ether for the purpose of wireless telegraphy and telephony is part of the vast monopoly of postal communications (including the ordinary telegraph and telephone systems) vested by law in the Postmaster General. No one in fact is entitled to use the ether, either for the transmission or reception of wireless signals of any kind, without the formal permission or "licence" of the P.M.G. This was the case long before the introduction of the present Broadcasting service, and the position remains the same to-day.

Of course, in practice, by far the larger part of the revenue collected by the Post Office under this head goes to maintain the B.B.C. in active operation, but whatever surplus is diverted into the Treasury coffers goes there properly and legally as a rent or profit made by the P.M.G. out of his monopoly powers over the ether.

Conditions of the Licence.

The present P.M.G. licence covers the use of one or more broadcast receivers in the same household. It does not, however, cover the use of a separate receiver by a lodger or sub-tenant in the same house. Similarly the occupier of each flat in the same block of buildings must take out his own licence.

If the possessor of a wireless set supplies low frequency current over wires to a loud speaker in an adjacent house, the owner of the loud speaker must take out a separate licence. In the case of a local relay service which supplies a large number of subscribers by means of wires from a central receiving station, the owner of the service must take out a special licence, whilst each subscriber must pay 10s. a year for the P.M.G. licence over and above the cost of the service itself.

The P.M.G. licence covers the use of one portable set, in addition to a set permanently installed in the household. Such portable set must, however, be operated only by the licensee or by a member of his family residing in the same house, who must carry the licence with him for inspection if required.

The receiving set must not be used in such a manner as to cause "interference," *i.e.*, the valves must not be allowed to oscillate.

The licensee must not use his set to intercept messages other than those broadcast for general reception. If he does happen to overhear any private messages he must not reproduce or make any other use of them.

Every receiver is liable to inspection by a duly authorised official of the P.M.G., who must, however, produce an official card of identification if required.

The licence is not transferable. Any permanent change of address should be notified to the Postmaster of the new district. A temporary change of address need not be notified.

A notice is now inserted on each licence warning listeners who use mains-driven sets not to make any direct connection between the electric supply mains and the aerial.

It has also been agreed that a dealer may supply a set on approval for fourteen days without it being licensed, provided he keeps a record showing the name and address of the prospective purchaser, and the dates of delivery and completion of sale.

A dealer whose shop is part of his house has to take out a licence for his demonstration receiver, as well as the licence for his family receiver. The shop installation is a "separate receiving station."

Naturally, demonstration receivers in lock-up shops must be licensed just the same.

The P.O. listening licence position regarding car-radio was the subject of a question in the House of Commons.

In reply, Sir Kingsley Wood, then the Postmaster-General, said:—

"A wireless licence covers the regular use of wireless receiving apparatus at the address shown on the licence, and also the occasional use by the licensee (or a member of his household) of a portable receiving set at another place, whether in a house, or in the open air, or in a motor-car. The licence must be carried by the person using the portable set.

"The concession in regard to portable sets does not cover the use of a wireless set which is permanently fitted in a motor-car. A separate licence must be obtained for such a set, and must be carried in the car."

THE A.4 LICENCE

The A.4 agreement, which is the latest form of licence to manufacture issued to set makers in this country, is offered by the British Thomson-Houston Co., Ltd., Electric and Musical Industries, Ltd., Marconi's Wireless Telegraph Co., Ltd., Standard Telephones and Cables, Western Electric Co., Ltd., and the Hazeltine Corporation.

The agreement covers radiograms as well as receivers and is designed to supersede both the A.3 licence and the R.G.2.

It is a licence agreement to continue until August 28th, 1938, and covers the manufacture and sale of broadcast receiving apparatus in Great Britain, Northern Ireland, the I.F.S., Channel Islands and the Isle of Man for private and domestic use only with the exception that the use of radio sets and radiograms is permitted in public-houses, hotels, cafés and small dance halls not being attached to a theatre or cinema.

Except as stated above the use of broadcast apparatus for revenue earning purposes is prohibited.

Export is not permitted without the consent of the licensors.

The licence covers kits as well as complete receivers and a clause concerning British radio licence conditions in this country stipulates that all companies or firms directly or indirectly owned or controlled by the licensee shall, if engaged in any field of business to which the licence is applicable, accept licences from the grantors.

No permission is includod in the licence to manufacture or sell valves, loudspeakers or television apparatus, and manufacturers are bound to use British-made apparatus.

The royalty on receivers is 2s. 6d. per valve holder, the expression valve meaning in the case of multiple-valves that every cathode-anode stream shall be deemed to be one valve. The royalty on kits is 1s. 6d. per valve with the same proviso applying in the case of multiple-valves.

In the case of radio gramophones, in addition to the above royalty, there is a further single payment of 2s. 6d. over and above the per valve royalty, while in the case of kits of parts intended for assembly into radiograms, there is also a further additional final sum of 2s. 6d. over and above the 1s. 6d. per valve royalty.

No royalty is payable in respect of a battery eliminator incorporated in a broadcast receiver or radiogram.

A minimum royalty of £150 per annum is payable and licensees may not manufacture sets for sale except under their own trade-mark or trade name.

The royalty on eliminators sold separately is 2s. 6d. per valve or equivalent of a valve.

To the scale of royalty as set out above a form of rebate is applied, to come into operation when the licensee pays a sum of £1,800 to the Pool.

This sliding scale rebate does not apply to the single payment of 2s. 6d. due in the case of radio gramophones.

The rebate is of such a nature that the scale ends at a point where the actual amount of royalty due, after deducting the percentage rebate, drops to 1s. in the case of sets or 6d. in the case of kits.

In actual practice, while the per valve royalty of a manufacturer whose actual payment to the Pool is £1,800 per annum remains, therefore, at the standard rate per valve of 2s. 6d., a manufacturer whose total payment to the Pool on this standard scale would amount to £9,000 would receive such a rebate as would reduce his per valve payment to approximately 1s. 5d. and the actual net sum from £9,000 to £5,000.

No schedule of patents is incorporated in the licence, but the following is a list of the principal patents, including those of the Hazeltine Corporation, which are held at the moment by the Pool.

Patent No. 275 of 1915 covering the push-pull amplifier (recently extended by order of the High Court until January, 1935) is still on the list, as well as No. 15448/15 relating to the use of a centre-tapped filament for raw A.C. valves, which was similarly given a fresh lease of life up to November, 1935.

One or two of the scheduled patents are due to expire within the next year, including one of the earliest superhet patents, No. 135177, but the rest have still a long term to run.

The well-known "Craft" patent, covering the basic principle of the radiogram, the Rice-Kellog patents for moving-coil speakers, and the Wilians tone-compensating circuits are, of course, carried over from the old RG2 to the new A4 agreement. In addition, there are circuits covering forms of automatic grid bias, the use of the loudspeaker field coil to assist the eliminator "smoothing," and a D.C. supply unit with means for applying out-of-phase voltages to compensate for hum.

The following is a short analysis of the patents now included for the first time, and not previously scheduled, either in the RG2 or A3 agreements.

No. 259664 (Western Electric Co.), July 14, 1925.—Part of the output from the second detector of a superhet is diverted through a tuned circuit and fed to an auxiliary amplifying valve, which passes the amplified current to a rectifier. The direct-current voltage developed across a resistance in the plate circuit of the latter is used to control the grid bias of one or more of the high frequency valves in accordance with the strength of the incoming carrier.

No. 283120 (British Thomson-Houston), January 3, 1927.—In a "straight" circuit the output from the second H.F. valve is fed to a detector. The plate circuit of the detector includes the primary of a low-frequency transformer and, in series with it, a high resistance. The latter is in the input circuit of an auxiliary valve amplifier, the D.C. output voltage from which is applied directly to bias the grids of the H.F. stages. The auxiliary valve may be dispensed with, and the D.C. voltage may be used to bias the grids either of the preceding H.F. stages or of the following L.F. stages.

No. 372155 (Marconi's Wireless Telegraph Co.), July 7, 1930.—"Quiet" automatic volume control. The loudspeaker is cut out of circuit so long as the desired programme falls below a certain strength. This eliminates undesirable background "noise" during the operation of tuning. The anode circuit of one of the intermediate-frequency valves includes a time relay so adjusted that a short-circuiting resistance is connected across the loudspeaker input until the signal being tuned in reaches a certain level of strength. The short-circuit is then removed and the loudspeaker automatically comes into operation.

No. 377307 (Marconi's Wireless Telegraph Co.; G. Mathieu; and G. A. Isted), March 28, 1931.—The rectified voltage from the second detector valve of a superhet is applied in the first instance

to regulate the bias on the first detector valve only; next, if necessary, to control the output of the intermediate frequency valve; and then, in succession, the frequency-changing valve and the H.F. amplifier. The A.V.C. rectifier may be a diode valve arranged in parallel with the second detector.

No. 381847 (Marconi's Wireless Telegraph Co.), March 21, 1931.—The A.V.C. voltage is derived either from a double-diode-triode valve, or from an ordinary triode valve in which the cathode and grid are used to rectify the signal voltages, while the cathode and anode act as a second pair of electrodes to rectify the carrier-wave. The rectified carrier voltage is fed back to the grid of the preceding valve for A.V.C., whilst the audio-frequencies are applied to a resistance in the grid-cathode circuit, and, after passing through the valve in this form, are fed forward to another stage of L.F. amplification. The arrangement can be used to give "quiet" or "delayed" A.V.C. by preventing the development of any D.C. carrier voltage until the signal reaches a definite level of strength.

No. 393318 (Marconi's Wireless Telegraph Co. and R. M. Armstrong), December 2, 1931.—Part of the rectified carrier-wave is used to vary the voltage applied to the screening-grid of a S.G. valve in such a way as to increase its effective amplification-factor as signal strength falls off and vice versa. Part of the resistance across which the A.V.C. voltage is developed may consist of the anode-cathode path of an auxiliary valve.

OTHER PATENTS.

Ganged Tuning Control.—No. 221868 (Western Electric Co. and G. H. Nash), June 19, 1923.—Covers the use in a receiving set of a number of variable tuning condensers which are mounted coaxially, but not on the same shaft, and so locked together that the rotation of one from a single control knob simultaneously effects the rotation of the others.

Anti-Reaction Circuit.—No. 260036 (H. J. Round), July 20, 1925.—In order to eliminate reaction due to interelectrode capacity, the usual anode "balancing" inductances consist of various coils, some wound in the ordinary way, whilst others are astatically wound, i.e., so that there is no external magnetic field.

Screening.—No. 285020 (British Thomson-Houston), February 8, 1927.—Covers the use of "partition" screening in the case of screen-grid amplifiers. The input and output circuits are preferably arranged on opposite sides of the same partition, the bulb of the valve extending part way through.

Automatic Grid-bias.—No. 348540 (S. J. Anderson), February 12, 1930.—"Free" grid bias is obtained by using the voltage drop across one of the usual anode impedances. For instance, the D.C. voltage developed across the primary of an ordinary L.F. coupling-transformer is used to bias the grids both of the detector and the following L.F. stage.

Remote Tuning Control.—No. 355706 (Marconi's Wireless Telegraph Co. and A. T. Witts).—The tuning condensers of a receiving set are controlled from a distance through a potentiometer knob, which varies the resistance in a circuit, comprising a solenoid, and so alters the position of an armature moving in and out of the solenoid. The armature is coupled to the moving plates of the condenser through a spring-controlled plunger, which prevents any movement of the condenser plates when the solenoid is de-energised.

Straight-line Amplifier.—No. 358932 (Marconi's Wireless Telegraph Co.; H. J. Round; and P. K. Turner), June 12, 1930.—The grid and cathode of a valve of high mutual conductance are tapped across a small portion of the inductance of a tuned circuit, which is also lightly coupled to the plate circuit, the degree of reaction being such as to reduce the damping practically to zero. The response of such a circuit to impressed signals is substantially linear.

Frequency-correcting Circuits.—No. 370300 (N. M. Rust), December 24, 1930.—Covers the use of inductance, resistance, and capacity networks for correcting variations in current frequency or phase, and compensating for attenuation.

Band-pass Circuits.—No. 393983 (N. P. Hinton).—A variably-tuned band-pass input or coupling-circuit which has two resonant frequencies at each setting (double-humped curve), and a constant difference between these two frequencies at all points within the tuning range. The two circuits forming the band-pass are cross-connected, so that there is always a tuned "series" circuit, together with a second tuned "figure-of-eight" circuit. The arrangement is suitable for ganged control, and more particularly for coupling the signal and local oscillator circuits in a superhet receiver.

The Hazeltine Corporation's list includes one patent originally issued to Mr. Scott Taggart for an early neutrodyne development, and certain others issued to Messrs. Loftin and White for couplings designed to ensure a constant amplification over the entire tuning range of a set.

Broadly speaking, the inventions fall into three main groups, the first relating to constant amplification, the second to methods of ganging for single-knob tuning control, and the third to neutrodyning. The remainder are chiefly concerned with constructional details.

As they were originally intended for the American rather than the British market the circuits are not, as a rule, designed to cover both medium and long-wave ranges. There is, however, evidence of a far-sighted appreciation of the problems of ganged tuning and automatic volume control.

The first-mentioned group is probably the most important at the present time. It covers various methods of ensuring constant coupling, and therefore constant amplification at different frequencies, together with other advantages, such as increased stability and simplified control.

The patents concerned are:—

256644, issued to S. Y. White.
256967, issued to S. Y. White.
259613, issued to Hazeltine Corporation.
263804, issued to E. H. Loftin.
273639, issued to Hazeltine Corporation.
297723, issued to Hazeltine Corporation.
315399, issued to Hazeltine Corporation.

The constant-coupling circuit usually identified with the names of Loftin and White consists of a magnetic coupling combined in additive phase with a capacity coupling. That is to say, the two separate couplings are so proportioned as to give a constant total transfer of energy throughout the whole tuning range.

The first patent 256644, describes this coupling as applied between the aerial and the input to a valve amplifier. The other two patents, 256967 and 263804, cover the same principle as applied to intervalve couplings. In addition to maintaining a constant energy transfer, the coupling counteracts any tendency to instability caused by the inter-electrode capacity of the valve.

With this type of coupling, the plate circuit is not purely inductive, but contains a capacity element, and also the resistance of the tuned circuit at resonance.

In general, resistance or inductance in the plate circuit creates a positive feed-back, while a capacitative plate circuit produces the opposite effect, the change from an inductive to a capacitative load reversing the phase of the oscillatory voltages. With an inductive load, the resultant feed-back to the grid is in phase, while with a capacitative load it is out of phase with the input.

By combining the two effects, the feed-back can be adjusted either to zero or to any desired amount necessary to obtain increased amplification, while, at the same time, maintaining stability. In actual practice one of the magnetic couplings is usually adjusted by the manufacturer before sale, so that the receiver cannot be made to oscillate at any point on the tuning scale.

Patents 273639 and 315399 cover an alternative system of constant coupling, more suited to mass production. By analysing the response curves of an ordinary amplifier it is shown that

A.4 LICENCE

the required effect can be secured by means of a mixed inductive, and capacity coupling in combination with a choke-fed valve, the whole output circuit, including the choke, being tuned to a wave-length slightly longer than the longest to be received.

The tuned circuit, as a whole, has a capacitative reactance, and the transformer primary an inductance reactance to the valve output, causing the currents in the two windings to be in opposite phase. The amplification is, in fact, maintained constant throughout the tuning range entirely by the design of the primary circuit. The moving vanes of the condenser in the secondary circuit can therefore be earthed, to facilitate "ganging" and to eliminate hand capacity effects.

Patent No. 259613 covers the use of differently designed transformers in a multi-stage amplifier. The first-stage transformer is, say, most efficient at one wave-length, while the transformer in the next stage is made more efficient at another wave-length, the result being that the overall efficiency is kept substantially constant for all wave-lengths.

Patent No. 297723 discloses a constant amplification receiver, in which the valves are neutrodyned by split primary transformers, the primary, neutralising and the secondary inductances all being variable, while the coupling to the secondary is controlled by means of movable screens. All the variable components are ganged to specially designed tuning-condensers in such a way as to maintain constant amplification at all points on the tuning scale.

To avoid the difficulty of ganging the aerial circuit, the input to the first valve is made aperiodici.

The next group relates to methods of ganging for tuning control, and comprises the following patents:

250162, issued to S. Y. White.
250969, issued to Hazeltine Corporation.
252691, issued to Hazeltine Corporation.
312354, issued to Hazeltine Corporation.
314070, issued to Hazeltine Corporation.

Patent No. 250162 describes a self-contained speaker set with some interesting ganging features. Trimming condensers are used to secure resonance at the lowest wave-length to be received, whilst at the highest wave-length special plates are provided on the tuning condensers to allow the rate of change of capacity to be varied in order to secure uniformity. The ordinary aerial is replaced by a metal plate inserted at the bottom of the speaker compartment, the screens and batteries serving as a counterpoise earth. If an external aerial is used, any variation in capacity is compensated by a series condenser.

Circuits of the reflex type where the same valve is used to amplify at both high and low frequency are concerned in patents 250969 and 252691. By using an untuned aerial two advantages are gained. First, re-radiation is prevented, and, secondly, the difficulty of ganging is overcome.

In No. 312354 the aerial tuning-coil is made sufficiently large to tune to a wavelength slightly longer than the longest wave to be received, and is only loosely coupled to the secondary. The aerial is thus kept inductively reactive over the whole tuning-range, and does not reflect capacity into the coupled secondary circuit. This secures the following advantages: (1) The aerial constants are less critical than with the usual aperiodic aerial; (2) the aerial tuning favours the longer waves, which ordinarily are the least amplified; and (3) the only component affected by "ganging" is the aerial tuning-coil and not the tuning condenser, which means less cost.

PROBLEMS OF GANGING.

The problem of ganging when using a frame aerial and without employing large trimming or padding condensers, which restrict the tuning range, is touched on by patent 314070. The required object is achieved by making the inductance of the frame equal that of the tuning coils, the larger distributed capacity of the loop being reduced to that of the other tuned circuits by connecting a part only of the frame across the input to the first valve.

The third group of patents covers various methods of neutrodyning, or balancing-out the effect of inter-electrode capacity inside the valve.

Since the introduction of the screened-grid amplifier the value of the neutrodyne has fallen off as far as the modern receiving set is concerned, but the principle still has important applications in other directions.

The neutrodyne patents are contained in the following list:—

217971, issued to J. Scott-Taggart.
222894, issued to Jackson-Mellersh (Independent Radio Manufacturing, Inc.).
222895, issued to Jackson-Mellersh (Independent Radio Manufacturing, Inc.).
223181, issued to Jackson-Mellersh (Independent Radio Manufacturing, Inc.).
240114, issued to Hazeltine Corporation.
248389, issued to Hazeltine Corporation.
248311, issued to Hazeltine Corporation.
256649, issued to Hazeltine Corporation.
264304, issued to A. E. White (Thermodyne Research Lab., Inc.).

The earliest of the series is 217971, which was originally issued to Mr. John Scott-Taggart. It covers the use of a supplementary condenser inserted in parallel with the grid-anode capacity of the valve, as well as a neutralising condenser.

The others are of American origin and include No. 222895, which is the first to describe "split primary" neutralising with maximum coupling between the primary and neutralising windings. It also refers particularly to the use of screening and the employment of sheathed leads as a refinement in stabilising.

It depends upon the use of a "balanced" bridge, the arms of which are made up of the anode-grid capacity C1, the neutrodyne condenser NC, and the inductances L1 and L2. The input is applied across the diagonal AB, whilst the output is taken from the opposite diagonal CD, so that fluctuations in one cannot affect the other so long as the bridge is balanced.

Patent 222894 applies the neutrodyne idea to an input coupling between an aerial and secondary circuit. In No. 223181 the turns ratio of the neutralising and the primary windings is made equal to the ratio of the grid-anode capacity to the neutralising capacity, and Nos. 240114 and 248389 relate to neutrodyning by capacitative elements only, with the object of maintaining a more exact balance at all frequencies.

The last three patents in this series disclose features of more modern interest. For instance, 248311 describes the decoupling of the H.T., L.T. and G.B. supplies in a neutralised receiver. Resistance-capacity decoupling combinations are used, and the necessity for the separate screening of each stage is recognised.

No. 256649 covers a method of arranging the components and wiring of a receiver in such a way that the mutual capacitative couplings automatically give a neutrodyne effect.

The plate circuit of a valve is arranged in 264304, to give a capacitative step-up by applying the anode voltage across one of a pair of series condensers used to tune the output inductance. The arrangement also reduces the oscillating voltage between the anode and filament, and so diminishes feedback to the grid.

The remaining patents mostly relate to various detail improvements in components and circuit design.

Patent 229625 covers a neutrodyne condenser formed of a wire and insulating sleeving, with a sliding tubular electrode for adjustment.

No. 231820 aims to reduce the magnetic coupling between adjacent coils by setting them with their axes parallel and inclined at an angle of 55 degrees to the line joining the centres of the coils.

No. 238256 is for a method of mounting a

coil on a tuning condenser by means of short brackets, and 252315 is for a valve-mounting in which the connecting leads form the sole support for the valve. The leads consist of spring strips flexible in both the horizontal and vertical planes.

The improvement of selectivity is the aim of 253146. The idea is to make the primary winding of the coupling-transformers smaller than the calculated optimum value, so that the impedance of each tuned circuit, as presented to the valve, is less than the anode impedance.

There remain two patents which fall outside the groups already mentioned.

Patent 293462 covers various improvements in automatic volume control, including the use of a meter to give a visual indication of resonance. The use of a two-electrode valve as a detector and for obtaining a biasing voltage for the high-frequency valves, is described, as well as the use of the ordinary type of detector valve for the same purpose. Both systems are designed to prevent fluctuations in the mains supply voltages from affecting the output. Volume control may also be applied by varying in the filament current in a mains-driven set using series-connected valve filaments.

The elimination of hum is the object of the next patent. No. 304309 covers the use of a Wheatstone bridge filter for suppressing disturbances in the supply circuits of a valve amplifier. A "balanced bridge" is formed of the anode-cathode path of the valve, a choke or resistance and two condensers. The output is taken from the diagonal A, B joining the plate of the valve to the mid-point of the two condensers, while the H.T. supply is inserted across the opposite diagonal.

As long as the bridge is balanced, voltage fluctuations in the H.T. supply cannot affect the speaker, which is across the opposite diagonal of the bridge. Similarly, any mains hum, or any current from other valves passing through the common H.T. supply, cannot affect the output. The arrangement therefore eliminates any form of low-frequency distortion, such as "motor-boating," or "hum," due to incomplete smoothing.

PHILIPS—MULLARD LICENCE

The terms of the Philips-Mullard agreement offered to manufacturers of radio sets was announced in May, 1933.

The text of the agreement follows broadly the general lines of the old A.3 and R.G.2 licences issued by the British Pool.

The initial period of the agreement is two years from June 1, 1933. If not previously terminated by six months' notice before June 1, 1935, it is to continue on a yearly basis.

Fifty-seven selected patents are scheduled and the amount of the royalty payable is fixed at 1/6 per valve holder with a proviso that in the case of multi-valves the rate is 1/6 for the first function of the valve and 1/- for every additional function.

The royalty is subject to a sliding scale of rebate. This rebate varies from a minimum of ½ per cent. on a payment of £1,500 to a maximum of 62 per cent. on a payment of £30,000.

The patents listed vary from the earliest which dates back to July, 1926, and is due to expire on July, 1942, to a patent which normally would remain in force until June, 1947.

The well-known pentode patent is of course included.

Actually 50 of the patents are scheduled on the part of Philips Lamps and seven by the Mullard Radio Valve Co.

A clause of special interest in the licence states thati t is the intention of the licensors to maintain the scheduled patents free from infringement by third parties, to indemnify licensees from all actions for infringement by third parties and to furnish technical information and assistance to enable licensees to manufacture and use their sets to the best advantage. A selection of the patents scheduled includes:

287958, Mullard.—Pentode valve patent. Covers any three-grid amplifier in which the grid nearest the anode is directly connected to the cathode so as to be maintained continuously at cathode potential. Also claims various arrangements designed to prevent a rise in screen-grid current when the anode potential falls below that of the screening grid.

361450, Mullard.—Indirectly heated diode rectifier combined with a triode amplifier in which means are provided to prevent the amplifier from working on an unfavourable part of the curve. A condenser connected between the grid and cathode of the amplifier is shunted by a resistance, and the capacity of the condenser is made such that no H.F. potential occurs between the rectifier cathode and either the grid or cathode of the amplifier.

347018, Philips.—A full-wave grid-leak rectifier valve, having two grids (at least one being provided with a grid condenser), in which both grids are connected to the common input circuit at points sufficiently out-of-phase to counteract any tendency to anode rectification.

323823, Philips.—Back-coupled amplifier for A.C. voltages at high or low frequency, or for D.C. Distortion is prevented by feeding back to the grid an out-of-phase component tapped off from a shunt resistance in the output circuit.

341403, Philips.—Pentode circuit designed to limit the high-note response and to prevent excessive voltage on the anode. The primary or secondary of the coupling transformer is shunted by a high resistance; or the resistance may be inserted in parallel with the loudspeaker.

358861, Philips.—Automatic volume control by utilising the bias derived from a grid-leak detector through a resistance connected between the grid of the detector and a point situated on the cathode side of the grid circuit of a preceding H.F. amplifier.

381907, Philips.—Superhet set in which the coupling between the I.F. stages consists of a tuned series circuit, connected between a step-down output transformer and a step-up input transformer.

384583, Philips.—Superhet in which the local oscillator is inductively back-coupled between its grid and plate, but is capacitatively coupled to the H.F. input valve and to the first detector, so that the energy transferred to the grid of the first detector is kept constant over the whole tuning range.

MERCHANDISE MARKS ACTS

Radio Set and Components Marking Order, 1935

Prior to the passing of the Merchandise Marks Act, 1926, which became law at the end of that year, these matters were dealt with under the Merchandise Marks Act, 1887.

This Act of 1887, which is still in force, prohibits the importation of all goods which, if sold, would be liable to forfeiture under the Act, and also all goods of foreign manufacture bearing any name or trade mark being, or purporting to be, the name or trade mark of any manufacturer, dealer, or trader in the United Kingdom, unless such name or trade mark is accompanied by a definite indication of the country in which the goods were made.

The principal classes of goods which, if sold, are liable to forfeiture under the Act are goods bearing forged trade marks or trade marks which are false or calculated to deceive, or false trade descriptions.

The expression "trade description" includes any description, statement or other indication direct or indirect as to the material, quantity, measure or weight, etc., of goods, or as to the place or country of manufacture.

The Act also applies to goods bearing marks indicating that they are the manufacture or merchandise of some person other than the person whose manufacture or merchandise they really are.

The Merchandise Marks Act, 1926, entailed a radical modification of the law in regard to the marking of imported goods. Section 1 provides that "it shall not be lawful to sell, expose for sale, or, by way of advertising goods of some other kind, distribute in the United Kingdom any imported goods to which there is applied any name or trade mark being, or purporting to be, the name or trade mark of any manufacturer, dealer or trader, or the name of any place or district in the United Kingdom unless the name or trade mark is accompanied by an indication of origin."

The Section thus not only brought the law in relation to the sale of imported goods in the United Kingdom into line with the provision of the Act of 1887 referred to above, requiring the name or trade mark of any manufacturer, dealer or trader in the United Kingdom to be accompanied by an indication of origin, but especially in the matter of distributing goods by way of advertisement, extended the provisions of that Act.

Section 2 of the new Act gave power to make an Order in Council requiring imported goods of any class or description to be marked with an indication of origin on sale or exposure for sale in the United Kingdom, unless it appeared to the Government Department concerned that the trade of the United Kingdom or the trade generally of other parts of His Majesty's Dominions with the United Kingdom would be prejudiced.

The Section further provided that an Order in Council may require imported goods to bear an indication of origin at the time of importation, unless the Department, having regard to all the circumstances of the case including the re-export trade of the United Kingdom in that class or description of goods, considered such action undesirable.

No Order in Council could be made until after a public inquiry had been held in accordance with the provisions of the Act by a Standing Committee.

The Act contains provisions enabling the Department concerned to give provisional exemptions from Orders in certain cases, and also to exempt particular descriptions of goods from the requirements of the first Section.

Offences under the Act of 1926 render traders liable in the same way as under the Act of 1887, but the penalties are limited to a maximum fine of £5 for the first offence and a maximum fine of £20 for subsequent offences. Also, in the case of second and subsequent offences the Court may order the goods in question to be forfeited.

A person, however, is not treated as guilty if he can show that he had no reason to suspect that the goods were subject to the Acts (or to an Order made under the Acts) and that he had otherwise acted innocently.

The Radio Set and Components Marking Order came into force on July 1, 1935.

The order requires that sets, radio-gramophones, electric gramophones and L.F. amplifiers, whether imported complete or in parts, shall carry a mark indicating the country of their origin.

Components similarly included in the order are speakers and speaker units, mains units, chokes, condensers, drives for variable condensers, pick-ups, volume controls, electric gramophone motors, turntable units comprising an electric motor and a turntable, 'phones, resistors, valve-holders and adaptors, transformers, tuning coils, R.C.C. units, choke capacity coupling units, and chassis or frames carrying or adapted to carry a collection of components.

FACTORY AND WORKSHOPS ACTS

By the Legal Editor

The main structure of the law relating to Factories and Workshops in this country is contained in the Act of 1901, which is too lengthy to be reproduced in full. The main provisions are summarised below, attention being directed to points of particular interest. A copy of the Act should be in the possession of every manager of a workshop or factory, since those responsible are expected to make themselves conversant with their duties and obligations to employees. It should be remembered that in matters of law ignorance is no excuse.

It is difficult to draw any clear distinction between "Factory" and "Workshop." They are both places where any manufacturing process is carried on, with or without the use of mechanical power.

Broadly speaking the legislature only protects the adult male worker in those matters which directly affect his safety and health. For the rest he is expected to be able to fend for himself. It is very different as regards (a) women of 18 and upwards, (b) "young persons" (male and female), between the years of 14 and 18, and (c) children of both sexes under 14 years of age.

Health (*Sections* 1–9).

The factory or workshop must be kept clean and properly ventilated. Wet floors must be drained and a reasonable temperature maintained. There must be no overcrowding, (i.e. a minimum of 250 cubic feet of space must be allowed per person, and during periods of overtime, at least 400 cubic feet per person). Proper sanitary conveniences must be provided.

All the inside walls and ceilings of each room, whether plastered or not, if they have not been painted with oil or varnished once at least within seven years, must be limewashed at least every fourteen months; and if they have been painted or varnished, must be washed with hot water and soap every fourteen months.

Safety (*Sections* 10–18).

Certain kinds of machinery must be fenced; steam boilers maintained in proper condition and periodically overhauled; adequate means of escape provided in case of fire; the doors must be made to open from inside; the moving carriage of any automatic machine must not run out beyond the fixed frame of the machine to within a distance of eighteen inches from any fixed structure in any passage or space through which any person is liable to pass.

A child is not allowed to clean any part of any machinery, or any place under any machinery other than overhead mill gearing. A young person is not allowed to clean any dangerous part of any machinery while in motion. A woman or young person is not allowed to clean mill gearing while in motion.

The Courts are given power to make an Order prohibiting the use of any dangerous machinery or plant, or to close down a factory or workshop as unhealthy or dangerous.

Accidents (*Sections* 19–22).

These Sections are now supplemented by the Notice of Accidents Act, 1906, and the "Dangerous Occurrences Notification Order of 1928," dealt with below.

Any accident in a factory or workshop
(*a*) causing loss of life to a worker, or
(*b*) due to any power-driven machinery, or to molten lead or hot liquid, or to an explosion or escape of gas or steam, or to electricity, inflicting such injuries to a worker as to cause him to be absent from employment for at least one day, or
(*c*) any accident disabling a worker from employment for more than seven days,

must be notified in writing to the Factory Inspector and also to the certifying Surgeon for the district.

Hours of Employment, etc. (*Sections* 23–35).

These sections relate to hours of employment and provision for meal-times and holidays, particularly as affecting women, young persons, and children.

The manager must fix a notice in a prominent position in the factory or workshop setting out (a) the daily hours of employment, (b) the time allowed for meals. A copy must be sent to the Factory Inspector, who must also be notified of any subsequent changes.

The period of employment of women and young children in a non-textile factory or workshop shall, except on Saturday, and

FACTORY ACTS

with certain other exceptions, begin between 6 a.m. and 8 a.m., and end between 6 p.m. and 8 p.m., with meal intervals of not less than one hour and a half, of which at least one hour must be before 3 p.m. No woman or young person shall be employed continuously for more than five hours without an interval of at least half an hour for a meal.

All women and young persons must have their meals at the same times of day ; they must not be employed or allowed to remain in any room in which work is in progress during these times.

The recognised Bank Holidays must be observed—or a full day, or its equivalent, allowed as a holiday in lieu.

If an employer of the Jewish faith keeps his factory or workshop closed on Saturday until sunset, he may employ women and young persons from after sunset on Saturday until 9 o'clock in the evening. If he closes down all day on Saturday, he may extend the permitted hours of work by one hour each day during the rest of the week, except on Sunday.

Miscellaneous Provisions.

The remaining sections of the Act may be briefly summarised as follows :—

Sections 36–48 set out special exceptions which may be made to the general rules previously laid down regarding hours and holidays.

Sections 49–60 regulate overtime and night-work, and deal with intermittent and special employment.

In non-textile factories and workshops the "hours of employment" for women on any day except Saturday may be extended for two hours overtime, provided that at least two hours are allowed during the day for meals, of which half an hour must be after 5 p.m., and also provided that a woman must not be so employed on overtime for more than three days in any one week, or for more than thirty days in twelve months.

Sections 61–67 forbid the employment of children under 12, and of women within four weeks of childbirth. Employers must have medical certificates of fitness in the case of young persons and children residing more than three miles from the factory.

Sections 68–72 relate to education, and make the employer share with the parent the obligation of seeing that each employed child shall attend a recognised school.

A child employed during the morning or afternoons must attend a recognised efficient school on each work-day for at least one attendance ; or, when employed on the alternate day system, must on each other day make at least two attendances at the school, these attendances being between the hours of 8 a.m. and 6 p.m. ("Child" is defined to be a person under the age of 14 years and who has not—at the age of 13—obtained a certificate of proficiency or attendance at school.)

Sections 73–86 are concerned with certain industries specified as "Dangerous and Unhealthy."

Sections 87–106 set out certain modifications and extensions which are allowable in respect of the provisions made in the preceding sections.

Sections 107–115 are concerned chiefly with the conditions of employees who work at their own homes, particularly as regards the use of unwholesome premises or where there is infectious disease.

Sections 116–117 are designed to ensure that piece-workers in certain trades are fairly paid for the work they do.

In every factory, for the purpose of enabling each piece-time worker to calculate the amount of wages due to him, there must be a clear list of the rate of wages applicable to the work done, and also particulars of the work to which the rate is applicable. These must be given to the worker when the work is handed to him, or posted up in a conspicuous place in the workroom.

Sections 118–134 contain provisions regarding the general administration of the Act ; the appointment, power, and duties of Factory Inspectors and Surgeons ; and regulations as to special notices, registers, and returns, and how and when they are to be made.

Sections 135–148 relate to the various penalties incurred by any breach of the Act, and the legal procedure for enforcing them.

The last part of the Act (*Sections* 149–163) are of a supplementary nature, and do not call for further description.

Since the passing of the 1901 Act various supplementary measures have been passed.

"Notice of Accidents Act, 1906."

This tightens up the provisions of the 1901 Act relating to accidents, and lays down that certain kinds of "dangerous occurrences" must be notified even though no bodily injury is caused.

Dangerous Occurrences Notification Order, 1928.

This is a further development of the preceding Act making notification to the Inspector compulsory in the following cases, whether personal disablement or injury is involved or not—

(*a*) bursting of a revolving vessel or wheel driven by mechanical power ;

(*b*) breaking of a rope or chain or other appliance used for raising or lowering persons or goods by mechanical power ;

(*c*) any explosion or fire due to (i) ignition of dust, vapour, or gas; (ii) ignition of celluloid or substances composed wholly or partly of celluloid; (iii) electrical short-circuit or failure of electrical apparatus, if the occurrence causes damage to the structure of any building in which persons are employed or to any machinery or plant therein, and results in the complete suspension of ordinary work, or stoppage of plant for not less than five hours;

(*d*) explosion or fire due to causes other than those set out under (*c*) above, and causing total suspension of ordinary work for not less than 24 hours.

Police, Factories, etc. (Miscellaneous Provisions) Act, 1916.

This act empowers the Secretary of State to make "Welfare Orders" compelling special precautions to be taken for the health and comfort of workers in certain industries.

Employment of Women, Young Persons, and Children Act, 1920.

This was passed to give effect to recommendations made by the International Labour Organisation of the League of Nations. It forbids the employment of children under fourteen years of age in any industrial undertaking, except domestic factories and workshops. It also restricts the employment of young persons of both sexes between the years of 14 and 18.

In this connection it may be pointed out that the Education Act of 1921 forbids the employment of children between 12 and 14 in any manner which prevents their attendance at school.

Regulations for Accumulator Manufacture and Repair.

Among the numerous Statutory Rules and Orders issued under the Factory and Workshops Acts, No. 28 of 1925, which repeals a previous Order of 1923, No. 1004, is of particular interest since it applies to the repair, as well as the manufacture, of any accumulator containing lead or any compound thereof. The principal provisions are:—

No person under 18 years of age shall be employed in any lead process, *i.e.*, in melting lead or any material containing lead, or in casting, pasting, lead-burning, or any operation involving trimming, abrading or cutting of pasted plates containing lead oxide.

No woman or young person under 18 shall be employed in any room in which the manipulation of raw oxide of lead, or pasting, is carried on.

In every room in which a lead process is carried on there must be a minimum of 500 cubic feet of air per person, any height over 12 feet not being taken into account.

Every person employed in a lead process shall be medically examined within seven days of his first employment, and monthly thereafter.

Other sections of the Order regulate the working conditions under which various processes are to be carried out, prescribe the protective clothing to be worn by the workers, and specify the sanitary and washing accommodation to be provided in each workshop or factory.

Regulations for the Use of Electrical Energy (Order No. 1312 of 1908).

The principal provisions are as follows:—

All apparatus and conductors shall be sufficient in size and power for the work they are called upon to do, and so constructed, installed, protected, worked and maintained as to prevent danger so far as is reasonably practicable.

All conductors shall either be covered with insulating material, and further efficiently protected where necessary to prevent danger, or they shall be so placed and safeguarded as to prevent danger so far as is reasonably practicable.

Every switch, switch fuse, circuit-breaker, and isolating link shall be: (*a*) so constructed, placed, or protected as to prevent danger; (*b*) so constructed and adjusted as accurately to make and to maintain good contact; (*c*) provided with an efficient handle or other means of working, insulated from the system, and so arranged that the hand cannot inadvertently touch live metal; (*d*) so constructed or arranged that it cannot accidentally fall or move into contact when left out of contact.

Every switch intended to be used for breaking a circuit and every circuit-breaker shall be so constructed that it cannot with proper care be left in partial contact, or so that an arc cannot accidentally be maintained.

Every fuse and every automatic circuit-breaker used instead thereof shall be so constructed and arranged as effectively to interrupt the current before it so exceeds the working rate as to involve danger.

Every electrical joint and connection shall be of proper construction as regards conductivity, insulation, mechanical strength and protection.

Efficient means, suitably located, shall be provided for cutting off all pressure from every part of a system, as may be necessary to prevent danger.

Every motor, convertor and transformer shall be protected by efficient means suitably placed and so connected that all pressure may thereby be cut off from the motor, convertor or transformer as the case may be, and from all apparatus in connection therewith: provided, however, that where one point of the system is connected to earth, there shall be no obligation to disconnect on that side of the system which is connected to earth.

FACTORY ACTS

Every flexible wire for portable apparatus, for alternating currents or for pressures above 150 volts direct current, shall be connected to the system either by efficient permanent joints or connections, or by a properly constructed connector.

In all cases where the person handling portable apparatus or pendant lamps with switches, for alternating current or pressures above 150 volts direct current, would be liable to get a shock through a conducting floor or conducting work or otherwise, if the metal work of the portable apparatus became charged, the metal work must be efficiently earthed.

The Truck Act, 1896.

The Truck Acts prohibit, in general, the payment of workers' wages in any form other than cash.

The 1896 Act, which amends former Acts, lays down that an employer shall not make any contract with a workman for any deduction from the stipulated rate of wages, or for fine, unless

(*a*) the terms of the contract are conspicuously displayed in the workshop, or are set out in writing and signed by the worker, and

(*b*) the contract sets out specifically the acts or omissions in respect of which fines may be levied, and

(*c*) the fine imposed by the contract is in respect of some act which causes or is likely to cause loss to the employer, and

(*d*) the amount of the fine is fair and reasonable having regard to all the circumstances of the case.

These provisions apply equally to shop assistants as to other workers.

Deductions or fines in respect of damage done by workmen to goods or materials supplied are also subject to the foregoing provisions. In addition :—

(*a*) Not only must the fine be "fair and reasonable," but it must not, in any circumstances, exceed the actual amount or loss suffered by the employer.

(*b*) The contract need not set out all particulars of deductions, since it is impossible to foresee these completely, though it must set out definitely that deductions are to be made in respect of damage done to materials by the workman.

Any sum taken by or paid to the employer by way of fine, contrary to this Act, can be recovered by the employee provided he applies to the Court within six months of the date of deduction or fine ; but if he has signed a contract agreeing to such fines or deductions, he can only recover whatever amount has been paid in excess of that which the Court may hold to be fair.

REGISTRATION OF BUSINESS NAMES ACT, 1925

This Act is designed to ensure that the true name and nationality of any person trading under a "Business Name" shall be officially registered.

All firms or individuals, whether of British or alien nationality, having a place of business in the United Kingdom must register under the Act, (a) if in the case of a firm it trades under a name which does not consist of the true surnames of all the partners ; or (b) if any member has at any time changed his name (except, in the case of a woman, on marriage) ; or (c) if, in the case of an individual, he does not trade under his true surname.

The Act does not in general apply to a business which is incorporated as a limited company ; but certain of its provisions are now applicable under the Companies Act of 1929 to any company incorporated subsequently to the 22nd November, 1916.

A firm, individual, or corporation carrying on business in this country as the nominee, trustee, or on behalf of another person or firm, or acting as general agent for any foreign firm is bound to register under the Act.

In the case of death or retirement of one of the partners, the successor or survivor can carry on the business under its original name, without registering afresh, provided he adds his own name to the original trading name, together with the words "successor to" or "late."

Firms established abroad, but having places of business in this country, are included in the Act.

Section 18 of the Act lays down that every individual and firm required by the Act to register shall show, in legible characters, (a) the present surname and Christian names or initials, (b) and former Christian name or surname, and (c) the nationality, if not British (and also the nationality of origin if this is not the same as the present nationality) *on all trade catalogues, circulars, show cards, and business stationery.* In the case of firms, these particulars must be given for all the partners.

Registration must be made, within fourteen days of the commencement of business, at Princes House, Kingsway, London, W.C.2, when the business is situated in England or Wales, or at Exchequer Chambers, Parliament Square, Edinburgh, for businesses carried on in Scotland. The cost of registration is 5s.

Neglect to comply with the provisions of the Act renders each individual concerned liable on Summary Conviction to a fine not exceeding £5 for each offence.

SHOP REGULATION ACTS

In his own interest the owner or manager of any shop, large or small, should study the main provisions of the Shops Acts. He is responsible for the proper observance of specified obligations towards his employees, and cannot evade the consequences of any infraction of the law under the plea of ignorance.

The Act of 1912 consolidated the Shops Regulation Acts 1892–1911. Since then there have been the Acts of 1928 and 1934.

Conditions of Employment.

(*a*) On at least one weekday in each week a shop assistant shall not be employed after half-past one-o'clock in the afternoon.

This does not apply to the week preceding a Bank Holiday if the shop assistant is not employed on the Bank Holiday, and if on one weekday in the following week, in addition to the Bank Holiday, the employment of the shop assistant ceases not later than half-past one o'clock in the afternoon.

(*b*) The occupier of a shop shall set out in a notice displayed in the shop the day of the week on which his shop assistants are not employed after half-past one o'clock, and may fix different days for different shop assistants.

Meal Times.

Intervals for meals shall be allowed to each shop assistant and shall be arranged so as to secure that no person shall be employed for more than six hours without an interval of at least twenty minutes being allowed, provided that :—

(1) where the hours of employment include the hours from 11.30 a.m. to 2.30 p.m., an interval of not less than three quarters of an hour shall be allowed between those hours for dinner, which shall be increased to one hour in cases where that meal is not taken in the shop, or in a building of which the shop forms a part or to which the shop is attached :

(2) where the hours of employment include the hours from 4 p.m. to 7 p.m., an interval of not less than half an hour shall be allowed between those hours for tea.

This provision does not apply to a shop if the only persons employed as shop assistants are members of the family of the occupier of the shop, maintained by him and dwelling in his house.

The penalty for any breach of the foregoing regulations is, for the first offence, a fine not exceeding £1 ; for a second offence £5 ; and for a third or subsequent offence £10 ; but an exception is made in the case where an assistant stays on after 1.30 for the purpose of serving customers who were in the shop at that time.

Employment of Young Persons.

The provisions with regard to the employment of persons under the age of 18 years have been considerably changed by the new (1934) Shops Act. This operates from December 30, 1934. Thenceforward :

(*a*) No " young person " (*i.e.*, one under the age of 18 years) shall be employed in or about a shop for a longer period than 52 hours in any one week until December 27, 1936, or for more than 48 hours in any one week after that date.

(*b*) On occasions of seasonal or exceptional pressure, however, young persons between 16 and 18 may be employed in excess of these normal maxima subject to certain provisions, which are, briefly, that when in any year there have been six weeks of overtime no young person involved shall be again so employed during the remainder of the year, and that when any young person has been employed overtime

1. for 50 hours in any year after 1936 or for 24 hours in any year up to 1936, or
2. for 12 hours in any week after 1936 or for eight hours in any week up till the end of 1936,

he must not be again so employed during that period.

The Home Secretary has power to issue regulations dealing with the extent to which such employment may be divided into spells.

(*c*) Any young person who is employed in a shop must be allowed an interval of at least 11 hours in every 24 between complete periods of employment, and these 11 hours must include the hours of 10 p.m. until 6 a.m.

Offences render shopkeepers liable to fines not exceeding £10 for every person in respect of whom the contravention occurs.

(*d*) In every shop in which a young person is employed a notice shall be kept exhibited by the occupier of the shop in a conspicuous place stating the number of hours in the week during which a young person may lawfully be employed in or about the shop.

If the occupier of a shop fails to comply with the provisions regarding " notices " he is liable to a fine not exceeding forty shillings.

SHOP REGULATION ACTS

Sanitary Arrangements in Shops

Section 10 of the new (1934) Shops Act lays down that in every part of the shop in which assistants are employed there must be :

(*a*) proper ventilation,
(*b*) means to maintain a reasonable temperature,
(*c*) sanitary conveniences (unless certificate of exemption is obtained),
(*d*) proper means of lighting,
(*e*) sufficient washing facilities (unless certificate of exemption is obtained),
(*f*) facilities for taking meals where meals are taken.

Local authorities can require an owner to take steps to comply with this provision, and if there is non-compliance the shopkeeper may be liable on summary conviction to a fine not exceeding £20 for the first offence, or a fine of £50 or £5 per day since the first conviction, whichever is the greater, for a second conviction.

Seats for Female Assistants.

In all rooms of a shop where female shop-assistants are employed in the serving of customers, the occupier of the shop shall provide seats behind the counter, or in such other position as may be suitable for the purpose, and such seats shall be in the proportion of not less than one seat to every three female shop-assistants employed in each room.

Failure to comply with this provision entails a fine not exceeding three pounds for the first offence, and for a second or subsequent offence a fine not less than one pound and not exceeding five pounds.

This has been amended by the Shops Act (1934) to the extent that it is now the duty of a shopkeeper to permit female shop assistants to make use of their seats whenever this does not interfere with their work, and it is obligatory to give them notice that they are intended to use them in this way.

Early Closing.

Every shop shall, save as otherwise provided, be closed for the serving of customers not later than one o'clock in the afternoon on one weekday in every week.

The local authority may, by order, fix the day on which a shop is to be so closed for "the weekly half-holiday," and any such order may either fix the same day for all shops, or may fix :—

(*a*) different days for different classes of shops ; or
(*b*) different days for different parts of the district ; or
(*c*) different days for different periods of the year.

Failing such an order, the weekly half-holiday shall be such day as the occupier may specify in a notice affixed in the shop, but it shall not be lawful for the occupier of the shop to change the day oftener than once in any period of three months.

Where the local authorities have reason to believe that a majority of the shopkeepers of any particular class in any area are in favour of being exempted from the provisions of this section either wholly or by fixing as the closing hour instead of one o'clock some other hour not later than two o'clock, the local authorities shall make an order exempting the shops of that class within the area from the provisions of this section of the Act, either wholly or to such extent as specified.

Failure to comply with any of the provisions of this section, entails a fine not exceeding :—

(*a*) in the case of a first offence, one pound ;
(*b*) in the case of a second offence, five pounds ; and
(*c*) in the case of a third or subsequent offence, ten pounds.

Special Exceptions.

In places frequented as "holiday resorts" during certain seasons of the year, the local authority may by order suspend, for such period or periods as may be specified in the order (not exceeding in the aggregate four months in any year), the obligation imposed by this Act to close shops on the weekly half-holiday.

Where the occupier of any shop in any place in which any such order of suspension is in force satisfies the local authority that it is the practice to allow all his shop assistants a holiday on full pay of not less than two weeks in every year, and keeps affixed in his shop a notice to that effect, the requirement that on one day in each week a shop assistant shall not be employed after half-past one o'clock shall not apply to the shop during such period or periods as aforesaid.

The Shops (Hours of Closing) Act, 1928.

This enacts that every shop (with certain exceptions which do not include wireless retailers) shall be closed not later than nine o'clock in the evening on one day in the week (known as the late day) and not later than eight o'clock in the evening of all other weekdays.

PATENTS, DESIGNS AND TRADE MARKS

By "The Broadcaster" Patent Expert

The last Patents and Designs Act, which came into force on November 1st, 1932, introduced certain important changes in existing practice. For the information of those familiar with the former procedure, it may be convenient to give a short summary of the more outstanding alterations.

In order to give more time to an inventor to develop his plans, the time limit for filing a Complete after a Provisional Specification has been increased from nine to twelve months (or to thirteen months by paying an extension fee). A corresponding extension has been made in the statutory periods for Acceptance and Sealing.

An applicant who has filed a Complete Specification may convert it into a Provisional, in order to be able to include later developments; or he may post-date his Specification, on paying a fee, for a period not exceeding six months.

The official search into the novelty of the invention may now include Foreign as well as British patent Specifications, together with technical and scientific periodicals, text-books, and other relevant publications.

To cover the extended search, the fee paid on filing a Complete Specification has been increased from £3 to £4. Otherwise the official Stamp fees—with a few unimportant exceptions—remain as before.

A patent may now be granted direct to an assignee, in cases where the inventor has agreed to assign. The Comptroller is also given powers to adjudicate as to the grant of licences when joint owners disagree.

The grounds on which a patent may be revoked have been specified and enlarged. They include—an objection that the invention is not useful; that it is not fairly described in the specification; that the scope of the patent is not fairly ascertained; that the inventor has not described the "best" method of carrying out the invention known to him when he filed his application; that the invention has been "secretly" worked on a commercial scale before patent protection was applied for; and various other objections.

The provisions intended to protect the public against unjustifiable threats of infringement have been strengthened. Relief against such threats may now be obtained whether the threatener has an interest in the patent in question or not. Also it is now no defence against an "action for threatening" to institute proceedings for infringement. This used to be a convenient way out for the threatener—if brought to book—as the infringement suit could always be dropped if the threats were merely "bluff."

The Patent Office is now given power to refuse patents for inventions of an obviously frivolous or fantastic nature.

A new Tribunal has been set up to hear Appeals on the part of inventors from decisions of the Comptroller. Such appeals were formerly heard by the Law Officer, who has now been replaced by a Judge of the High Court (Mr. Justice Luxmoore).

The procedure as regards Designs is but little affected. Perhaps the most important change is one allowing the proprietor of a Registered Design to secure protection for a minor improvement on his design in much the same way as an inventor is allowed to take out a "patent of addition."

What May be Patented.

In the first place the invention must be for a "manner of manufacture." That is to say, it must have some commercial application and be beneficial to trade.

The discovery of a new scientific principle, such as Einstein's theory of relativity, is not patentable unless it is embodied in some practical application. The same objection applies to any abstract notion or bare philosophic idea.

Inventions for which a patent can be obtained usually fall into one or other of the following classes:—

(1) New articles of commerce made by mechanical or chemical operations.
(2) New machinery and apparatus.
(3) New processes of manufacture in which a series of operations are performed in sequence.

Essentials of a Patent.

Obviously the invention must be new and original. The degree of novelty may be slight, but it must be present. In other words, the inventive step must be something more than an improvement such as would naturally be carried out by an intelligent artisan or skilled workman engaged in the trade to which the invention relates.

The invention must also be useful. There is no advantage either to the State or the inventor in granting a patent for something which is obviously futile.

To secure a patent, the inventor must file a written specification setting out clearly and fairly (a) the nature of his invention, and (b) the way in which it is to be carried into effect. An inventor is sometimes tempted to give as little information as possible. This is dangerous because it may have the effect of rendering the patent

PATENTS, DESIGNS, ETC.

invalid. The criterion is that the description must be sufficient to enable a skilled workman to carry out the invention and to secure the correct results from the information given in the Patent specification. Anything less than this, or any deliberate misstatement of facts, will be sufficient to invalidate the patent should it be brought to Court.

Procedure on Application.

Generally speaking, it is advisable to employ professional assistance.

To assist inventors who may desire to proceed in person, a useful official pamphlet entitled "Instructions to Applicants for Patents" may be obtained free on application to the Comptroller-General of Patents, 25, Southampton Buildings, London, W.C.2. This sets out in detail the formalities to be observed in preparing the written specification and accompanying drawings.

Provisional Application.

The application for a patent may be made either in two stages or in one. In the former case the first step is to file a Provisional specification, and then at any time within twelve months to follow this up by filing a Complete specification.

In the Provisional specification the inventor is only called upon to give a brief description of the nature of his invention. He then has a further year (or 13 months, by paying an extension fee) in which to work out the idea fully before filing the Complete specification.

It should, however, be clearly understood that the filing of a Provisional application only establishes the priority date of a patent if and when granted. Otherwise it gives the inventor no patent rights whatever. These do not come into existence until a Complete specification has been filed, accepted, and sealed.

Complete Specification.

The Complete specification should contain a full and detailed description of the invention and the way in which it is to be carried into effect. Usually it must be illustrated.

The specification may be deposited at the Patent Office in the first instance. Or it may be submitted nine months after the preliminary filing of a Provisional application for the same invention, as previously explained.

The Cost of a Patent.

(Official Stamp Fees only)

Provisional specification only..	£1	0	0
On filing Complete specification thereafter	4	0	0
	£5	0	0
Or Complete specification filed in the first instance	£5	0	0

In both cases there is a Sealing fee of £1, making the total £6.

There are no further charges for the first four years, but £5 must be paid before the end of the fourth year to keep the patent alive during its fifth year, £6 for the sixth year, £7 for the seventh year, and so on, up to the sixteenth and last year of the monopoly period. There are various other fees and "fines" which may be incurred by not filing documents within the proper times. These are set out in the Patent Acts and Rules.

Trade Marks.

The register of trade marks is divided into Part A and Part B. As the fullest protection in law is obtained by marks entered in Part A, it is desirable, if possible, to qualify for entry in this part of the register. A registered trade-mark remains in force for a period of 14 years, and may be renewed for subsequent periods of 14 years on payment of a fee of £2 for each such renewal.

Part A Registration.

For registration in Part A, a trade mark must contain or consist of at least one of the following essential particulars :—

Group 1 :—The name of a company, individual, or firm represented in a special and distinctive manner, such as by particular lettering, which must, however, be really distinctive and not ordinary printing.

Group 2 :—The signature of the applicant for registration, or some predecessor in his business.

Group 3 :—An invented word or words, such as "Kodak."

Group 4 :—A word or words having no direct reference to the quality or character of the goods and not being, according to its ordinary significance, a geographical name or a surname. Obviously such words as "best," or "loudest," could not in fairness be monopolised by any one maker of, say, loud-speakers.

Group 5 :—This includes such marks as pictorial, ornamental and geometrical devices, letters, numerals, and monograms, which are distinctive.

Formerly the rules excluding references to quality were rigidly enforced, but nowadays skilful and covert allusions to quality, so long as they are not evident or obvious, are frequently accepted.

Part B Registration.

Part B of the register is mainly intended to take trade marks that have been in use for over two years without having previously been registered; but marks which do not possess any of the essential particulars requisite for Part A may, in certain cases, qualify for Part B, so long as such marks are capable of distinguishing the trader's goods.

A mark which is not new as applied to the particular goods for which it is proposed to use it, cannot be registered.

Application for registration should be made direct or in writing to the Registrar, Trade Marks Branch, Patent Office, Southampton Buildings, Chancery Lane, London, W.C.2, who will forward full particulars.

Designs.

A registrable design is defined by Act of Parliament to be "the features of shape, configuration, pattern or ornament applied to any article by any industrial process or means, whether manual, mechanical, or chemical, separate or combined, which in the finished article appeal to and are judged solely by the eye; but does not include any mode or principle of construction or the operation of a mechanical device."

The necessary forms can be obtained through the Post or on personal application at the Patent Office, 25, Southampton Buildings, Chancery Lane, London, W.C.2.

The Register is divided into a number of different classes, and it is necessary to specify the particular class in which registration is required. If the applicant is uncertain on this point, he can apply by letter to the Patent Office.

Marking Articles.

Before delivery on sale of any article to which a Registered Design has been applied, the proprietor of the design must mark the article "Registered" or "Regd." even if such articles are only intended for export. Failure to do this may cause the proprietor to lose his right to get damages for infringement.

Any person who falsely represents that a trade mark is registered, when in fact it is not, is liable for every offence on summary conviction to a fine not exceeding £5.

ELECTRICITY SUPPLY CHANGEOVER

Customers frequently come to radio dealers with problems concerning changes in electricity supply (generally from D.C. to A.C.), and ask whose responsibility it is to render their radio sets suitable for use on the new system.

The position under the Electricity (Supply) Acts, 1882-1935, regarding alterations in the system and pressure of supply declared to consumers by authorised electricity undertakers is as follows:—

Under the Regulations for securing the safety of the public and for ensuring a proper and sufficient supply of electrical energy which are imposed on all authorised electricity undertakers, the undertakers are under obligation to obtain the consent of the Commissioners, or, in certain cases, of the local authority, before making any alteration in the system and pressure of supply declared to consumers prior to January 15th, 1934.

Supplies commenced on or after January 15th, 1934, are governed by the provisions of Regulation 34 of the Electricity Supply Regulations, 1934, under which the Commissioners are the consenting authority in respect of alterations of any system and pressure of supply, and in due course when they are applied generally these Regulations will also govern supplies given prior to January 15th, 1934.

In those cases where the Commissioners are the consenting authority, they attach to their consent certain conditions, which are as follows:—

"Unless otherwise agreed, the Undertakers shall at their own expense carry out the necessary alterations to consumers' existing apparatus to suit the altered system and pressure of the supply, or pay to each consumer injuriously affected by the alteration of system and pressure such sum as may be agreed upon, or, in default of agreement, as may be determined by an Arbitrator to be appointed on the application of either party by the Minister of Transport as the reasonable cost of and incidental to the change of system and pressure (including compensation for any loss or damage incurred in consequence of the alteration), and upon such appointment being made, the reference to the Arbitrator shall be deemed to be a reference to a single Arbitrator under the provisions of the Arbitration Act, 1889.

"Provided that in any case where notice of their intention to carry out the aforesaid necessary alterations is served by the Undertakers on a consumer not less than one month and not more than six months prior to the date fixed by the Undertakers for carrying out the said alterations, no liability shall attach to the Undertakers, in respect of apparatus installed by the consumer after the service of such notice unless otherwise agreed between the Undertakers and the consumer, and a condition to this effect shall be clearly stated in any such notice as aforesaid."

There are a few comparatively unimportant undertakings which have been set up independently of the Electricity (Supply) Acts, and over whom the Electricity Commissioners have no control.

In these cases where the local authority is the consenting authority, this body may give consent for the change-over, subject to such conditions, if any, as it deems fit.

EDITORIAL INDEX

EDITORIAL INDEX

N.

O.

P.

Q.

R.

EDITORIAL INDEX

S.

T.

Index to Advertisers

DIRECTORY SECTION

(*Starts on opposite page*).

Makers or wholesalers, respectively, of radio and gramophone instruments, parts and accessories, with addresses and telephone numbers, are listed in the first two sections of the Directory mentioned above.

Inclusion of a trade name in the Trade Names Directory does not necessarily mean the name is registered.

Addresses of firms in the "Products Supplied" section are given in the Manufacturers' and Wholesalers' Directories.

The first short list of Supply Voltages contains names of towns with their own supply undertakings. Both Voltage Directories are published by courtesy of "The Practical Electrician's Pocket Book."

MANUFACTURERS' DIRECTORY

Abbey Engineering Works, Watton, Norfolk. Watton 2.

Ace Radio, 2-5, Dingley Place, E.C.1. Clerkenwell 7874.

Accumulators Elite, Hebble Mill, Salterhebble, Halifax, Yorks. Halifax 4304. Elite, Halifax.

Acme Album Service (Lunn, Wright and Co.), 47-51, Featherstone Street, City Road, London, E.C.1. Clerkenwell 3196.

Adey Portable Radio, 99, Mortimer Street, Regent Street, London, W.1. Langham 3258.

Advance Components, Ltd., Advance Works, Back Road, Walthamstow, E.17. Walthamstow 4366–7.

Aerialite, Ltd., Junction Mills, Whitligton Street, Ashton-under-Lyne. Aerialite, Ashton-under-Lyne. Ashton-under-Lyne 1205. 5, St. George's Avenue, Aldersbury, London. Metropolitan 0181.

Aerodyne Radio, Ltd., Aerodyne Works, Tottenham, London, N.17. Tottenham 4500. Aerodyne, Phone, London.

Aeronautical and General Instruments, Ltd., Purley Way, Croydon. Thornton Heath 3211. Instradio, Croydon.

Aladdin Gramophone and Accessories Co., 93, Tabernacle Street, E.C.2. Clerkenwell 3852.

Allen and Co., Ltd., E., Imperial Steel Works, Sheffield 9. Attercliffe 41054. Allen, Sheffield. Artillery House, Westminster, London, S.W.1. Victoria 4528.

Allied Electrical and Furniture Industries, Brent Crescent, North Circular Road, N.W.10. Willesden 5311.

Allnutt & Co., Thos., Lee Chapel Lane, Langdon Hills, Essex. Laindon 122. Allnutt, Lee Chapel Lane, Laindon.

Altham Radio Co., 25, Mosley Street, Manchester 2. Central 6427. Staportco, Manchester.

Alton Battery Co., Ltd., Alton, Hants, Alton 367-8 Battery Alton. Donington House, Norfolk Street, W.C.2. Temple Bar 9265. Battericol, Estrand, London.

Ambassador Radio-Gramophones, Radio Works, Bramston Street, Brighouse, Yorks. Brighouse 283. 14, Oxford Road, Manchester. Central 6089. 8, New Station Street, Leeds. Leeds 22192. 6, Cow Green, Halifax. Halifax 3889.

Amerad (Great Britain), Ltd., Aldwych House, Aldwych, W.C.2. Holborn 9111.

Amplifiers Ltd., Billet Works, Billet Road, Walthamstow, E.17. Larkswood 2244.

Amplion (1932), Ltd., 5, Torrens Street, E.C.1.

Andrews and Co., A. E., 165, Stapleton Hall Road, Stroud Green, N.4. Mountview 1958.

Anglo-American Industries Corpn., 56, Howland Street, W.1. Museum 5675. Anamindus, London.

Anglo Swiss Screw Co., Ltd., Trout Road, West Drayton, Middlesex. West Drayton 404. Accuracy, West Drayton.

Anti-Static Installation, Ltd., St. Stephens House, Cannon Row, S.W.1. Whitehall 5661. Natrasco Works, Cobbold Road, Willesden, N.W.10. Willesden 7421.

Appletons (Leeds) Ltd., Hanover Place, Leeds. Leeds 21694-5-6. 96, New Bridge Street, Newcastle-on-Tyne. Newcastle 27651. Gramophones, Newcastle.

"Ardente" Acoustic Laboratories, 11-12, Pollen Street, W.1. Mayfair 1801-1718. Acoucies, Wesdo, London.

Ashton and Co. (Est. 1787), Ltd., 45, Chorlton Street, Manchester. Central 0365. Klaretun, Manchester.

Ashton's Wireless Depot, 3, Bull's Head Yard, Market Place, Manchester. Blackfriars 2854. Harold Ashton, A.M.I.E.E., Manchester.

Atlas Carbon and Battery Co., Ltd., 56, Southwark Bridge Road, S.E.1. Hop 0795. Atlasbatry, Sedist, London.

Audiovisor, Ltd., 28, Little Russell Street, London, W.C.1. Holborn 2986.

Automatic Coil Winder and Electrical Equipment Co., Ltd., Winder House, Douglas Street, S.W.1. Victoria 3404-7; Autowinda, Sowest, London.

Automobile and Home Radio, Ltd., Buchanan Buildings, 24, Holborn, E.C.1. Holborn 7394. Autohome, London.

A.E.F. Manufacturing Co., 17, Queensway, Ponders End, Middlesex. Enfield 3249. Juicepotz, Enfield.

Baird Television, Ltd., 66, Haymarket, S.W.1 Whitehall 5454. Televisor, Lesquare, London.

Bakelite, Ltd., 68, Victoria Street, S.W.1. Works: Birmingham. Victoria 5511. Bakelite, London.

Baker's Selhurst Radio, Ltd., Sussex Road, South Croydon, Croydon 3441.

Balcombe, Ltd., A. J., 52-58, Tabernacle Street, E.C.2. Clerkenwell 1322. Abalgramo, Finsquare.

Baldwin Instrument Co., Brooklands, Dartford, Kent. Dartford 989.

Barber and Colman, Ltd., Marsland Road, Brooklands, Manchester. Sale 2277. Barcol Sale.

Barnard Accumulator Co., 195-197, Perry Vale, London, S.E.23. Forest Hill 5106.

Batteries, Ltd., Redditch. Astwood Bank 4, Batteries, Redditch.

Baty, E. J., 157, Dunstable Road, Luton. Luton 229. Baty, Luton.

Becker, G., Ltd., Ampere Works, Wembley Park, Middlesex. Wembley 3737. Switches Wembley.

Beddoes, Ltd., J. G., 11, Great Hampton Street, Birmingham, 18. Central 6940. Tantivy, Birmingham. Southern House, Cannon Street. London, E.C.4. Mansion House 8031. Beddofram, London.

Beethoven Radio, Ltd., Beethoven Works, Chase Road, N. Acton, N.W.10. Willesden 2336.

Belling and Lee, Ltd., Cambridge Arterial Road, Enfield, Middlesex. Enfield 3322-5.

Benjamin Electric, Ltd., Brantwood Works, Tariff Road, Tottenham, N.17. Tottenham 1500. Benjalect, Southtot, London.

Bennett Television Co., Redstone Copse, Redhill, Surrey. Redhill 720. Redhill 720.

Berclif, Ltd., 38, Rabone Lane, Smethwick. Smethwick 0751.

Berk and Co., Ltd., F. W., 106, Fenchurch Street, E.C.3. Monument 3874. Berk, Phone, London.

Bestone Radio, 36a, Bruton Place, W.1. Mayfair 3425. Rockbound, Wesdo, London.

Beswick, Ltd., K. E., Alert Works, Seven Kings. Seven Kings 1987.

Betterset Radio, Ltd., Clarendon Works, Montague Street, Worthing. Worthing 654.

Bird and Sons, Ltd., Sydney S., Cyldon Works, Cambridge Arterial Road, Enfield, Middlesex. Enfield 2071. Capacity, Enfield.

Birkbys, Ltd., Liversedge, Yorks. Cleckheaton 103. Elo, Liversedge.

Birmingham Sound Reproducers, Ltd. Claremont Works, Claremont Street, Old Hill, Staffs. Cradley Heath 6212. Electronic, Old Hill.

Block Batteries, Ltd., By Pass Road, Barking-Essex. Rippleway 3346.

Bond and Sons, Ltd., V.C., Parkfield Works, Church Road, Leyton, E.10. Leytonstone 1066. Veeceebee, Leystone, London.

Bonson, E. W., Fox Court, Holborn, London, E.C.1. Holborn 8010.

Bowerman, Ltd., Geo., 137, Praed Street, London, W.2. Paddington 1903. Quesolar, Edge.

Bowyer-Lowe and A.E.D., Ltd., Diamond Works, Coombe Road, Brighton. Brighton 2404.

Bradnam and Co., 15, Heywood Street, Moss Side, Manchester.

MANUFACTURERS' SECTION.

Bramley, J. W., Radio House, Corporation Street, Halifax. Halifax 3394.

Bridger and Co., Ltd., R. O. No. 4 Factory, Shelford Place, Church Street, London, N.16. Clissold 6077–8.

Britannia Batteries, Ltd., Britannia Works, Union Street, Redditch. Redditch 155. Britanicus. 10-15, Chitty Street, W.1. Museum 7163.

British Aluminium Co., Ltd., Adelaide House, King William Street, London, E.C.4. Mansion House 5561-4 and 8074-5. Cryolite, Bilgate, London. Cryolite, London. 25/29, Pancras Road, London, N.W.1. Terminus 5301-2. Lawley Street, Birmingham; 274, Deansgate, Manchester, 3; 66, Kirkstall Road, Leeds, 3.

British Belmont Radio, Ltd., Belmont House, 4–5, Ridgmount Street, London, W.C.1. Museum 0285-6. Belrad, Phone, London.

British Blue Spot Co., Ltd., Sterling Works, Dagenham, Essex. Seven Kings 3466.

British Celanese, Ltd., Celanese House, Hanover Square, W.1. Mayfair 8000. Celanese, Wesdo, London.

British Centralab, Ltd., Canterbury Road, Kilburn, N.W.6. Maida Vale 6066.

British East Light, Ltd., 18, St. Clare Street, Minories, London, E.1. Royal 4207. Fileastli.

British Electric Meters, Ltd., Morden Road, Mitcham, Surrey, Mitcham 2121. Britmeter, Mitcham. 45, Westminster Bridge Road, London, S.E.1. Blackfriars House, Parsonage, Manchester 3.

British Ferrocart Co., Ltd., Peel Works, Silk Street, Salford, 3. Blackfriars 8888. Sparkless, Salford.

British General Radio Co., Ltd., 1, Central Place, Yeovil.

British Goldring Products, Ltd., Balfour House, 115-119, Finsbury Pavement, London, E.C.2. National 8838. Eckergram, Phone, London. Beechcroft Road, S. Woodford, E.18. Wanstead 0039.

British G.W.Z. Battery Co., Ltd., Falmouth Road, Trading Estate, Slough, Bucks. Slough 660. Geewhizz, Slough.

British Homophone Co., Ltd., Barry Road, Stonebridge Park, London, N.W.10. Willesden 0386-7-4394. Homochord, Harles, London. Studios, 84A, High Road, Kilburn, London, N.W.6. Maida Vale 4806-7. 9/9A, High Street, Bull Ring, Birmingham. Midland 6233. 9, Fleet Street, Liverpool. Royal 3920.

British Ideal Patents, Ltd., Green Street, Brimsdown, Middlesex. Enfield 1808, 3327-9. Daptacon, Enfield.

British Insulated Cables Ltd., Prescot, Lancs. Prescot 6571. Insulator, Prescot.

British Leowe Manufacturers, Ltd., 3-4, Clement's Inn, Strand, W.C.2.

British Needle Co., Ltd., Argosy Works, Redditch. Redditch 119. Argosy, Redditch, 9, Falcon Avenue, Aldersgate Street, London, E.C.1. 52, Spencer Street, Birmingham.

British N.S.F. Co., Ltd., Building No. 3, Waddon Factory Estate, Waddon, Surrey. Croydon 4166. Enesef, Croydon.

British Permel Enamelled Wire Ltd., Charlton, S.E.7. Greenwich 2820. Permel, Charlton, Kent.

British Pix Co., Ltd., 118, Southwark Street, London, S.E.1. Waterloo 4640.

British Radio Corporation, Ltd., 46, Grosvenor Gardens, London, S.W.1.

British Radio Gramophone Co., Ltd., Pilot House, Church Street, Stoke Newington, London, N.16. Clissold 6287–8.

British Radiophone Ltd., 56, Vicarage Lane, Ilford, Essex. Ilford 3040.

British Radiovision Corp., 56, Hazel Road, Kensal Rise, N.W.10. Willesden 6180.

British Rectifiers Engineering Co., Carfax Works, Vernon Place, Bath Road, Cheltenham. Manchester: G. H. W. Gasper, 7, Palatine Buildings, Victoria Street.

British Rola Co., Ltd., Minerva Road, Park Royal, N.W.10. Willesden 4322. Vorcecoil, Harles, London. Vorcecoil, London.

British Ropes, Ltd., Wire Sales Dept., Doncaster. Doncaster 1348. Britrope. 52, High Holborn, W.C.2. Chancery 8822. Rutherglen, Nr. Glasgow. Rutherglen 520. Cleckheaton, Yorks. Cleckheaton 281. Retford, Notts. Retford 249. Sankey, Warrington. Warrington 418. 18, Ludgate Hill, Birmingham. Central 5585. Wakefield. Wakefield 2266. Gateshead. Gateshead 71127.

British Television Supplies, Ltd., Faraday House, 8-10, Charing Cross Road, W.C.2. Temple Bar 0134. Teleview, Lesquare, London.

British Thomson-Houston Co., Ltd., Crown House, Aldwych, W.C.2. Temple Bar 8040. Asteroidal, Estrand, London; Asteroidal, London.

British Tungsram Radio Works, Ltd., West Road, Tottenham, N.17. Tottenham 3548. Tungsvalve Southtot, London. (See also Tungsram Electric Lamp Works (G.B.), Ltd.)

British Tyre and Rubber Co., Ltd., Thames House, Millbank, S.W.1. Victoria 3848. Britgoods, Telex, London.

British Zonophone Co., Ltd., 98, Clerkenwell Rd., London, E.C.1. Clerkenwell 7620. Talkingdom, Smith, London.

Bromley-Langton Electric Wire and Insulator Co., Ltd., 34-5, Newman Street, Oxford Street, W.1. Museum 2256-7. Elewires, Rath, London.

Brookes Measuring Tools, 51-3, Church Street, Greenwich, London, S.E.10. Greenwich 1828.

Browning Wireless Manufacturers, 18, Shellgrave Road, N.16. Clissold 0853.

Brunswick, Ltd., 1-3, Brixton Road, London, S.W.9. Reliance 3311. Brunsrad, Claproad, London.

Bryce and Co., W. Andrew, 28, North Road, Burnt Oak, Edgware, Middlesex. Edgware 2828. Woodfield Works, Tile Street, Bury, Lancs.

Bulgin and Co., Ltd., A. F., Abbey Road, Barking, Essex. Rippleway 3474 (3 lines). 64, Holborn Viaduct, E.C.1. Central 2751.

Bulle Products, Ltd., Bulle Clock House, 187, Tottenham Court Road, W.1. Museum 6336.

Bullers, Ltd., 6, Laurence Pountney Hill, E.C.4. Mansion House 9971. Bullers, Cannon, London. Bullers, London.

Bulmer, Fred, 4, Carlton Terrace, Scarborough. Scarborough 723. Bulmer 723, Scarborough.

Burall Brothers, Ltd., Patent Label Factory, Wisbech, Cambs. Wisbech 113. Burall, Wisbech.

Burgess Products Co., Ltd., Barwell, Leicester. Earl Shilton 141. Thames House, Millbank, S.W.1. Victoria 2961. Burducto, Sowest.

Burgoyne Wireless (1930), Ltd., Great West Road, Brentford, Middlesex. Ealing 2091. 56, Victoria Street, Manchester. Blackfriars 4829. 181, Corporation Street, Birmingham. Central 8521.

Burnand and Son, W. E., Duo Works, 66-106, Shoreham Street, Sheffield 1. Central 20766 and 24850. Burnand, Sheffield.

Burndept, Ltd., Light Gun Factory, Erith, Kent. Erith 3080. 24, High Holborn, E.C.1.

Burne-Jones and Co., Ltd., 309-317, Borough High Street, S.E.1. Hop. 0495. Burjomag Sedist, London; Burjomag, London.

Busby and Co., Ltd., 40-47, Price Street, Birmingham. Aston Cross 5696. Busco, Birmingham.

Bush Radio, Ltd., Power Road, Chiswick, W.4. Chiswick 6491-7. Supersetz, Chisk, London.

Butcher and Sons (Ross), Ltd., W., The Wireless Depot, Ross, Herefordshire. Ross 140.

Callender's Cable and Construction Co., Ltd., Hamilton House, Victoria Embankment, London, E.C.4. Central 5241. Callender, Fleet, London.

Calvete, Ltd., I., Icall Works, North Street, Clapham, S.W.4. Macaulay 3202. Elecalvete, Clapcom, London.

Cambridge Instrument Co., Ltd., 45, Grosvenor Place, London, S.W.1. Sloane 9146. Unipivot, Knights, London.
Camel Accumulators, Ltd., 9, Newington Causeway, S.E.1. Hop 3404. Camelac, 'Phone, London.
Carrington Mfg. Co., Ltd., Camco Works, Sanderstead Road, South Croydon. Croydon 1925. Camco, Croydon.
Castagnoli, Gordon, A.M.I.R.E., Culver Street, Colchester. Colchester 814.
Castle Fuse and Engineering Co., Ltd., Castle Works, 33, Chester Street, Liverpool 8. Royal 1610. Corundum, Liverpool.
Celestion Ltd., Kingston-on-Thames. Kingston 5656. Celestion, Kingston-on-Thames.
Cellgrave Co., 49-51, Dartmouth Road, S.E.23. Forest Hill 4759.
Central Equipment, Ltd., 188, London Road, Liverpool. Royal 6152.
Chalkley, C. G. (Incorporating Chalgrove Radio), 6, Grove Street, Wellingborough, Northamptonshire. Chalgrove, Radio, Wellingborough.
Chapman, Ltd., A. W., Ranelagh Gardens, Hurlingham, S.W.6. Renown 1372. Nevejah, Phone, London.
Charlesworth Mouldings, Ltd., Northcote Road, Stechford, Birmingham. Stechford 2148.
Charlton Higgs (Radio), Ltd., Westbourne Place, Hove, 3, Sussex. Hove 6009; Hove 6009.
Chloride Electrical Storage Co., Ltd., Exide Works, Clifton Junction, near Manchester. Swinton 2011. Chloridic, Pendlebury 137. Victoria Street, S.W.1. Victoria 6308. Chloridic, Sowest, London. Lexden Road, Acton, W.3. Acorn 2203. Exidestorbelux, London. 205-231, Shaftesbury Avenue, W.C.2. Temple Bar 5454. Exidedepo Phone, London. 57-58, Dale End, Birmingham. Central 7629. Exidedepo, Birmingham, 4. 16-18, Broadmead, Bristol. Bristol 22461. Exidedepo, Bristol. 40-44, Tureen Street, Glasgow, S.E. Bridgeton 985. Exidedepo, Glasgow, S.E. 1, Franklin Street. Belfast. Belfast 26953. Exidedepo, Belfast, 18-22, Bridge Street, Manchester, 3. Blackfriars 1158. Exidedepo, Manchester, 3.
Chorlmet Radio Elec. Ltd., Arras Mill, Fitzgeorge Street, Collyhurst, Manchester. Collyhurst 2741-2.
Chorlton Metal Co., Ltd., Millgate House, 55, Blossom Street, Manchester. Central 7461-2. Chorlmet, Manchester.
Christie and Sons, Ltd., Jas., 246, West Street, Sheffield. Sheffield 22732. Christie, Sheffield.
City Accumulator Co., 18-20, Normans Buildings, Central Street, London, E.C.1. Clerkenwell 6206. Cityacco, Barb, London.
Clarion Radio Valve Co., Regent House, Kingsway, London, W.C.2. Holborn 9811. Phoenix Works, Tyburn Road, Erdington, Birmingham. Erdington 1291.
Clarke and Co. (Manchester), Ltd., H., Atlas Works, George Street, Patricroft, Manchester. Eccles 2001. Pirtoid, Phone, Manchester.
Clarke's (Redditch), Ltd., Sinew Works, Redditch. Redditch 100. Sinew, Redditch.
Clifford Pressland (Sales) Ltd., 13, Creek Road, East Molesey, Molesey 1231.
Climax Radio Electric, Ltd., Brent Crescent, North Circular Road, N.W.10. Willesden 4727.
Cole, Ltd., E. K., Ekco Works, Southend-on-Sea. Southend 49491. Ekco, Southend-on-Sea.
Collaro, Ltd., Culmorc Works, Culmore Road, Peckham, S.E.15. New Cross 2050. Korllaro, London.
Collet Mfg. Co., S. H., 341, Goswell Road, London, E.C.1. Clerk. 7984.
Collie and Co., J. H., 10, Canning Place, Liverpool. Central 5039.
Collinson's Precision Screw Co., Ltd., Forest Road, E.17. Walthamstow 0532. Elecolvern. 150, King's Cross Road, London, W.C.1. Terminus 3077.
Columbia Graphophone Co., Ltd., Columbia House, 98-108, Clerkenwell Road, E.C.1. Clerkenwell 7620-4. Talkingdom, Smith, London. Fibrillose, London.
Colvern, Ltd., Mawney's Road, Romford, Romford 2020. 150, King's Cross Road. London, W.C.1. Terminus 3077.
Concordia Electric Wire Co., Ltd., Trent Mills, New Sawley, Nr. Nottingham. Long Eaton 249. Polianite, Long Eaton. 81, Milton Street, Sydney Avenue, E.C.2. Metropolitan 9780.
Connollys (Blackley), Ltd., Blackley, Manchester. Cheetham Hill, 1801-2-3. Connollys, Blackley. Oswaldestre House, Norfolk Street, W.C.2.
Cookson and Co., 25, New Oxford Street, W.C.1. Holborn 8503.
Cooper and Son (Wolverhampton), Ltd., R., Atlas Works, Church Lane, Wolverhampton. Wolverhampton 22527. Cooper, Wolverhampton 22527.
Coppock, James T., Ltd., 61-67, Old Street, E.C.1. Clerkenwell 0430. Jatocop, London.
Correx Amplifiers, Peckford Place, Brixton, S.W.9. Brixton 3782.
Cosmocord, Ltd., Enfield, Middlesex. Enfield 4022-3.
Cossor, Ltd., A.C. Cossor House, Highbury Grove, N.5. Canonbury 1234. Amplifiers, Phone, London. Amplifiers, London. 14-16, Carrs Lane, Birmingham 4. Midland 1627. 14, Bath Street, Bristol 1. Bristol 20271-2. 21, Waterloo Street, Glasgow, C.2. Central 4446-7. 17, Wellington Street, Leeds 1. Leeds 21581. 42, Paradise Street, Liverpool 1. Central 1877. 6-10, Cannon Street, Manchester 3. Blackfriars 9777-8. 3, St. Nicholas Buildings, Newcastle 1. Newcastle 23154. 3, Porter Street, Moor Head, Sheffield 1. Sheffield 23103-4. 185, Pearse Street, Dublin. Dublin 44066. 47, Queen Street, Belfast. Belfast 26088. 4, Park Lane, Cardiff. Cardiff 172.
Crabtree, J. A., and Co., Ltd., Lincoln Works, Walsall. Walsall 2202-6. Quality, Walsall. 12, Dyott Street, London, W.C.2. Temple Bar 2741. Kwicmake, Phone, London. 80, Blythswood Street, Glasgow. Central 701-702. Crabtree, Glasgow. 10, Dolefield, Deansgate, Manchester. Blackfriars 0071. Kwicmake, Phone, Manchester. 32, Park Cross Street, Leeds. Leeds 25387. Kwicmake, Phone, Leeds. Queen's Buildings, 10, Royal Avenue. Belfast 26728. Galvanic, Belfast.
Crypton Equipment, Ltd., North Acton Road, Willesden, N.W.10. Willesden 2272. Crytoquip, Phone, London.
Crystalate Gramophone Record Mfg. Co., Ltd., Imperial House, 60-62, City Road, London, E.C.1. Clerkenwell 2633, 2116. Town Works, Tonbridge, Kent. Tonbridge 35. Golden Green, Tonbridge, Kent. Hadlow 33.
Cullums, Ltd., J., 4, Cullum Street, E.C.3. Mansion House 0128. Franksurum, Fen.
Curtis Mfg. Co., Ltd., 26-28, Paddenswick Road, Hammersmith, W.6. Riverside 4456. Phone, Rheofaire, London.

Dallas and Sons, Ltd., John E., Dallas Building, Ridgmount Street, Tottenham Court Road, W.C.1. Museum 6351-9 and 7486. Lensidern, Phone, London.
Daly, H. C., 44, Ranelagh Road, S.W.1. Victoria 5878.
Darwins, Ltd., Fitzwilliam Wks., Sheffield. Sheffield 41341. Eros House, 29-31, Regent Street, London, S.W.1. Regent 5627.
Davis, L., Westacott, Clifton Terrace, Sion Road, Bedminster, Bristol, 3. Bristol 64067.
Davis and Timmins, Ltd., Brook Road, Wood Green, N.22. Bowes Park 1136. Screwdatim Wood, Lon.
Decca Gramophone Co., Ltd. and Decca Record Co., Ltd., 1-3, Brixton Road, S.W.9. Reliance 3311. Decca-Gramo, Claproad, London.
De la Rue and Co., Ltd., Thos., Shernhall Street, Walthamstow, E.17. Walthamstow 2900. Telenduron, Walt., London.
Dent and Co., and Johnson, Ltd., Linwood Works, Linwood near Paisley. Johnstone 109. Dentcompa, Linwood.
Diehl, H., 40, Sun Street, London, E.C.2. Bishopsgate 7949. Diehlency, London. Saxonbury House, New Wanstead, E.11. Wanstead 3385.

MANUFACTURERS' SECTION

Diggle & Co., Ltd., A., Jane Street, Rochdale. Rochdale 2869.
Disque Cabinet Co., Ltd., 11, Poultry, London, E.C.4. City 6631. Towundal, Cannon, London.
Distavox Radio, 119, Bunhill Row, London, E.C.1. National 8589.
Distavox Service and Television Co., 119, Bunhill Row, E.C.1. National 8589.
Doherty and Sons, Edward, 718-728, Seven Sisters Road, N.15. Stamford Hill 4646.
Dual Motors, Ltd., 85-86, New Bond Street, W.1. Mayfair 1648-9. Dualmoto, Wesdo, London.
Dubilier Condensor Co. (1925), Ltd., Victoria Road, N. Acton W.3. Acorn 2241. Hivoltcon, Phone, London.
Dulcetto Polyphon, Ltd., 2-3, Newman Street, W.1. Museum 4201. "Dulcetpoly" London.
Duray, 101, London Road Nth., Lowestoft. Lowestoft 165.
Dyson & Co. (Works), Ltd., J., 2, Coleman Street, E.C.2. Metropolitan 7988. Londepot, Ave., London. 5, Godwin Street, Bradford. Bradford 6037. Equipment, Bradford. 6, Albion Street, Hull. Hull 35693. 33, Pilchergate, Nottingham. Nottingham 42327-8. 47, Winchester Street, Salisbury. Salisbury 1163. 170, Corporation Street, Preston. Preston 2926.

Eagle Engineering Co., Ltd., Eagle Works, Warwick. Warwick 126-7. Eagle, Warwick.
Eagle Transfer, Ltd., Spring Road, Hall Green, Birmingham. Springfield 1117. Eagtranco, Birmingham.
Eastick and Sons, J. J., 118, Bunhill Row, London, E.C.1. Metropolitan 0314. 9, Library Place, Jersey. 10/11, St. Helens Place, Swansea. Commercial House, Place Road, Portsmouth. 23, Westwick Street, Norwich. 3, Leigh Road, Leigh-on-Sea, Essex. 23, Sydenham Road, Guildford, Surrey.
Eburite Corrugated Containers, Ltd., Park Royal Road, North Acton, N.W.10. Willesden 4701-6. Eburitico, London.
Edge Radio, Ltd., Salop Street, Bolton, Lancs., Bolton 1942.
Edison Storage Battery Distributors, Ltd., Victoria House, Southampton Row, W.C.1. Holborn 6673-4. Accedison, Westcent. London, Accedison, London.
Edison Swan Electric Co., Ltd., 155, Charing Cross Road, W.C.2. Gerrard 8660. Windmill Brae, Aberdeen (Sub store operating from Dundee). 12, King Street, Belfast. Belfast 20549. 50, Gt. Charles Street, Birmingham. Central 6411. 32, Duke Street, Brighton. Brighton 2518. 63, Victoria Street, Bristol. Bristol 20161. 89-90, Frederick Street, Cardiff. Cardiff 3157-8. 47, Dawson Street, Dublin, C.2. Dublin 43581-2. 20, Bank Street, Dundee. Dundee 3129. 127, George Street, Edinburgh. Edinburgh 27321. 167a, St. Vincent Street, Glasgow, C.2. Central 1609. 15, Upperhead Road, Huddersfield (Sub-store operating from Leeds). 12, Waltham Street, Hull. Central 36823. Crown Hall Chambers, Hyde Park Corner (Sub-store operating from London). 15-15a, Wellington Street, Leeds. Leeds 29634-5. 27, High-cross Street, Leicester. Leicester 58124-5. Edswan House, Paradise Street (Sub-store operating from Manchester), Liverpool. Central 2002. Lloyds House, Albert Square, Manchester. Blackfriars 4423-6. Wards Buildings, High Bridge, Newcastle. Central 27473-5. Masonic Place, Goldsmith Street, Nottingham. Nottingham 42511-2. 9, Whimple Street, Plymouth (Sub-store operating from Bristol). Mappin Buildings, Norfolk Street, Sheffield. Sheffield 22144. 24, High Street, Southampton. Southampton 6121-2 (Sub-store operating from Bristol). 4, Nelson Street, Swansea (Sub-store operating from Cardiff). 157-8, The Arcade, Northampton (Sub-store operating from Leicester). Northampton 1655. 18, Bedford Street, Norwich. Norwich 695. 24, Peel Place, Leeds Road, Bradford. Bradford 2821 (Sub-store operating from Leeds). 36, Bridge Street, Taunton. Taunton 3267 (Sub-store operating from Bristol). Telegraphic address in each case: Ediswan, followed by name of town.
Edmonds, Ltd., G., Soho Hill Works, Birmingham, 19. Northern 0129. Reciprocal, Birmingham. 3-4, Gamage Building, London, E.C.1. Holborn 0128.
Efandem Co., Ltd., Fallings Park Works, Wolverhampton. Wolverhampton 31012-3. Efandem, Wolverhampton. 11, Fitzroy Square, W.1. Museum 2265.
Electric Lamp Service Co., Ltd., 105-9, Judd Street, King's Cross, London, W.C.1. Euston 1183. Eleclampo, Kincross, London.
Electrical Equipment and Carbon Co., Ltd., 107-9-11, New Oxford Street, W.C.1. Temple Bar 7050-8-9. Thermotype, Westcent, London.
Electrical Ohms, Ltd., 4, Clyde Place, Glasgow. South 328.
Electrico (Croydon), Ltd., 97, George Street, Croydon. Croydon 2527.
Electromicro Mfg. Co., 75, Masboro' Road, Kensington, W.14. Shepherd's Bush 2912.
Electro-Dynamic Construction Co., Ltd., St. Mary Cray, Kent. Orpington 2560.
Elliott Radio Mfg. Co., Ltd., 87, Senhouse Street, Maryport, Cumberland. Maryport 104. Elliott Radio, Maryport.
Elliotts O' Maryport, 33, Curzon Street, Maryport, Cumberland. Cumberland 104. Elliotts O'Maryport.
Ellison Insulations, Ltd. Works: Wellhead Lane, Perry Barr, Birmingham, 20. Birchfields 4554-5. Tufnol. Principality Buildings, Queen Street, Cardiff. Cardiff 1638. Switchgear. 200, St. Vincent Street, Glasgow, C.2. Central 6564. Ellison, Central 6564, Glasgow. Standard Buildings, City Square, Leeds, 1. Leeds 20133-4. Switchgear 131. Victoria Street, London, S.W.1. Victoria 1083. Starters, Sowest. 1, Dickenson Street, West Manchester, 2. Blackfriars 7637-8. Ellison, Blackfriars 7637. Carliole House, Newcastle-on-Tyne, 1. Newcastle-on-Tyne 22855. Starters.
Elvy, C. L., 1, Dyott Street, Shaftesbury Avenue, London, W.C.1. Temple Bar 4982.
Emmott (Pawsons), Ltd., George, Wadsworth Mill, Oxenhope, near Keighley, Yorks. Haworth 14. Emmott, Oxenhope.
Enfield Cable Works, Ltd., Lincoln House, 296-302, High Holborn, W.C.1. Holborn 0591. Enfelcama, Phone, London.
Enfield Zinc Products, Ltd., 30, Newgate Street, E.C.1. City 6079. Penedoog London.
Eon Vacunm Wireless Co., 7, Pool Valley, Brighton. Shirley Street, Hove. Brighton 5246.
Epoch Reproducers, Ltd., Aldwych House, Aldwych, W.C.2. Holborn 9111.
Ercolani and Sons, Ltd., A., Walthamstow Avenue, North Circular Road, S. Chingford, E.4. Larkswood 1041.
Ericsson Telephones, Ltd., 67-73, Kingsway, W.C.2. Holborn 3271. Ericsson, Westcent, London. Works, Beeston, Notts.
Erie Resistor, Ltd., Carlisle Road, The Hyde, Hendon, N.W.9. Colindale 8011.
Ernest Turner Electrical Instruments, Ltd., Chiltern Works, High Wycombe, Bucks. High Wycombe 301. Gorgeous, High Wycombe.
Ever Ready Co. (Gt. Britain), Ltd., Hercules Place, Holloway, N.7. Archway 3030. Eveready, Holway, London.
Everett, Edgcumbe and Co., Ltd., Colindale Works, Hendon, N.W.9. Colindale 6045. Evergendos, Hyde, London.
Evershed and Vignoles, Ltd., Acton Lane Works, Chiswick, W.4. Chiswick 1370. Megger, Chisk, London.
Eves Radio, Ltd., 11, Lichfield Street, Wolverhampton. Wolverhampton 22886. Cable Sebeve.
Evington Electrical Mfg. Co., 5, Beckingham Road, Leicester. Leicester 59221. Evington Electric, Leicester.

Evrizone Radio and Television Co., Ltd., Evrizone Works, 2, Southlands Road, Bromley, Kent. Ravensbourne 1957.
E.M.G. Hand Made Gramophones, Ltd., 11, Grape Street, W.C.2. Temple Bar 7167.
E.M.I Service, Ltd., Sheraton Works, Hayes, Mddx. Southall 2468. Service, Hayes, Mddx. 135, Renfield Street, Glasgow. Douglas 6060. Emiserv, Glasgow.
Factors (Nottm.), Ltd., Woodland Place, Nottingham. Nottingham 40249. Facta, Nottingham.
Faraday All-wave Wireless, 4, Holborn Place, W.C.1. Holborn 7709.
Farrex Radio, Ltd., rear of 543, Holloway Road, N.19. Archway 3389. Arc. 3389.
Faulkner Knight, Ltd., Westmoreland Works, 44-52, Norwood Road, S.E.24.
Feldman, M. (Radio XXX Supplies), 58, Meanwood Road, Leeds. Leeds 23768.
Ferranti, Ltd., Radio Works, Moston, Manchester, 10. Failsworth 2271. Ferranti, Manchester. Bush House, London, W.C.2. Temple Bar 6666. Ferranti, Bush, London.
Film Industries, Ltd., 60, Paddington Street, W.1. Welbeck 2293-4 and 2385-6; 4758. Troosound, Wesdo, London.
Fluxite, Ltd., Dragon Works. Bermondsey Street, S.E.1. Hop 2632.
Forbat, E., 28-29, Southampton Street, W.C.2. Temple Bar 8608. Hyvoltstar, Rand, London.
Formo Products, Ltd., Masons Hill, Bromley, Kent. Ravensbourne 3379.
Fourwave, Ltd., 92, Victoria Street, S.W.1. Victoria 2817. Majestic Works, Oaklands Road, London, N.W.2.
Francis, Ltd., E. M., 36, Heathcote Grove, Chingford, E.4. Silverthorn 1355.
Francois, E. J., 89, Clerkenwell Road, E.C.1. Holb. 6055. Nosamfran, Smith, London. Nosamfran, London.
Franklin Electric Co., Ltd., 150, Charing Cross Road, London, W.C.2. Temple Bar 5833. Elecfranko, Westcent, London. Elecfranko, London.
Fraser and Glass, Assembly Works, Woodside Lane, Finchley, N.12.
French, Cyril, 29, High Street, Hampton Wick, Kingston-on-Thames. (Sole distributor for Celestion loudspeakers). Kingston 2240.
Fry's (London), Ltd., 24-25, King Street, London, E.1. Royal 6152-3. Fryonia, Edo, London.
Fuller Accumulator Co., (1926), Ltd., Woodland Works, Grove Road, Chadwell Heath. Seven Kings 1200. Fuller, Chadwell Heath. 48, Gt. Charles Street, Birmingham. 53A, Back George Street, Princess Street, Manchester. 13, Cumberland Street, Bristol. 73, Robertson Lane, Glasgow.
Gale, A. E., 16, Archer Street, W.1. Gerrard 7851.
Garrard Engineering and Manufacturing Co., Ltd., Newcastle Street, Swindon. Swindon 534-5. Garrard, Swindon.
Gee (Birmingham), Ltd., 249-252, Icknield Street, Birmingham. Northern 1232.
General Electric Co., Ltd., Magnet House, Kingsway, W.C.2. Temple Bar 8000. Electricity, Westcent, London. Polyphase, London.
General Mouldings Co., Ltd., 240-2, York Road, N.7. North 2292. Genmolding, Norwest, London.
Gent and Co., Ltd., Faraday Works, Leicester. Leicester 24151. Gents, Leicester. 47, Victoria Street, London, S.W.1. Victoria 2655. Tangent House, Leazes Park Road, Newcastle-on-Tyne 2. Newcastle 20135.
George Green (Gee Gee), Ltd., 18, Camden Street, Birmingham, 1.
George Tucker Eyelet Co., Ltd., Cuckoo Road, Lechells, Birmingham, 7. East 0441-2-3. Eyelets, Birmingham.
Giffens (London), Ltd., 661-663, Harrow Road, N.W.10. Whizgif, Harles, London.
Gilbert and Co., Ltd., C., Arundel Street, Sheffield. Sheffield 25032. Gilrad, Sheffield. Pall Mall, Hanley. South Street, Hull. St. Mary's Place, Newcastle-on-Tyne. 174, Cleethorpe Road, Grimsby. 9, Venn Street, Huddersfield. 10, Gillygate, York. 22, Derby Road, Nottingham. 44, Wilson Street, Middlesbrough. 12-14, Bank Street, Bolton.
Globe Radio, Ltd., 415, Oxford Street, W.1. Mayfair 5031. Electrasol, London.
Goodmans Industries, Ltd., Lancelot Road, Wembley, Middlesex. Wembley 4001.
Gordon Equipments, Ltd., 25, Milton Street E.C.2. Metropolitan 3170. Gorquip, Barb, London.
Graham Farish, Ltd., 153, Masons Hill, Bromley, Kent. Ravensbourne 3377-9. Grafar, Bromley.
Graham's Radio, 194, Tolworth Rise, Kingston By-Pass, Surrey. Malden 2060.
Grampian Reproducers, Ltd., Kew Gardens, Surrey. Richmond 1175-6-7.
Green and Faulconbridge, Ltd., 11, Queen's Road, Coventry. Coventry 3543.
Grey and Sons, J., 57, City Road, E.C.1. Clerkenwell 5376.
Gripso Co., Abford House, Victoria Station, S.W.1. Victoria 2433. Unmuzzled, Vic.
Grosvenor Electric Batteries, Ltd., Bowman's Place, Holloway, N.7. Archway 2285(2 lines).
Grosvenor Works (Holloway), Ltd., 113, Cottenham Road, Holloway, London, N.19. Archway 1039.
Guiterman and Co., Ltd., S., 35, Aldermanbury, E.C.2. Metropolitan 8074. Guiterman, Phone, London.

Hacker and Sons, H., Perfecta Works, Ray-Lea Road, Maidenhead, Berks. Maidenhead 1211.
Halcyon Radio, Ltd., Sterling Works, Dagenham, Essex. Seven Kings 3466.
Halford Distributors, Ltd., 39, Sackville Street, London, W.1. Regent 7136-7. Julhalford, London.
Hambling and Co., A. W., 10, Cecil Court, London, W.C.2. Temple Bar 4704.
Harlie, Ltd., Balham Road, Lower Edmonton, N.9. Tottenham 4372. Brosharlie, Phone, London.
Harries Thermionics, Ltd., 233, Shaftesbury Avenue, W.C.2. Temple Bar 8327. Eleclab, Westcent, London.
Harrison, A. T., and Co., Kintore Works. Grange Road. Bermondsey, S.E.1. Bermondsey 1155.
Hartley Turner Radio, Ltd., Thornbury Road, Isleworth, Middlesex. Hounslow 4488.
Havenhand, Lewis and Co., Kingsley Works, Young Street, Sheffield. Sheffield 23788.
Haynes Radio, Ltd., Queensway, Enfield, Middlesex. Enfield 2726.
Healey, Ltd., P., 239-241, Gt. King Street, Birmingham. North 1835. Perceal.
Healey Mouldings, Ltd., 109, Gt. Hampton Row, Birmingham. Northern 2641. Perceal.
Heayberd and Co., F. C., 10, Finsbury Street, E.C.2. Metropolitan 7516-7. Heayberd, Finsquare, London.
Hellesens, Ltd., 260-8, Gray's Inn Road, W.C.1. Terminus 3087. Hellesens, Kincross, London.
Henry Ford Radio, Ltd., 22, Howland Street, W.1. Museum 5675.
Hicking, H. B., 37, Station Approach Hayes, Kent. Hurstway 1267. Hicking, Hayes, Kent.
Higgs Motors, Ltd., Witton, Birmingham 6, Birchfields 4545. Higswiton, Birmingham. Dudley House, 36, Southampton Street, Strand, London, W.C.2. Temple Bar 4616. 47, Corporation Street, Manchester 4, Blackfriars 8800. 74, York Street, Glasgow, C.2. Central 5863. 7, Unity Street, College Green, Bristol 1. Bristol 24902. Hope Street Lane Works, Cardiff. Cardiff 1271. 5, Woodland Mount, Leeds 7. Chapeltown 42222. 34, Bath Terrace, Gosforth, Newcastle-on-Tyne 3. Gosforth 51044.
High Frequency Engineering Services, 16, Lyndhurst Avenue, N.12. Finchley 1227.
High Vacuum Valve Co., Ltd., 113-117, Farringdon Road, London, E.C.1. Clerkenwell 7587 and 8064. Hivac Smith, London. Hivac, London.
Hilger, Ltd., Adam, 98, Kings Road, London, N.W.1. Gulliver 5426. Sphericity, Phone, London. Sphericity, London.

MANUFACTURERS' SECTION

"His Master's Voice," 98-108, Clerkenwell Road, London, E.C.1. Clerkenwell 3426. Jabberment, Telex, London. Factories: Hayes, Middlesex. Southall 2468.
Holiday and Hemmerdinger, Holmer Works, Dolefield Bridge Street, Manchester 3. Blackfriars 4096.
Holmes Bros. (London), Ltd., Holbro Works, Billet Road, Walthamstow, E.17. Larkswood 1086. Dogfish, Phone, London.
Hunt, Ltd., A. H., Bendon Valley, Garratt Lane, Wandsworth, S.W.18. Battersea 3132. Trimmers, Put, London. Trimmers, London.
Hyatt and Co., Ltd., J., Ento Works, De Beauvoir Road, London, N.1. Clissold 7635-6.
H.S.P. Wireless Co., Langford Works, Weston-super-Mare. Weston-super-Mare 620.

Igranic Electric Co., Ltd., 149, Queen Victoria Street, E.C.4. Central 7123. Igranic, London. 73-74, Exchange Bldgs. B'ham. 1, Small Street, Bristol. 50, Wellington Street, Glasgow. Standard Buildings, Leeds. 30, Cross Street, Manchester. 90, Pilgrim Street, Newcastle.
Imp Radio Co., 202, Earshall Road, Eltham Park, S.E.9. Eltham 2465. Eltham 2465.
Imperial Chemical Industries, Ltd., Millbank, S.W.1. Victoria 4444. Impkemix, Telex, London.
Imperial Transportables (London), Clarendon Yard, Montague Street, Worthing. Worthing 654.
Impex Electrical, Ltd., 47, Victoria Street, Westminster, London, S.W.1. Victoria 3914. Dariolect, Sowest, London.
Incorporated Radio Society of Great Britain, 53, Victoria Street, S.W.1. Victoria 4412.
Insulators, Ltd., Leopold Road, Edmonton, London, N.18. Tottenham 1491.
International Majestic Radio Corpn., Ltd., 173-5, Farringdon Road, E.C.1. Clerkenwell 9456. Stanhop, Smith, London.
Invicta Radio, Ltd., Radio Works, Parkhurst Road, N.7. North 3883.
Ismay Rawson, Ltd., Sterling Works, Dagenham, Essex. Seven Kings 3466.
Ivory Electric, Ltd., 18, Noel Street, London, W.1. Gerrard 2378.

Jackson Bros. (London), Ltd., 72, St. Thomas Street, S.E.1. Hop 1837. Walfilco, Boro', London. 47, Pershore Street, Birmingham. Central 7794. 140D, Victoria Street, Bristol. Bristol 2230. 113, St. Vincent Street, Glasgow. Central 6447. 47, Fleet Street, Dublin. Dublin 21760.
Jeacocks, 14, Gloucester Way, Clerkenwell, E.C.1. Clerkenwell 1725.
Johnson and Phillips, Ltd., Charlton, London, S.E.7. Greenwich 3244. Juno, London.
Joseph, H., 33, Percy Street, W.1. Museum 7634. Lockabinet, Rath, London.
Kay Brothers, Ltd., Kayborough, Stockport. Heaton Moor 1232. Kay, Stockport.
Keats and Co. (Radio), Ltd., 91-3, Bishopsgate, E.C.2. London Wall 4710. Blastpipes, London.
Kemp's Vulcanising Co., Ltd., 50, 52 and 69, Hardman Street, Manchester. Blackfriars 4652. Kempoleum, Manchester. Evac Works, Basil Street, Rusholme, Manchester. Rusholme 4367.
Kenwell Radio, Ltd., 15-29, Windsor Street, Essex Road, N.1. Clerkenwell 5746. Urocordmer, Nordo, London.
Kingsway Electricals, Ltd., 3-9, Dane Street, High Holborn, W.C.1. Holborn 6192.
Kniveton Cable Works, Ltd., Queensway, Ponders End, Middlesex. Enfield 3452.
Kolster-Brandes, Ltd., Cray Works, Sidcup, Kent. Sidcup 1188. Kolster, Phone, Sidcup. Matchtone, Sidcup. 163-165, Gt. Portland Street, London, W.1. Welbeck 3511. Lloyds House, Albert Square, Manchester 2. Blackfriars 8718.

Laker Co., Ltd., J. and J., Kent House Road. Beckenham, Kent. Sydenham 5394. Lakerco, Beckenham. Jaylakerco, London.
Lawrence, Percy Harold, 38, Market Street, and Aldergate, Tamworth. Tamworth 330. Lawrence, Tamworth.
Lawrence, P. M., 20a, Belsize Grove, N.W.3. Primrose 2442.
Lawrence & Bray, 20a, Belsize Grove, N.W.3. Primrose 2442.
Le Carbone Co., Ltd., Spencer House, South Place, E.C.3. National 4536. Lacombe, Ave, London. Battery Works, Portslade, Sussex.
Lechner and Co., Ltd., F. W. 61, Spencer Street, London, E.C.1. Clerkenwell 8638.
Lectro Linx, Ltd., 79A, Rochester Row, S.W.1. Victoria 3541-2, Victoria 3516. Trolinx. Sowest, London. Trolinx, London.
Lehmann, Archer and Lane. Ltd., 5, Farringdon Road, E.C.1. Holb. 7456 (3 lines). Tapsandies, London.
Levy's Sound Studios, Ltd., Rosslyn House, 96, Regent Street, W.1. Regent 1675. Tonophase, Piccy, London. Tonophase, Piccy.
Lilley and Son, Ltd., S., 80, Alcester Street, Birmingham. Midland 2385. Birmingham. Mid. 2385. Uneedus, Birmingham.
Linolite, Ltd., 96, Victoria Street, London, S.W.1. Victoria 1563. Lytanclip, Sowest, London.
Lissen, Ltd., Angel Road, Edmonton, N.18. Tottenham 3901. Lissenium, Phone, London. Lissenium, London. Sales and Advert. Dept., 113-117, Charing Cross Road, W.C.2. Gerrard 5871.
Lithanode Co., Ltd., 190, Queen's Road, Battersea. Macaulay 4541-2. Lithanode, Claproad, London.

Lock, Ltd., W. and T., Bath. Weston, Bath 7234. Lock, Bath. 33, Percy Street. London, W.1. Museum 7634. Lockabinet, Rath, London.

London Electric Appliances, Ltd., 62, Glengall Road, Old Kent Road, S.E.15. Bermondsey 2022.

London Electric Wire Co. and Smiths, Ltd. Church Road, Leyton, E.10. Leytonstone 3636 (10 lines). Lewcos, Phone, London.

London Electric Clock Co., 15, Park Street, Islington, N.1. North 3967.

London Electrical Manufacturing Co., Ltd., Lemco Works, 462, Fulham Road, S.W.6. Fulham 4444. Fulham 4444, London. Lemco, London.

London Radio Co. (Leeds), Ltd. 26, Queen's Arcade, Leeds. Leeds 24928. 41, Headrow, Leeds.

London Radio Development Services, Ltd., 56, Hazel Road, Kensal Rise, N.W.10. Willesden 6180.

London Transformer Products, Ltd., L.T.P. Works, Cobbold Estate, Cobbold Road, Willesden, N.W.10. Willesden 3568. 7743. Transelect, Willroad, London. Transelect, London.

Londona, Ltd., 66, Hatton Garden, E.C.1.

Lotus Radio (1933) Ltd., 105, Judd Street, London, W.C.1. Euston 1183.

Lucas, Ltd., Joseph, Gt. King Street, Birmingham 19. Northern 5201. Lucas, Birmingham. 319, Regent Street, London, W.1. Langham 4311. Guidepost, Wesdo, London.

Lugton and Co., Ltd., 203, Old Street, London, E.C.1. Clerkenwell 0257. Maxitone, Finsquare, London. 161, Howard Street, Glasgow. Central 5602.

Lukely Engineering and Moulding Co., Ltd., Lukely Works, Carisbrooke Road, Newport, I. of W.

Lundberg and Sons, Ltd., A. P., 477-489, Liverpool Road, London, N.7. North 3351. Lundberg, London.

Lyons, Ltd., Claude, 76, Oldhall Street, Liverpool. Central 4641. Minmetkem, Liverpool. 40, Buckingham Gate, Westminster, London, S.W.1. Victoria 3068. Minmetkem, Sowest, London.

Lystan Products, Ltd., Lystan House, St. Andrew's Road North, Lytham St. Annes. St. Annes 1194. St. Annes 1194.

L.P.S. Electrical Co., Ltd., Ealing Road, Alperton, Wembley. Perivale 5621. Engineyor, Phone, London.

McLeod and McLeod, Ltd., 329, High Holborn, W.C.1, Chancery 8696-7. Macleodius, Holb, London. Macleodius London.

McMichael Radio, Ltd., Wexham Road, Slough, Bucks. Slough 441-2-3. Radiether, Slough. 179 and 265, Strand, London, W.C.2. Temple Bar 6988 and Holborn 2466.

McMillan and Co., J., 17, Surrey Street, Strand, W.C.2. Temple Bar 8250. Elektriken, London. Walsall.

Magnaphone Production Co., 187A, West End Lane, N.W.6. Maida Vale 2252.

Magnetic and Electrical Alloys, Ltd., Lancelot Road, Wembley, Middlesex. Wembley 4933. Magnetic, Wembley.

Mains Radio Gramophones, Ltd., Vaughan Street, Bradford. Bradford 6795. Emmargee, Bradford.

Mains Radio Mfg. Co., 103A, Parchmore Road, Thornton Heath, Surrey. Livingstone 1164.

Majestic Service Co., 4, Victoria Bridge Street, Manchester 3.

Manufacturing R. A. P., Ltd., Ferry Works, Thames Ditton, Surrey. Emerbrook 2453 and 3320.

Marconiphone Co., Ltd., Radio House, 210-212, Tottenham Court Road, London, W.1. Museum 4144. Marconifon, Rath, London. Registered office and factories, Hayes, Middlesex. Marconifon, Hayes, Middlesex. Southall 2468. Depots: 135, Renfield Street, Glasgow. Douglas 2556. Marconifon, Glasgow. 31-3, Holloway Head, Birmingham. Midland 2227. Marconifon, Birmingham. 52-6, Wood Street, Liverpool. Royal 5128. Marconifon, Liverpool. 3-9, Wood Street, Cardiff. Cardiff 1388. Marconifon, Cardiff.

Marconi's Wireless Telegraph Co., Ltd., Electra House, Victoria Embankment, London, W.C.2. Temple Bar 4321. Expanse, Estrand.

Margolin, J. and A., 112 to 116, Old Street, E.C.1. Clerkenwell 1638.

Maul and Murphy, Ltd., 70, Milton Street, E.C.2. National 2372. Centuplico, Barb, London.

Mellow Tone Co., The, 153, Holland Road, Kensington, London, W.14. Park 5489.

Meritus (Barnet), Ltd., 36, Wood Street, High Barnet, Herts. Barnet 3667.

Mervyn Sound and Vision Co., Ltd., 4, Holborn Place, London, W.C.1. Holborn 7709.

Metropolitan Radio Service Co., 1,021, Finchley Road, Golders Green, N.W.11. Speedwell 3000. Metradio.

Mica Mfg. Co., Ltd., Volta Works, Bromley, Kent. Ravensbourne 0118. Micamanu, London.

Micanite and Insulators Co., Ltd., Empire Works, Blackhorse Lane, Walthamstow, London, E.17. Larkswood 1044. Mytilite, Phone, London.

Microfuses, Ltd., 4, Charterhouse Buildings, Goswell Road, E.C.1. Clerkenwell 4049.

Midgley-Harmer, Ltd., Dukes Road, Western Avenue, London, W.3. Acorn 3295. Trutone, Act, London.

Midland Electric Wire Co., Ltd., Lutterworth. Lutterworth 8. Conductors.

Millet, J., 39, Farringdon Road, E.C.1. Holborn 0293 and 4299. Alembic, Smith, London.

Milnes Radio Co., Ltd., Victoria Works, Church Street, Bingley, Yorks. Bingley 600. Six Hundred, Bingley.

Mobile Amplifiers, Ltd., 1, Balham High Road, S.W.12. Balham 1660.

Money Hicks, 172-184, Newington Butts, S.E.11. Reliance 3124.

Montague, Ltd., S. & D., Chase Road, North Acton, N.W.10. Willesden 2336.

Morgan Crucible Co., Ltd., Battersea Works, Church Road, S.W.11. Battersea 2250. Crucible, Phone, London. Crucible, London.

Mortley, Sprague and Co., Ltd., Nelson Road, Tunbridge Wells. Tunbridge Wells 159.

Morton, Ltd., E. R., 11, Newman Street, W.1. Museum 6616.

Morton and Co., Ltd., R., Fitzall Works, Sidney Street, Sheffield. Sheffield 23905.

Muirhead and Co., Ltd., Elmers End, Beckenham, Kent. Beckenham 0041. Muirheads, Elmers End.

Mullard Radio Valve Co., Ltd., New Road, Mitcham Junction, Surrey. (See also Mullard Wireless Service Co., Ltd.) Mitcham 2071. Emvalco, Phone, London.

Mullard Wireless Service Co., Ltd., 225, Tottenham Court Road, W.1. Museum 3484. Radiovalve, Westcent, London.

Muller and Co. (England), Ltd., Sphinx Works, Chase Road, Park Royal, London, N.W.10. Willesden 7282-3.

Multitone Electric Co., Ltd., 95-8, White Lion Street, London, N.1. Terminus 5474-5. Multonelec, Isling, London.

Murphy Radio, Ltd., Broadwater Road, Welwyn Garden City, Herts. Welwyn Garden 800.

Musikon, Ltd., 17, Lisle Street, Leicester Square, London, W.C.2. Gerrard 4476.

M.C.L. and Repetition, Ltd., Pool Lane, Langley, Birmingham. Broadwell 1115. Karlyteko, Langley, Worcs.

M.O. Valve Co., Ltd., Osram Works, Brook Green, Hammersmith, W.6. Riverside 3431. Thermionic, Phone, London.

M.R. Supplies, 11, New Oxford Street, W.C.1. Holborn 7058.

Neutron (1927), Ltd., 54, Lamb's Conduit Street, London, W.C.1. Holborn 6455.

New London Electron Works, Ltd., East Ham, E.6. Grangewood 0044. Stannum, Forgate, London.

MANUFACTURERS' SECTION

Newton Bros. (Derby), Ltd., Alfreton Road, Derby. Derby 777. Dynamo, Derby. Dynamo, Derby, England.
Nobel Chemical Finishes, Ltd., Nobel House, Buckingham Gate, S.W.1. Victoria 8432. Dulux, Sowest, London.
Norma Technical Products, Ltd., Balfour House, 119-125, Finsbury Pavement, London, E.C.2. National 8838 and 7467. Normaco Ave, London.
Norman Rose Electrical, Ltd., 94, Tottenham Court Road, W.1. Temple Bar 4175.
Northampton Plating Co., St. Giles Street, Northampton. Northampton 1804.
Novo Radio (1935), Ltd., Union Works, St. John Street, Newcastle-on-Tyne, 1. Newcastle-on-Tyne 21781. Novo 21781, Newcastle-on-Tyne. 4, Highbury Place, London, N.5 (Mr. A. Kaye). Canonbury 2800.

Octron, Ltd., Regent House, Kingsway, W.C.2. Holborn 9811. Phœnix Works, Tyburn Road, Erdington, Birmingham. Erdington 1291. Octron, Birmingham.
Oldham and Son, Ltd., Denton, near Manchester. Denton 2431. Oldhams, Denton. 40, Wicklow Street, King's Cross, London, W.C.1. Terminus 4446. Shurestart, Kincross, London. 4-5, Freeman Street, Birmingham. Midland 0709.
Orel-Micro Electric, Ltd., 39, Berners Street, W.1. Museum 0032. Orelmicro.
Orion Lamps, Ltd., 82-4, Theobald's Road, W.C.1, Holborn 9150.
Ossicaide, Ltd., 447, Oxford Street, London, W.1. Mayfair 1528.

Parlophone Co., Ltd., 102, Clerkenwell Road, London, E.C.1. Clerkenwell 7620. Parlocord, Telex, London.
Parsonage, W. F., 104, Harrison Street, Bloxwich, near Walsall.
Parmeko, Ltd., Aylestone Park, Leicester. Aylestone 487. Parmeko, Leicester.
Partridge, N., King's Bldgs., Dean Stanley Street, London, S.W.1. Victoria 5035. Victoria 5035.
Partridge, Wilson and Co., Ltd., Davenset Works. Evington Valley Road, Leicester. Leicester 24612 and 24882. Davenset, Leicester. 21, Douglas Street, Glasgow. Central 8853. 167, Shaftesbury Avenue, W.C.2. Temple Bar 4791.
Pegasus, Ltd., Low Mills, Nussey Mill Lane, Lower Wortley, Leeds. Armley 38901.
Person and Son, L., 63, Shaftesbury Street, London, N.1. Clerkenwell 7139.
Peto and Radford (Props., Pritchett and Gold and E. P. S. Co., Ltd.). 50, Grosvenor Gardens, S.W.1. Sloane 7164. Dagenite, Sowest, London. 18, Princess Street, Manchester, 1. Central 6167. Dagenite, Manchester. 158, Clyde Street, Glasgow. Central 4886. Dagenite, Glasgow.
Peto-Scott Co., Ltd., 77, City Road, E.C.1. Clerkenwell 9406. 62, High Holborn, W.C.1. Holborn 3248.
Philco Radio and Television Corporation of Great Britain, Ltd., Wadsworth Road, Perivale, Middlesex. Perivale 3344.
Philips Industrial (Philips Lamps, Ltd.), 145, Charing Cross Road, London, W.C.2. Gerrard 7777. Phildustry, Telex, London.
Philips Lamps, Ltd., 145, Charing Cross Road, W.C.2. Gerrard 7777. Phillamps, Westcent, London; New Road, Mitcham Junction, Surrey. Mitcham 2081. Stafford Road, Waddon, Surrey; Fairfield 4191. 30, Handyside Arcade, Percy Street, Newcastle; Newcastle 21236-7. 14-16, Bridge Street, Manchester; Blackfriars 2261. 28, St. Paul's Street, Leeds; Leeds 29001-2-3. 28, Warser Gate, Nottingham; Nottingham 40581. 112, St. Thomas Street, Bristol; Bristol 20307. Ludgate Hill, Birmingham; Central 7201-2-3. 26, Bothwell Street, Glasgow; Central 4302.
Pickett's Cabinets, Albion Road, Bexleyheath. Bexleyheath 194.
Pilot Radio, Ltd., 87, Park Royal Road, N. Acton, N.W.10. Willesden 7353. Piloset, Harles, London. Piloset, London.
Pioneer Mfg. Co., Cromwell House, Fulwood Place, London, W.C.1. Chancery 7054. Pioneer, Jamarker, London.
Pix Valves, Ltd., Pix House, 118, Southwark Street, London, S.E.1. Waterloo 4640. Waterloo 4640, London.
Plessey Co., Ltd., Vicarage Lane, Ilford. Ilford 3040. Plessey, Ilford.
Pollock and Co., Ltd., W. J., 79-81, Mortimer Street, W.1. Museum 2874.
Pooley, G. J., 25, Kenilworth Avenue, London, E.17.
Portadyne Radio (Gorst Electrical Co., Ltd.), Gorst Road, North Acton, N.W.10. Willesden 7541-2.
Portland Radio Co., Ltd., 222, Great Portland Street, London, W.1. Museum 1023.
Prideaux, Junr., Ralph, 101, Hatton Garden, E.C.1. Holborn 6244.
Primus Mfg. Co., Primus House, Willow Street, E.C.2. Bishopsgate 5681. Aatsolo, London.
Prism Manufacturing Co., California Works, Brighton Road, Belmont, Surrey. Sutton 5361.
Provincial Incandescent Fittings Co., Ltd. (Pifco, Ltd.), Pifco House, 1, Watling Street, Manchester. City 4044 and 0831. Provencal, Manchester. 150, Charing Cross Road, London, W.C.1. Temple Bar 3720. Pifco, Westcent, London.
Pye Radio, Ltd., Radio Works, Cambridge Cambridge 3434. Pyrad, Cambridge. Sales Organisation: Africa House, Kingsway, London, W.C.2. Holborn 5384. Pyradlim, Westcent, London.

Quadrant Carbon and Metal Products, Ltd., Quadrant Works, Cumberland Road, Stanmore Middlesex. Wordsworth 1138. Quadmor, Phone, London.
Quartz Crystal Co., Ltd., 63a and 71, Kingston Road, New Malden, Surrey. Malden 0334.

Radenite Batteries, Ltd., Coventry. Coventry 8644. Vanraden.
Radiamp Co., Ltd., Orchard Works, Farningham Road, Tottenham, London, N.17. Tottenham 2157.
Radio Development Co., Aldwych House, Aldwych, London, W.C.2. Holborn 9111.
Radio-Electric Products Co., Whitcomb Court, Whitcomb Street, W.C.2. Whitehall 8877. Loudigs, Lesquare, London.
Radio Furniture and Fittings, Ltd., Cranmer Court, Sloane Avenue, Chelsea, S.W. Kensington 7434.
Radio Gramophone Development Co., Ltd., Globe Works, Newtown Row, Birmingham, 6. Aston Cross 3521. Gramorad. 40, Doughty Street, London, W.C. Holborn 7360. 17, Bridge Street, Manchester. Blackfriars 1951.
Radio Resistor Co., 1, Golden Square, Piccadilly, London, W.1. Gerrard 7291.
Radio Service and Television, Ltd., 68a, Colebrook Row, Islington, N.1. Clerkenwell 1157.
Radiometers, Ltd., Dunbar Works, Dunbar Street, West Norwood, S.E.27. Streatham 2241.
Radiomonic, Ltd., W.R.C. Works, Cobbold Road, Willesden, N.W.10. Willesden 3722.
Radiovox Wireless Services, Ltd., Radiovox House, 16, Portland Crescent, Leeds 1. Phone 23804. Radiovox 23804. Leeds.
Rainbow Radio Manufacturing Co., Chapel Street Works, Blackburn, Lancs.
Ramsey, F. W., 63, Shaftesbury Street, New North Road, N.1. Clerkenwell 7139.
Record Radio, Ltd., 2-3, Eldon Street, London, E.C.2. Bishopsgate 1301. Radorecord, Ave, London.
Redfern's Rubber Works, Ltd., Hyde, Cheshire. Hyde 622. Rubbers, Hyde. 212, Gt. Portland Street, London, W.1. Museum 0381. Berrub, Wesdo. 7, Albion Street, Leeds. Leeds, 22166.

Regent Fittings Co., 120, Old Street, London, E.C.1.
Regentone Products, Ltd., Regentone Works Worton Road, Isleworth, Middlesex. Hounslow 2212.
Reliance Electrical Wire Co., Ltd., Staffa Road, Leyton, E.10. Leytonstone 2214.
Reliance Manufacturing Co. (Southwark), Ltd., Westbury Works, Westbury Road, Walthamstow, London, E.17. Walthamstow 0235.
Reproducers and Amplifiers, Ltd. (R & A), Frederick Street, Wolverhampton. Wolverhampton 22241. Audio, Wolverhampton.
Rich and Bundy, Ltd., New Road, Ponders End. Middlesex. Enfield 0777.
Riley and Sons, Ltd., John. Hapton, Near Burnley. Padiham 290-1. Rileys, Hapton.
Ripaults, Ltd., King's Road, N.W.1. Euston 2525. Ripault, Norwest, London. Ripault, London.
Roberts Radio Co., Ltd., 4, Rathbone Place, W.1.
Robinson and Co., Ltd., Lionel, Furnival House, 14-18, High Holborn, W.C.1. Holb. 6322. Ferrydom, Holb, London.
Robson's Trade Radio Service, 262, Norwood Road, West Norwood, S.E.27. Streatham 1478.
Romac Motor Accessories, Ltd., Romac Works, The Hyde, Edgware Road, N.W.9. Colindale 6055-9. Strength, Hyde, London.
Ronnie Engineering Co., Crewdson Road, London, S.W.9. Reliance 2809.
Rose, Morris and Co., Ltd., 57, City Road, E.C.1. Clerk. 5377.
Ross, Courtney and Co., Ltd., Ashbrook Road, Holloway, N.19. Archway 1166. Homonyms, Holway, London.
Rothermel, Ltd., R. A., Rothermel House, Canterbury Road, Kilburn, N.W.6. Maida Vale 6066.
Rotor Electric, Ltd., Brent Crescent, North Circular Road, N.W.10. Willesden 4727. Rotorstat.
Ruhl (1922), Ltd., O., 15-29, Windsor Street, Essex Road, London, N.1. Clerkenwell 5746. Unocordmer, Nordo, London.
R.A.P., Ltd., Ferry Works, Thames Ditton, Surrey. Emerbrook 2453-4.

Salford Electrical Instruments, Ltd., Peel Works, Silk Street, Salford, 3. Blackfriars 8888; Sparkless, Salford. Magnet House, Kingsway, W.C.2.
Sankey and Sons, Ltd., Joseph, 168, Regent Street, W.1. Regent 2748. Permeable, London.
Savage, W. Bryan, Ltd., Westmoreland Road, N.W.9. Colindale 7131. Decibel, Phone, London.
Saxon Radio Co., Henry Street Works, South Shore, Blackpool. Blackpool 1894.
Saxonia Electrical Wire Co., Ltd., Roan Works, Greenwich, S.E.10. Greenwich 0463 and 1672. Saxonist, London.
Scientific Supply Stores (Wireless), Ltd., 126, Newington Causeway, London, S.E.1. Hop 4177.
Scophony, Ltd., Thornwood Lodge, Campden Hill, London, W.8. Park 8181. Scofony, London.
Scott, Geo. L., and Co., Ltd., Kingsway, Croydon, Surrey. Croydon 5533. Steelhead, Croydon.
Scott Insulated Wire Co., Ltd., Queensland Road. N.7. North 1194. Silcotenam, London.
Scott, Sessions and Co., G., Muswell Hill, N.10, Tudor 4101 (two lines). Tropiset, London. (Cables only.)
Selecta Gramophones, Ltd., 81, Southwark Street, S.E.1. Waterloo 6671.
Self Changing Gramophones, Ltd., 11, Berkeley Square, W.1. Mayfair 5855. 11 and 12, Coach and Horses Yard, Old Burlington Street, W.1. Regent 5855.
Shaftesbury Microphones, Ltd., 24, Aldersgate Street, E.C.1. National 2521.
Siemens Electric Lamps and Supplies, Ltd., 38-9, Upper Thames Street, London, E.C.4. Central 2332 (14 lines). Siemotor, Cent., London.
Siemens Schuckert (Gt. Britain), Ltd., 30-34, New Bridge Street, E.C.4. Central 8461-2-3. Wernerwerk, Lud, London.
Sifam Electrical Instrument Co., Ltd., Hollydale Road, Queen's Road, S.E.15. New Cross 2168. Sifamafis, Peck, London.
Sinclair Speakers, Alma Grove, Copenhagen Street, N.1. Terminus 4355. 4355 Terminus.
Smith and Sons (Motor Accessories), Ltd., S., Cricklewood Works, London, N.W.2. Gladstone 3333. Speedofac, Phone, London.
Smurthwaite, Ltd., F. W., Harmony Works, Ross Parade, Wallington, Surrey. Wallington 1982.
Sonomac Sound Products (Proprs., Metal Agencies Co., Ltd.), Grove Avenue, Bristol 1. Bristol 21061. Themac, Bristol.
Sound Sales, Ltd., Tremlett Grove, London, N.19. Archway 1661.
Sparkes and Co., J., 119, Cheapside, London, E.C.2. National 6847.
Stadium, Ltd., 75-77, Paul Street, Gt. Eastern Street, E.C.2. Clerkenwell 9321-2-3-4. Etiencimex, London.
Standard Telephones and Cables, Ltd., Valve Works, Footscray, Sidcup, Kent. Sidcup 960. Brimar, Phone, Footscray. Registered Offices, Connaught House, Aldwych, London, W.C.2. Holborn 8765. Relay, Estrand, London.
Static Condenser Co., 11, Eden Street, London, N.W.1. Museum 5534.
Steatite and Porcelain Products, Ltd., Bewdley Road, Stourport-on-Severn. Stourport 111. Steatain, Stourport. Thames House, Millbank, S.W.1.
Stebbings, J. R., 6, Warwick Street, Piccadilly Circus, W.1. Gerrard 6702.
Sterling Batteries, Ltd., Sterling Works, Dagenham, Essex. Seven Kings 3466. Sterbats, Dagenham.
Stilwell and Sons, 153, Far Gosford Street, Coventry. Coventry 2263.
Stonehouse Radio Supplies, 54, Union Street, Stonehouse, Plymouth, Devon. Plymouth 2496.
Stratton and Co., Ltd., Eddystone Works, Bromsgrove Street, Birmingham. Midland 3771. Stratnoid, Birmingham.
Sturdy Electric Co., The, 1, Wesley Terrace, Dipton, Newcastle-on-Tyne. Dipton 21.
Sullivan, Ltd., H. W., Leo St., Peckham, S.E.15. New Cross 2911. Standelect, Peck, London.
Sunbeam Wireless Service, 10, The Pavement, Clapham, S.W.4. Macaulay 1385.
Swift Levick and Sons, Ltd., Clarence Steel Works, Sheffield. Sheffield 20371. Levick, Sheffield.
Sylvex, Ltd., 144, Theobald's Road, W.C.1. Holborn 0848.
Synchronome Co., Ltd., 19, Caxton House, London, S.W.1. Whitehall 4157 and 4032.
Synchrophone (1935), Ltd., Synchrophone Works, Gashouse Lane, Hertford. 156.
Tannoy Products (Guy R. Fountain, Ltd.), Canterbury Grove, W. Norwood, S.E.27. Streatham 4122 (6 lines). 2, Whitworth Street West, Deansgate, Manchester. Central 6830. 132, George Street, Edinburgh. Edinburgh 26836.
Telegraph Condenser Co., Ltd., Wales Farm Road, Acton, W.3. Acorn 0061. Telefarad, Phone, London.
Telephone Manufacturing Co., Ltd., Hollingsworth Works, Martell Road, S.E.21. Gipsy Hill 2211. Bubastis, Westnor, London.
Telsen Electric Co. (1935), Ltd., Fitzgeorge Street, Rochdale Road, Manchester 9. Collyhurst 1802. Escort, Manchester.
Thibouville-Lamy and Co., J., 10 and 12, Charterhouse Street, E.C.1. Holborn 5042. Tibouvil, London.
Thompson, Diamond and Butcher, 22-3, Clerkenwell Close, London, E.C.1. Clerkenwell 5492 (8 lines). Thomdibu, London.
Three Star Accumulators, Ltd., Rosebery Avenue, N.17. Tottenham 2777-8. Threcetar, Southtot, London.
Time Switches and Instruments, Ltd., 120, Victoria Street, S.W.1. Victoria 5273.

MANUFACTURERS' SECTION

Toubkin, J., Faraday House, Todd Street, Manchester, 3. Blackfriars 9348 and 9349. Toubkin, Manchester. 130, High Holborn, W.C.1. Holborn 5997. Toubkin, London.

Transreceivers, Ltd., 444, Ewell Road, Surbiton, Surrey. Elmbridge 2960. Transreceivers, Surbiton.

Triotron Radio Co., Ltd., 26, Bloomsbury Street, London, W.C.1. Museum 1908. Radiunited, Westcent.

Trix Electrical Co., Ltd., The, 8–9, Clerkenwell Green, London, E.C.1. Clerkenwell 3014–5. Trixadio, Smith, London. 50, Wellington Street, Glasgow. 5, Evans Terrace, Trealaw, Glam.

True Screws, Ltd., 99, Clerkenwell Road, E.C.1. Holborn 2618 and 9100. Truescrews, Holb, 2618.

Truphonic Radio, Ltd., Truphonic Works Aboyne Road, Garratt Lane, S.W.17. Wimbledon 4551. Wimbledon 4551.

Truvoice, Ltd., Davis Bldgs., Moor Street, W.1. Gerrard 2575. Selmatone, Rath, London.

Truwind Products, Ltd., 5, Torrens Street, London, E.C.1. Clerkenwell 2323.

Tungsram Electric Lamp Works (Great Britain), Ltd., 82-4, Theobald's Road, W.C.1. Holborn 3563. Tungselec, Holb, London.

T.M.C.-Harwell (Sales) Ltd., Britannia House, 233, Shaftesbury Avenue, W.C.2. Temple Bar 0055 (3 lines).

T.X. Products Co., Ltd., 407, Lordship Lane, N.17. Tottenham 4640.

Ultra Electric, Ltd., Western Avenue, Acton, W.3 Acorn 3434. Radwaves, London.

Union Radio Co., Ltd., U.R. Works, Aurelia Road, Croydon. Thornton Heath 1533. Unirad, Phone, Croydon. Unirad, Croydon.

Universal Gramophone and Radio Co., Ltd., Ryland Road, Kentish Town, London, N.W.5. Gulliver 1165-6-7. Unigramrad, Kentish, London.

Universal High Voltage Radio, Ltd., 28-9, Southampton Street, and 42, Maiden Lane, London, W.C.2. Temple Bar 4985-8608. Hyvoltstar, Rand, London.

Universal Radio Distributors, Ltd., 24, Fitzroy Square, London, W.1. Euston 3018. Unimpo, Rath, London.

Universal Services, 148, High Holborn, W.C.1. Holborn 6856.

Univolt Electric, Ltd., 119-125, Finsbury Pavement, London, E.C.2. National 6828-9. Belrad, Phone, London.

Vandervell, Ltd., C. A., Well Street, Birmingham. Northern 5201. Regent Street, W.1. Langham 4311. Guidepost, Wesdo, London.

Varley (proprietors, Oliver Pell Control, Ltd.), Bloomfield Road, Woolwich, S.E.18. Woolwich 2345. 103, Kingsway, W.C.2. Holborn 5303. Olipel, Phone, London. 1400, Victoria Street, Bristol. Bristol 21230. 11, Bothwell Street, Glasgow. Central 4339. 27, Reid Park Road, Jesmond, Newcastle-on-Tyne, Newcastle 22096.

Vee Cee Dry Cell Co. (1927), Ltd., Northwold Road, Stoke Newington, N.16. Clissold 4646.

Victor Battery Co., 15, Park Street, Islington, N.1. North 2161.

Vidor, Ltd., West Street, Erith, Kent. Erith 3080. 79, Fetter Lane, E.C.4.

Voigt Patents, Ltd., The Courts, Silverdale, Sydenham, London, S.E.26. Sydenham 6666.

V.G. Mfg. Co., Ltd., Gorst Road, Park Royal, London, N.W.10. Willesden 1632.

Ward and Goldstone, Ltd., Frederick Road, Pendleton, Manchester. Pendleton 2442-6, Multum, Manchester. 5, Percy Street, London, W.1. Museum 8371. Akros, Rath, London.

Waterhouse, Ltd., F., Ashwood Street, Dudley Hill, Bradford, Yorks. Dudley Hill 300.

Watmel Wireless Co., Ltd., Imperial Works, High Street, Edgware, Middlesex, Edgware 0323.

Webb Condenser Co., Ltd., 34, Hatton Garden, London, E.C.1. Holborn 2260. Holborn 2260, London.

Webber, Ltd., R. A., 8, Old King Street, Bristol. Bristol 23668. Webber, 23668, Bristol.

Weedon's Radio Repair Service, 262, Romford Road, Forest Gate, E.7. Maryland 2479.

Wego Condenser Co., Ltd., Bideford Avenue, Perivale, Middlesex. Perivale 2477. Wegodenser.

Westinghouse Brake and Signal Co., Ltd., 82, York Road, N.1. Terminus 6432, Westinghouse, Nordo, London. Westinghouse, London.

Westinghouse Electric International Co., 2, Norfolk Street, London, W.C.2. Temple Bar 3883. Wemcoexpo, Estrand, London.

Weston Electrical Instrument Co., Ltd., Kingston By-Pass, Surbiton, Surrey. Elmbridge 6400. Pivoted, Surbiton.

Wharfedale Wireless Works, 62, Leeds Road, Bradford. Bradford 4346. Wharfdel.

Whitelegg, F., 35, Union Road, London, S.E.16. Bermondsey 1264.

Whiteley Electrical Radio Co., Ltd., Victoria Street, Mansfield, Notts. Mansfield 762-3 and 983. Whitebon, Mansfield.

Wilkins and Wright, Ltd., Utility Works, Holyhead Road, Birmingham. Northern 2974-5. Utility, Birmingham. 11, Newman Street, London, W.1. Museum 6616.

Williams and Moffat, Ltd., Ladypool Road, Sparkbrook, Birmingham. Vic. 0659. Taffom, Birmingham.

Wingrove and Rogers, Ltd., 188-9, Strand, W.C.2. Temple Bar 2244. Compounded, Estrand, London. Polar Works, Old Swan, Liverpool 13. Old Swan 1500. Components, Liverpool.

Wolsey Television, Ltd., 54, Lamb's Conduit Street, W.C.1.

Wright and Weaire, Ltd., 740, High Road, Tottenham, N.17. Tottenham 3847-8-9. Writewea, Southtot, London.

Wurlitzer Lyric Radio, Ltd., Leicester Square Chambers, Leicester Square, W.C.2. Whitehall 6864.

Young Accumulator Co. (1929), Ltd., Burlington Works, Malden Way, New Malden, Surrey. Malden 1171-2-3. Youngacc, New Malden.

Zelco, Ltd., 53, Farringdon Road, E.C.1. Holborn 2053. Zelcorad, London.

Zenith Electric Co., Ltd., Zenith Works, Villiers Road, Willesden Green, N.W.2. Willesden 4087-8. Voltaohm, Phone, London.

362 Radio Valve Co., Ltd., 324-6, Liverpool Road, Highbury, N.7. North 1853.

RADIO WHOLESALERS

Accessories (Edinburgh), Ltd., 4, Queensferry Street Lane, Edinburgh. Edinburgh 23107. Ignition.

Albion Electric Stores, Albion House, New Station Street, Leeds. Leeds 20196/8. Filaments. Albion House. 15, Toll Street, Nottingham. Nottingham 42989. 24, Nelson Street, Bradford. Bradford 10084.

Alger's Wholesale Supplies, Ltd., 46, Dock Street, Newport, Mon. Newport 4431. Alger, Newport.

Altham Radio Co., 25, Mosley Street, Manchester. Central 6427. Staportco, Manchester.

Andrews and Co., A. E., 165, Stapleton Hall Road, Stroud Green, N.4. Mountview 1958.

Appletons (Leeds), Ltd., Hanover Place, Leeds. Leeds 21694. 96, New Bridge Street, Newcastle 2. Newcastle 27651. Gramophones, Newcastle.

Atkins Electrical Appliances, Ltd., Industrial Buildings, 137, Suffolk Street, Birmingham. Midland 2478.

Attwoods (Factors), Ltd., Attwood House, Fryer Street and Long Street, Wolverhampton. Wolverhampton 21686. Attwoods 21686. Wolverhampton. Cold Pella Road, Colwyn Bay, North Wales. Colwyn Bay 2508. Atwoods 2508, Colwyn Bay. 14, Cable Street, South Castle Street, Liverpool, 1. Bank 4988. Atwoods, Liverpool. Bank 4988,

Baker and Co., Ltd., G. F., Xaltona House, Leeke Street Corner, King's Cross Road, London, W.C.1. Terminus 4302. Ocrekab, Kincross, London.

Balmford, Ltd., Walter, 116, Steelhouse Lane, Birmingham. Central 1264-5. Balmford, Birmingham. 23, Park Avenue, Shelton, Stoke-on-Trent. Stoke-on-Trent 48131.

Barker and Son, Ltd., A., 87, Anlaby Road, Hull. Hull 15089. Garage, Hull.

Baxendale and Co., Ltd., Miller Street, Manchester. Blackfriars 8282 (26 lines). Grassmarket, Edinburgh. Edinburgh 27047 (4 lines). Capel Street, Dublin. Dublin 21607 (4 lines). Hanover Street and School Lane, Liverpool. Royal 5555 (7 lines).

Beadle and Co., Ltd., T., 3-5, Castle Street, Hull. Hull 34675. 368-370, Cleethorpe Road, Grimsby. Grimsby 6737. 92, Rutland Street, Leicester. Leicester 20522. 96, Hamilton Street, Birkenhead. Birkenhead 4400. 12, Fletcher Gate, Nottingham. Nottingham 2276-7. Randal Street, Blackburn. Blackburn 4282.

Beardsall and Co., Ltd., W. E., 20, Mount Street, Manchester. Blackfriars 4255 (5 lines). Moonstone.

Beaumont and Son, Ltd., J., 36, Carliol Street, Newcastle. Newcastle 21083-4. Cycles. 28, Scotch Street, Carlisle. Carlisle 839.

Beaver Electrical Supply Co., Ltd., 5, Gt. Chapel Street, Oxford Street, W.1. Gerrard 3335-7.

Black, Ltd., Michael, 138, West George Street, Glasgow, C.2. Douglas 5900 (3 lines). Faneeka, Glasgow. 57-59, Elder Street, Edinburgh. Edinburgh 30390. 30-32, Chapel Street, Aberdeen. Aberdeen 2908.

Brand, T., 33, Frankfort Street, Plymouth. Plymouth 3181/2. Flashlamps, Plymouth.

Brown Brothers, Ltd. (allied companies Thomson and Brown Brothers, Ltd., and Brown Brothers (Ireland), Ltd.), Great Eastern Street, London, E.C.2. Bishopsgate 7654. Imbrowned, Finsquare, London. 126, George Street, Edinburgh. Edinburgh 22033. Accelerate Edinburgh. Branches: 74, Huntly Street, Aberdeen. Aberdeen 3324. Accessory. Aberdeen. 31, Adelaide Street, Belfast, Belfast 24476. Imbrowned, Belfast, 77-81, Bristol Street, Birmingham. Midland 0146. Imbrowned, Birmingham. 671, Christchurch Road, Boscombe, Bournemouth. Boscombe 2122. Vindec, Bournemouth. 93-97, Victoria Street, Bristol. Bristol 25341. Imbrowned, Bristol. 86-88, Adam Street, Cardiff. Cardiff 3904. Imbrowned, Cardiff. Cherry Orchard Road, Croydon. Croydon 4411. Vindec, Croydon. Dunlop House, Lower Abbey Street, Dublin. Dublin 45154. Imbrowned, Dublin. 80, North Lindsay Street, Dundee. Dundee 3151. Factor, Dundee. 65, Mitchell Street, Glasgow. Central 4980. Accelerate, Glasgow. Kingsway Works, Lombard Street, Hull. Central 31670. Vindec, Hull. 62, Eastgate, Inverness. Inverness 808. Accelerate, Inverness. 19-23, Grace Street, Leeds. Leeds 27351. Imbrowned, Leeds. 3-7, Colquitt Street, Liverpool. Royal 6170. Imbrowned, Liverpool. 142-4, New Cavendish Street, London (West End), W.1. Museum 1002. Submotoris, Wesdo, London. 261, 273, Deansgate, Manchester. Blackfriars 2472. Broncho, Manchester. Carliol Square, Newcastle-on-Tyne. Newcastle 20631. Distribute, Newcastle-on-Tyne. Marsh Lane, Southampton. Southampton 2181. Imbrowned, Southampton. South Henry Street, Carlisle. Carlisle 1444. Accelerate, Carlisle. Cornfield Road, Eastbourne. Eastbourne 2222. Vindec, Eastbourne. Huntingdon Street, Nottingham. Nottingham 3555. Vindec, Nottingham.

Burner Radio Electric Factors, The, 102, Wellington Street, Woolwich, London, S.E.18. Woolwich 2081-2.

Burris and Sons, Ltd., Fred, 7/16, Redcliff Street, Bristol. Bristol 23521. Horsenail, Bristol.

Cadisch and Sons, R., Red Lion Square, W.C.1. Chancery 6868. Cadisches, Holb., London. Princes Street, Ipswich. Ipswich 2253. Cadisches, Ipswich.

Capel's Wholesale Wireless Co., Ltd., Plymouth Street, Queen Street, Cardiff. Cardiff 6660-1. 3, Emlyn Street, Newport, Mon. Newport 2083.

Celtic Electric Co., 16, Wellington Quay, Dublin, C.4. Dublin 22876.

Chorlton Metal Co., Ltd., Millgate House, 55, Blossom Street, Manchester. Central 7461-2, Chorlmet, Manchester 4.

Churchmans, Ltd., 79, Maidenhurgh Street, and 7, 8 and 14, George Street, Colchester. Colchester 2831 and 3531. Wood Street, Peterborough. Peterborough 3095. 23, St. Helen's Street, Ipswich. Ipswich 4191.

Clarke Bros. (Leicester), Ltd., Victoria House, off London Road, Leicester. Leicester 20891 (4 lines).

Clarkson, H., 49, Pedder Street, Morecambe. Morecambe 44. 97, Cavendish Street, Barrow-in-Furness. Barrow-in-Furness 725. Back, 76, Caunce Street, Blackpool. Blackpool 1292.

Cleave (Radio), Ltd., H. R., 125, St. Thomas Street, Bristol. Bristol 23452. Eclipse, Bristol. 55, Cornwall Street, Birmingham. Central 1691. Station Road, Plymouth. Plymouth 2641.

Coates, Ltd., J. G., King's Mill, Bridge Street, Burnley, Lancs. Burnley 2295. Coates, Ltd., Burnley.

Cohen, Ltd., S. W., 7-15, King Street, Glasgow, C.1. Bell 212. Violins, Glasgow.

Coleman and Co., A. J., 37-44, The Arcade, Northampton. Northampton 905.

Cullums, Ltd., John, 4, Cullum Street, E.C.3. Mansion House 0128. Franksurum, Fen.

Currys, Ltd., Gt. West Road, Brentford, Middx. Ealing 1681. Currifacts, Phone, London.

Cuthbertson and Co., Ltd., 11, West Nile Street, Glasgow, C.1. Central 1687.

Dallas and Sons, Ltd., John E., Dallas Building, Ridgmount Street, Tottenham Court Road, W.C.1. Museum 6351.

Davies, Brickwood and Davies, Ltd., 38, St. Thomas Street, Bristol. Bristol 24337. Service, Bristol.

WHOLESALERS' SECTION

Daws, Clarke and Co., 23, The Avenue, Bedford Park, W.4. Chiswick 0368.
Dew and Co., Ltd., A. J., 32/34, Rathbone Place, W.1. Museum 8686. Dewmofac, London.
Dibben, Ltd., H., 34, Carlton Crescent, Southampton. Southampton 3171. Kilocycle, Southampton.
Dibben and Sons, Ltd., W., 80, St. Mary's Road, Southampton. Southampton 3141 (6 lines).
Downes and Davies, 1/9, Stanley Street, Liverpool. Bank 5760 (8 lines). Utis, Liverpool. 3A, Norfolk Street, Pall Mall, Manchester. City 8846/7. Paternoster Row, Carlisle. Carlisle 631. 94, Chester Street, Birkenhead. Birkenhead 4340.
Drake and Gorham, Wholesale, Ltd., 77, Long Acre, London, W.C.2. Temple Bar 3993/4/5. Dragorlite, Rand, London. 29, Piccadilly, Manchester. Central 4701. Accumulator, Manchester. 51, Waterloo Street, Glasgow. Central 1903. Accumulator, Glasgow. 35, Broad Street, Bristol. Bristol 23509. Dragorlite, Bristol. 24, Marlborough Place, Brighton. Brighton 3886. 2, Church Lane, College Green, Dublin. Dublin 22672. Accumulator, Dublin.
Drury Radio Co., Ltd., 23, Water Street, Liverpool. Central 2240. 9, Brooklands Avenue. Broughton Preston. Preston 7414. 2, Conwy Street, Rhyl. Rhyl 131. 58, Norlands Lane, Widnes. Widnes 13.
Dulcetto-Polyphon, Ltd., 2/3, Newman Street, W.1. Museum 4201. Dulcetpoly, London. 27, Jamaica Street, Glasgow. Central 8445-6. Dulcetpoly, Glasgow. 31, Quay Street, Manchester. Blackfriars 5006-7. Dulcetpoly. Jubilee House, 152-8, Westgate Road, Newcastle-on-Tyne. Newcastle 25661-2, Dulcetpoly, Newcastle-on-Tyne. 45, London Road, Southampton. Southampton 6561-2. Dulcetpoly, Southampton.
Duwes Ltd., 12 Hilton Street, Manchester. Central 5266. Diagram, Manchester.
Dyson and Co., Ltd., J., 5-7, Godwin Street, Bradford. Bradford 6037. Equipment, Bradford. 2, Coleman Street, London, E.C.2, Metropolitan 7988. Londepot, Ave, London. 6, Albion Street, Hull. Hull 35693. 33, Pilcher Gate, Nottingham. Nottingham 42327-8. 47, Winchester Street, Salisbury. Salisbury 1163. 170, Corporation Street, Preston. Preston 2926.
East London Rubber Co., Ltd., 29/33, Great Eastern Street, E.C.2. Bishopsgate 4321. Akerene, Phone, London. Kerry House, Furnival Street, Sheffield. Brunswick Street, West Hove. Falcon Street, Ipswich. Highcross Street, Leicester. 468, London Road, Croydon. 157, Foregate Street, Chester. 89, Broad Street, Canterbury. 60, Regents Street, Cambridge. 3, Ship Street, Oxford.
Eastick, J. J., and Sons, 118, Bunhill Row, E.C.1. Metropolitan 0314/5/6. 9, Library Place, Jersey. Commercial House, Commercial Place, Commercial Road, Portsmouth. 10-11, St. Helen's Place, Swansea. 23, Westwick Street, Norwich. 3, Leigh Road, Leigh-on-Sea, Essex. 23, Sydenham Road, Guildford, Surrey.
Ecco Radio, Ltd., Ecco House, Princess Street, St. John's Wood, N.W.8; 55, St. Clements. Oxford. 23A, Palmerston Road, Boscombe, Bournemouth. Paddington 6735 and 8373, Oxford 3397 and Boscombe 1958. 7A, Broad Street, Canterbury. Canterbury 920. Eccoradim, Padd., London.
Edinburgh Rubber Co., 178/182, Rose Street, Edinburgh. Edinburgh 27168. Insertion, Edinburgh 2.
Elrco (W.), Ltd., 29, Wellington Place and 28-30, College Street, Belfast. Belfast 26406. Elrco, Belfast. 9, Strand Road, Londonderry. Londonderry 812.
Electric Radio (Bristol), Ltd., 38, St. Thomas Street, Bristol. Bristol 24337.
Electrical Components, Ltd., Gt. Charles Street and 102, Snow Hill, Birmingham, 4. Central 3081. Clip, Birmingham. 71, Victoria Street, Bristol. Bristol 25526. 31, Hythe Bridge Street, Oxford. Oxford 4481. 35, The Wicker, Sheffield. Sheffield 22242. 45, Leeds Road, Bradford. Bradford 8744. 19, Dale Street, Liverpool. Bank 8800. 3, Greek Street, Manchester. Blackfriars 3692. 9, Campbell Street, Leicester. Leicester 5514. 117, Castlegate, Huddersfield. Huddersfield 4074. 38, Eastbank Street, Southport. Southport 2864. 48, Stoke Road, Shelton. Hanley 4535. 1, Deansgate, Blackpool. Blackpool 1549. 67, St. Benedict's, Norwich. Norwich 2243. 28, Queen's Street, Rhyl. Rhyl 834. 17, Sea Road, Boscombe. Boscombe 355-6. 3, Norton Street, Middlesbrough. Middlesbrough 3134. 33, Carlton Crescent, Southampton. Southampton 3715. 53, Regent Street, Brighton. Brighton 6969. Parliament Street, Gloucester. Gloucester 2202. St. Mary Street, Lincoln. Lincoln 1644.
Electrical and General Distributors, Ltd., 9, Southampton Street, London, W.C.1. Chancery 7541-2. Elektangen, Kincross, London.
Electrical Ohms, Ltd., 6, Bridge Street, Glasgow South 328.
Ellis and Mort, Ltd., 90/96, Topping Street, Blackpool. Blackpool 3426/7. 134A, Western Road, Brighton. Brighton 5721-2. 207, Corporation Street, Preston. Preston 3354.
E. G. S. Co., Ltd., 10/12, Trafalgar Street, Newcastle-on-Tyne. Central 23004/5. Volta. Gt. George Street and Woodhouse Lane, Leeds. Leeds 29584/5. Voltage. 18-26, Constitution Hill, Birmingham. Central 3855/6. Voltac.
Factors (Nottm.), Ltd., Woodland Place, Nottingham. Nottingham 40249. Facta, Nottingham.

Factors (Oxford), Ltd., Gloucester Street, Oxford. Oxford 3259.
Falk Stadelmann and Co., Ltd., 83-93, Farringdon Road, E.C.1. Holborn 7654. Lamps, London. Veritas House, Clyde Street, Glasgow C.1. Central 9494. Veritas House, Rochdale Road, Manchester 4. Deansgate 3351. Veritas House, 81-84, Lionel Street, Birmingham. Central 8031-3. Effesco, Veritas House, 3-11, Prudhoe Street, Newcastle-on-Tyne 2. Newcastle 22483-4. Veritas House, 85-86, Frederick Street, Cardiff. Cardiff 5757. Veritas House, 15-19, New Station Street, Leeds. Leeds 29741. Efesca House, Exchequer Street, Dublin. Dublin 21694-5. 47, Dale Street, Liverpool. Bank 4223. Telegraphic address in each case: Trilux, except Birmingham.
Faudels, Ltd., 36-40, Newgate Street, E.C.1. City 5010. Market Lane, Pilgrim Street, Newcastle-on-Tyne. Cooper Buildings, Church Street, Liverpool.
Flinders (Wholesale), Ltd., 14-20, St. Peters Street, Ipswich. Ipswich 3781-2. Hay Hill, Haymarket, Norwich. Norwich 3506. 91, Regent Street, Cambridge. Cambridge 2554. Tanners Lane, High Street, Lincoln. Lincoln 1424. East Stockwell Street, Colchester. Colchester 3178.
Flitton Bros., East Road, Cambridge. Cambridge 4441. 8, Redwell Street, Norwich. Norwich 4441-2.
Franks (Wholesale), Ltd., A., 3, South King Street, Manchester. Blackfriars 7960. Ukanhear, Manchester.
Furse Wholesale, Ltd., Traffic Street, Nottingham. Nottingham 8213/4/5. Elecshow, Nottingham. 13, Derby Road, Nottingham. Nottingham 43724. Elecshow, Nottingham. Victoria Buildings, 1, London Road, Derby. Derby 3297-8. Furse, 3297-8 Derby. 19, Newarke Street, Leicester. Leicester 20562.
Gilbert and Co., Ltd., C., Arundel Street, Sheffield. Sheffield 25032. Gilrad, Sheffield. 23, South Street, Hull. Gilrad, Hull. 30, St. Mary's Place, Newcastle-on-Tyne. 37, Pall Mall. Hanley, Stoke-on-Trent. 174, Cleethorpe Road, Grimsby. 9, Venn Street, Huddersfield. 10, Gillygate, York. 22, Derby Road, Nottingham. 44, Wilson Street, Middlesbrough. 12-14, Bank Street, Bolton.
Gladwell, Ltd., A. E., 57, High Street, Falmouth. Falmouth 478.
Gledson and Co., Ltd., J., 48/50, Blackett Street, Newcastle - on - Tyne. Newcastle 24137/8/9. Radiate, Newcastle-on-Tyne. 7, Tubwell Row, Darlington. Darlington 3026.
Glickson and Co., 174, High Street, Swansea. Swansea 3749.
Golding, H. J., 138A, Plough Road, Clapham Junction S.W.11. Battersea 1883 (2 lines).
Gothic Electrical Supplies, Ltd., 23-25, Constitution Hill, Birmingham, 19. Central 5531. Gothicelec.
Grafton Electric Co., 54, Grafton Street, Tottenham Court Road, W.1. Museum 0241.
Gratrix, Junr., and Bro., Ltd., S., Alport Works, Quay Street, Deansgate, Manchester. 3. Blackfriars 6601. Lead, Manchester.
Great Eastern Rubber Co., Ltd., 31, Norton Folgate, E.1. Bishopsgate 1807.
Greatrex and Co., R. G., Ballards Works, 123-125, High Street, Edgware. Edgware 2813.
Gripton and Co., Corner High Street and Lombard Street, West Bromwich. Staffordshire 0438.

Hallamshire Electric Co., Ltd., 11-15, Matilda Street, Moorhead, Sheffield. Sheffield 20157.
Hardman and Co., Ltd., The Baum, Rochdale. Rochdale 4151 (3 lines). Harco, Rochdale. 6, Park Place, Leeds. Leeds 23482.
Harper and Co., W., 93-99, Holm Street, Glasgow, C.2. Central 3882. Immediate, Glasgow.
Harris and Russell, Ltd., 91, Tottenham Court Road, W.1. Museum 6061. 4, Blagrave Street, Reading. Reading 2884. 15, Miller's Buildings, Hampshire Terrace, Portsmouth. Portsmouth 4997.
Harveyson and Co.. E. R., 27, Hendon Lane, Finchley, London, N.3. Finchley 3352-3. 115, Bute Street, Treherbert. Glam. Treherbert 49. 26, Edwards Terrace, Cardiff. Cardiff 4716.
Harwol Specialities Co., Ltd., 11, Strand Street, Liverpool. Bank 9249. Harwol, Liverpool.
Haslam and Stretton (E. and M.U.), Ltd., 75, Victoria Street, Bristol. Bristol 23690. Thor, Bristol.
Hastings, Factors, Ltd., Clegg Street, Hastings. Hastings 2865-6. Factors, Hastings.
Hathaway and Co., Ltd., S., 287, Edge Lane, Liverpool. Anfield 843.
Hawnt and Co., Ltd., 59, Moor Street, Birmingham 4. Central 3661.
Hayward and Son, C., 20-46, New Street, Ashford, Kent. Ashford 334. Hayward, Wireless, Ashfords Wholesale.
Henderson Electrical and Radio, Ltd., Electric House, Queen's Road, Brighton. Brighton 5704-5. Vale Hall, Vale Road, Tunbridge Wells. 109, Chapel Road, Worthing. 12, Grove Road, Eastbourne. 1, Soho Square, W.1.
Heys, Leonard, Faraday House, Henry Street, Blackpool. Blackpool 1894. Saxon, 1894, Blackpool.
Hillman Bros., Ltd., 123/5, Albion Street, Leeds. Leeds 29574-6. Aerial, Leeds.
Hindleys Wholesale, Ltd., Maypole Yard, Nottingham. Nottingham 43672.
Hirst Bros. and Co., Ltd., 57, Roscoe Street, Oldham, Lancs. Main (Oldham) 3671.
Hirst, Ibbetson and Taylor, Ltd., 9, Blackfriars Street, Manchester. Blackfriars 9381 (6 lines), Beforehand, Manchester. 68, Topping Street, Blackpool. Blackpool 3830. 12-14, Bridge Street, Burnley. Burnley 2283. 5, Gt. John Street, Lancaster. Lancaster 966. Ediswan House, 46, Paradise Street, Liverpool. Bank 5427. 15, Bay View Road, Colwyn Bay. Colwyn Bay 2248.
Hobday Bros., Ltd., 21/27, Gt. Eastern Street, E.C.2. Bishopsgate 4343. Yadboh, Bath, London. 16/20, Turner Street, Manchester. Central 7020. Yadboh, Manchester. 32/3, Cleveland Road, Wolverhampton. Wolverhampton 21602. Yadboh, Wolverhampton.
Hogan Bros., Ltd., 36, Lordship Lane, S.E.22. New Cross 1872.
Hollingdrake and Son, Ltd., H., Princes Street, Stockport. Stockport 4801-6. Hollingdrake, Phone, Stockport.
Houghtons, The Wholesalers, 88/9, High Holborn, W.C.1. Holborn 6900. Bromide, Phone. 76/78, York Street, Glasgow. Central 4665-6. Houghton's, Glasgow. 10, Nelson Street, Swansea. Swansea 4163. 3, Freeman Street, Moor Street, Birmingham. Midland 2695. 38A, Queen Street, Belfast. Belfast 20656. 10, Best Lane, Canterbury. Canterbury 999. 18-19, Hills Terrace, Cardiff. Cardiff 641.
Hulme and Co., E., 93A, Station Street, Birmingham. Midland 1263. Hulco, Birmingham.
Imp Radio Co., 202, Earlshall Road, Eltham Park, S.E.9. Eltham 2465. Eltham 2465.
Inman D., Nile Street, Lancaster. Lancaster 323. 92, Arundel Street, Sheffield. Sheffield 22147.
Irvine and Co., Ltd., J. F., Caird Hall, Dundee. Dundee 2853. Irvine, Cairdhall.

Johnson, Burton and Theobald, Ltd., 31, St. Peter's Street, Norwich. Norwich 1898. Factors, Norwich.
Jones and Co., A., Norton Street, Middlesbrough. Middlesbrough 3223. Radium. 24, Bedford Street, Sunderland. Sunderland 2516.
Kay, Ltd., Philip, 1, Old Church Lane, N.W.9. Colindale 8266.
Keates and Co. (Radio), Ltd., 91-3, Bishopsgate. E.C.2. London Wall 4710. Blastpipes, London.
Keith Prowse and Co., Ltd., 159, New Bond Street, W.1. Regent 6000. Stalls, Wesdo, London.
Kettle, H. E., Ltd., Knightrider Street, Maidstone. Maidstone 2206-7.
Lawrence, P. H., 38, Market Street, Tamworth, Staffs. Tamworth 330.
Lawrie and Co., Adelaide House, 2, Albert Road, Bournemouth. Bournemouth 5573.

WHOLESALERS' SECTION.

Leonard and Co., V., 40, Queen Street, Belfast. Belfast 24283.

Leslie Dixon Switchgear Co., 218, Upper Thames Street, E.C.4. Central 4611. Electradix Cent, London.

London Commercial Electrical Stores, Ltd., 13, Farringdon Avenue, London, E.C.4. Central 9471-2. Galvorite, London.

London Electrical Co. (Sherborne Lane), Ltd., 1, Sherborne Lane, King William Street. London, E.C.4. Mansion House 6201-3, Electa, Phone, London. 35, Arch, Great Suffolk Street, London, S.E.1.

London and Provincial Factors, Ltd., 146, Theobalds Road, London, W.C.1. Holborn 3251. Wanieblade, Holb, London. 16, Withy Grove, Manchester Blackfriars 4054.

London Radio Co. (Leeds), Ltd., 26, Queen's Arcade, Leeds. Leeds 24928. 41, The Headrow, Leeds.

Lugton and Co., Ltd., 203, Old Street, London, E.C.1. Clerkenwell 0257-9. Maxitone, Finsquare, London. 161, Howard Street, Glasgow. Central 5602.

Lyons, Ltd., Claude, 76, Oldhall Street, Liverpool, 3. Central 4641. Minmetkem, Liverpool. 40, Buckingham Gate, S.W.1. Victoria 3068. Minmetkem, Sowest, London.

L.E.S. Distributors, Ltd., 15/16, Alfred Place, London, W.C.1. Museum 5713.

Manufacturers' Accessories Co. (1928), Ltd., 85, Gt. Eastern Street, E.C.2. Bishopsgate 3511-2-3. Dogeate, Finsquare, London.

Markham and Co., W., 3, Campbell Street, Leicester. Leicester 21558. 44, Broad Street, Hanley, Staffs. Hanley 29469.

Mason and Collins, Ltd., A. G., 309, Gray's Inn Road, London, W.C.1. Terminus 4438.

Metal Agencies Co., Ltd., Queen Square, Bristol. Bristol 21061. Themac, Bristol. "Russells," Colston Street, Bristol. Bristol 10040. Alma, Bristol.

Metropolitan Distribution, Ltd., Trewirgie Vean, Falmouth Road, Redruth, Cornwall. Redruth 286.

Midland Auto Components (Props., E & H. P. Smith, Ltd.), 58, Cambridge Street, Birmingham. Midland 0181 (5 lines). Replace, Birmingham. 169-171, High Road, Willesden, N.W.10. Willesden 5001. 1, King Street, Gloucester. Gloucester 3589. 39, Cow Lane, Coventry. Coventry 3648.

Midland Wireless Co., 32, The Broadway, Bedford. Bedford 2590.

Moores and Co., J., King's Works, Ravald Street, Blackfriars Road, Salford, 3. Blackfriars 7618.

Morton, W. A., 71-73, Surrey Street, Sheffield. Central 25131 (2 lines). Morton, Sheffield 25131. 16, Tudor Street, Sheffield.

Murdoch Trading Co., 59/61, Clerkenwell Road, London, E.C.1. Clerkenwell 6144. Putiel-Smith, London. 46, Holloway Head, Birmingham. 55, Charles Street, Cardiff. 87, Maxwell Street, Glasgow. 30, High Bridge, Newcastle-on-Tyne. Meadow Road, Salisbury.

Needham and Brother, Ltd., C. E., Townhead Street, Sheffield. Sheffield 21011 (5 lines). Pumps, Sheffield.

Newcastle General Supply Co., Ltd., 10, Leages Park Road, Newcastle-on-Tyne. Newcastle-on-Tyne 23177.

Newcombe and Co., Ltd., F. D., 39/40, North Street, Exeter. Exeter 4116. Avenue Lane, The Square, Bournemouth. Bournemouth 4737.

North British Machine Co., Ltd., 200-14, Clyde Street, Glasgow, C.1. Central 3373. Cycles, Glasgow.

Northern Factors, Ltd., Crescent House, Crescent Road, Middlesbrough. Linthorpe 8271/2. Mocessory, Middlesbrough.

Northern Steel and Hardware Co., Ltd., Northern House, 7, Gartside Street, Manchester. Blackfriars 3871. Assiduous, Manchester. Stores, 23, Larkhill, Blackburn. Blackburn 5833.

Nottingham Radio Supplies, Ltd., Sherwood Buildings, Sherwood Street, Nottingham. Nottingham 44351/2.

Ormrod and Co., Ltd., A., Wigan. Wigan 3780.

Palmer, Riley, and Co., Ltd., 90-2, Abbey Street, Accrington. Accrington 2161. Export, Acorington. 36, King Street, Blackburn.

Philco Cheshire and North Wales Co., 136, Foregate Street, Chester. Chester 2275. Cyclaxe, Chester.

Philco Midland Distributors, Ltd., 85, Station Street, Birmingham 5. Midland 0102.

Price and Co. (Manchester), Ltd., 78-78A, Tib Street, Manchester. Deansgate 5242. Amelan, Manchester.

Priestley and Ford, 3/11, Carrs Lane, Birmingham. Midland 4941. Peeanef, Birmingham. 59, Friar Lane, Nottingham. Nottingham 40326. Peeanef, Nottingham. 21, Bridge Street and 18, King Street, West, Manchester. Blackfriars 9157. Peeanef, Manchester.

Provincial Incandescent Fittings Co., Ltd. (Pifco, Ltd.), Pifco House, 1, Watling Street, Manchester. City 0381 and 4044. Provencal, Manchester. 150, Charing Cross Road, London W.C.1. Temple Bar 3720. Pifco, Westcent., London.

Radio Supply Co., Wood Street, Northampton. Northampton 1494. Industries House, Queen Street, Peterborough. Peterborough 2146. 1, Waterloo Street, Swansea. Swansea 4871. 41, Albion Street, Leicester. Leicester 22860.

Radio Trading Co., Service House, 309, Old Street, London, E.C.1. Clerkenwell 0255 and 3940. Tradeonli, Finsquare, London.

Regent Fittings Co., 120, Old Street, London, E.C.1.

Renshaw Radio Manufacturing Co., 55, Renshaw Street, Liverpool. Royal 1880. Erw Wen Road, Colwyn Bay, North Wales. Colwyn Bay 2463.

Richardsons (R.M.L.), Ltd., 24, Park Lane, Liverpool. Bank 5443/4. Trutone, Liverpool. 24, St. John Street, Deansgate, Manchester. Blackfriars 6477/8. Trutone, Manchester.

Riddiough and Son, F., Lee Street, Thornton Road, Bradford, Yorks. Bradford 8777/8. Challenger, Bradford.

Roberts (Manchester), Ltd., John, 1/3, Bridgwater Viaduct, Knott Mill, Manchester. Blackfriars 1837/8.

Robertshaw and Co., Ltd., E., 20, Canal Road, Bradford. Bradford 4502.

Robertson, J., 95, West Nile Street, Glasgow. Douglas 4040. Exhaust, Glasgow.

Robinson, and Son, Ltd., George, River Plate House, South Place, London, E.C.2. Metropolitan 5886/8. Ancomac, Ave., London. 12, Percy Street, London, W.1. Museum 2178. 7, Marton Road, Middlesbrough. Middlesbrough 2141. Parcrosted, Middlesbrough.

Robinson and Hands Electric Co., Ltd., 54/6, Barwick Street, Birmingham. Branches: Lincoln, Stoke and Taunton. Central 8131/3. Rewind, Birmingham.

Rose, Morris, and Co., Ltd., 57, City Road, London, E.C.1. Clerkenwell 5377.

Ross and Adam, 68, Gordon Street, Glasgow. Central 849. Hedros, Glasgow.

Runwell Cycle Co. (Birmingham), Ltd., Lawson Street, Birmingham, 4. Aston Cross 0752. Runwell. 16, Great Eastern Street, London. E.C.2. Bishopsgate 1320. Cycorunel, London Camp Street. Deansgate, Manchester. Blackfriars 8352/3. Runwell, Manchester. 48, Duke Street, Liverpool. Royal 4725. Runwell, Liverpool. 101, Temple Street, Bristol. Bristol 21695. Runwell, Bristol. 5, Carver Street, Sheffield. Sheffield 23995. Runwell, Sheffield. Rose Lane Works, Norwich. Norwich 2042. Runwell, Norwich. 68, Bridge Street, Cardiff. Cardiff 4732. Runwell, Cardiff. 17, Crown Street, Ipswich. Ipswich 3808. Runwell, Ipswich. 111, Howard Street, Glasgow, C.1. Central 2826. 36, Wind Street, Swansea. Swansea 5428. 37, Lichfield Street, Wolverhampton. Wolverhampton 20064.

Sanger and Son, M., 31/31A, King Street Plymouth. Plymouth 3471. 19-22, Mitchell Lane, Victoria Street, Bristol. Bristol 23070. 6, Whitehall, Taunton. Taunton 2067.
Selecta Gramophones, Ltd., 81, Southwark Street, S.E.1. Waterloo 6671. Floradom, Boroh, London.
Sellers of Leeds, Ltd., 33, Park Place, Leeds. Leeds 31146 (3 lines). Orion, Leeds. 25, Glovers Court, Preston. Preston 4433. Selradio, Preston. 106, George Street, Hull. Central 34000. Selradio, Hull.
Sheffield Radio and Electric Co., 39, Eyre Street, Sheffield 1. Sheffield 26121.
Shemelds, Ltd., 17, College Street, Belfast, N. Ireland. Belfast 2336.
Siemens-Schuckert (Great Britain), Ltd., 30/34, New Bridge Street, London, E.C.4. Central 8461/3. Wernerwerk, Lud, London.
Silcocks Bros., 50, Victoria Street, Bristol 1. Bristol 25263. Silcocks Bristol 25263.
Simpson, Baker and Co., Ltd., 2/5, Nelson Street, Bristol. And at London and Birmingham.
Sinclair J. Corston and Co. (Newcastle), Ltd., 2, St. Nicholas Buildings, Newcastle-on-Tyne 1, Newcastle 22515/6. Rubelpac. Newcastle-on-Tyne.
Sloan Electrical Co., Ltd., Slonetric House, 54-5, Fetter Lane, E.C.4. Central 5200. Slonetric, Fleet, London. 17a, Nicholas Street, Manchester. Central 3088. Slonetric, Manchester. 79, Hanover Street, Edinburgh. East Central 30041. Slonetric, Edinburgh. 44, Victoria Street, Bristol. Bristol 23426. Slonetric, Bristol. 32/3, Gandy Street, Exeter. Exeter 4106. Slonetric, Exeter. 58, Uxbridge Road, W.5. Ealing 4592. Slonetric, Ealing. 1, Plymouth Street, Cardiff. Cardiff 791. Slonetric, Cardiff.
Smith Bros (Caerconan), Wholesale, Ltd., 5, Market Road, Doncaster. Doncaster 1316.
Smith and Cookson, 22, Paradise Street, Liverpool, 1. Bank 3525/6.
South Wales Wireless Installation Co., Ltd. 21/22, Edward Terrace, Cardiff. Cardiff 2636/7. Electron.
Stockall, Marples and Co., Ltd., 6/10, Clerkenwell Road, London, E.C.1. Clerkenwell 2781 (4 lines). 64, Bridge Street, Deansgate, Manchester.
Stubbs, C. P., 69a, Mansfield Road, Nottingham. Nottingham 2903. Stubbs 2903. Nottingham.
Sun Electrical Co., Ltd., 118/20, Charing Cross Road, W.C.2. Temple Bar 3500. Sunelec, Westcent, London. 48/50, Park Place, Leeds 1. Leeds 28511/2. Sunelec, Leeds. Sunco House, Carliol Square, Newcastle-on-Tyne 1. Newcastle-on-Tyne 20525. Sunelec, Newcastle-on-Tyne. 137, Victoria Street, Bristol 1. Bristol 22667. Sunco, Bristol. Kings Road, Guernsey, C.I. Guernsey 1664. Sunco, Guernsey.
Superlamp, Ltd., 6, Paul Street, London, E.C.2. Bishopsgate 8371. Superlamp, Finsquare, London. 24a, High Street, Charing Cross Road, W.C.2. Temple Bar 2504. 223, Hammersmith Road, London, W.6. Riverside 2254. 6, Bond Street, Ealing. Ealing 0938. 143, New Cross Road, London, S.E.14. New Cross 3677. 10A, Sunnyhill Road, Streatham, London, S.W. Streatham 3073. 805, High Road, Leyton, London, E. Leytonstone 2202. 62, Turnpike Lane, Hornsey, London, N. Bowes Park 1317. 38, Gloucester Road, Brighton. Brighton 4904. 11/3, Union Street, Maidstone. Maidstone 3033. 14, Market Street, Worthing. Worthing 735. 21, Queen's Road, Southend-on-Sea. Southend-on-Sea 3287. 91, Tabernacle Street, E.C.2. Clerkenwell 0234. 82, Queen's Road, Watford. Watford 5383.

Taylor and Son, F., Upperhead Mills, Huddersfield. Huddersfield 3647.
Taylor, H. S., Roper Street, Whitehaven, Whitehaven 390. Taylor, Factor, Whitehaven. 110, Stricklandgate, Kendal. Kendal 690.
Taylor and Co., J. H., Macaulay Street, Huddersfield. Huddersfield 341. Thorough, Huddersfield.
Thibouville-Lamy and Co., J., 10 and 12, Charterhouse Street, E.C.1. Holborn 5042. Tibouvil, London.
Thompson, Diamond and Butcher, 34, Farringdon Road, E.C.1. Clerkenwell 5492 (8 lines). Thomdibu, London. 351, Commercial Road, Portsmouth. Portsmouth 73832. Thomdibu, Portsmouth. 104, Bath Street, Glasgow, C.2. Douglas 1223. Thomdibu, Glasgow.
Thomson and Brown Brothers, Ltd. See Brown Brothers, Ltd.

Wall and Attwooll, Ltd., 47/49, Craswell Street, Portsmouth. Portsmouth 2031. Wanda, Portsmouth.
Warner and Son, Ltd., A., 201-7, Forest Road, Walthamstow, E.17. Larkswood 1181. Acsmart, London.
Watson Bros., 40, Dock Street, Newport, Mon. Newport 2741.
Watson's, 10, High Bridge, Newcastle-on-Tyne Newcastle-on-Tyne 25225.
Webber and Co., Ltd., J. M., Weblite House, 39, Gt. Eastern Street, E.C.2. Bishopsgate 1667. Weblite, Finsquare, London.
Whiteford and Co., J., 5, Oswald Street, Glasgow, C.1.
Wholesale Fittings Co., Ltd., 25, Commercial Street, E.1. Avenue 5828 and 9142. Calottes Edo, London. 142, King Street, Hammersmith, W.6. 9, Station Parade, Balham, S.W.12. 63-5, Newington Butts, S.E.11. 101, Dean Street, W.1. 78-80, High Street, Manchester 4. 83, Victoria Street, Bristol, 1.
Wildbores Radio, Ltd., 68, Yorkshire Street, Oldham, Lancs. Oldham Main 4939.
Wilkinson, L., Electric- House, 204, Lower Addiscombe Road, Croydon. Addiscombe 2027.
Wilkinson Radio and Musical, Ltd., 176, Ingram Street, Glasgow, C.1. Bell 2167. Accordeon, Glasgow.
Wireless-Electric (Wholesale), Ltd., 23/24, North Street, Bristol 1. Bristol 24505. 79B, Holdenhurst Road, Bournemouth, Bournemouth 2882.
Wood, E. A., 100, Aston Road, Birmingham. Aston Cross 2595/6. 105/7, John Bright Street, Birmingham. Midland 4334/5. Crutches, Birmingham. Eltic House, 61, Belgrave Gate, Leicester. Leicester 58178. Wood, Leicester 58178. 77, Gallowgate, near Glasgow Cross. Glasgow Bell 2304.
Wood, L. R., Bridge Street, Cork, I.F.S. Cork 1581. 16, Duke Street, Dublin. Dublin 44479.
Wood and Cairns, Ltd., 11, Queen Street, Edinburgh. Edinburgh 25237-8-9. Hillwood. 7 and 9, King Street, Dundee. 30-32, Cadogan Street, Glasgow, C.2.
Woodhall and Partners (1929), Ltd., Swansea. Swansea 2901. Equipment.
Woolfson, Ltd., P., 33, Cadogan Street, Glasgow, C.2. Central 4036. Radwest, Glasgow. 24, Ellison Place, Newcastle-on-Tyne. Newcastle-on-Tyne 20410. 9, George IV Bridge, Edinburgh. Edinburgh 26747.

Yevrah Electric Co. (Y.E.C.), 37, Union Street, London, S.E.1. Hop 2568.
Young and Wildsmith, Ltd., 35, Little Russell Street, W.C.1. Museum 7057 (4 lines). 17, The Oracle, Minster Street, Reading. Reading 2072. 49a, York Road, Ilford. Ilford 2691.

Zelco, Ltd., 53, Farringdon Road, London, E.C.1. Holborn 2053. Zelcorad, London.
Z. Electric Lamp and Supplies Co., Ltd., 21, Newman Street, London, W.1. Museum 7842 (5 lines). Zedellam, Phone, London. 126, Edmund Street, Birmingham. Central 7977/8. 62, Dingwall Road, Croydon. Croydon 4131/2. 157A, St. Vincent Street, Glasgow. Central 3360. 24, St. Mary's Parsonage, Manchester. Blackfriars 0915/6. 15, Lisle Street, Northumberland Street, Newcastle-on-Tyne. Newcastle 26789. 48, Friar Lane, Nottingham. Nottingham 2838. 55, Stafford Street, Derby. Derby 1985.

TRADE NAMES DIRECTORY

Inclusion of a trade name in this section of the directory does not necessarily mean the name is registered.

Ace.—John E. Dallas and Sons, Ltd. Gramophone.
Acfil Pump.—E. M. Francis, Ltd. Acid pump for accumulators.
Acme.—McLeod and McLeod. Instrument wire, insulating cloth and paper.
Ad-a-Gram.—Cosmocord, Ltd. Playing desks.
Adaband.—British Television Supplies, Ltd. Short wave adaptors.
Adaptagram.—Peto Scott Co., Ltd. Radiogram cabinet complete to take kit sets.
Adey.—Adey Portable Radio. General trade mark.
Aerialite.—Aerialite, Ltd. General trade mark.
Aerialite Levenstrand.—Aerialite, Ltd. Eleven strand insulated aerial wire.
Aermonic.—Jas. Christie and Sons, Ltd. Components.
Aerodyne.—Aerodyne Radio, Ltd. General trade mark.
Aeroficient.—Graham Farish, Ltd. Fans.
Agro.—T.M.C. Harwell (Sales), Ltd. Transformers, bells and accessories.
Airmax.—J. Dyson and Co. (Wks.), Ltd. Plug-in and 6-pin coils.
Airtune.—Varley. L.F. transformers with air di-electric trimmers.
Akoostex.—Ashton and Co. (Est. 1787), Ltd. Silk gauze.
Akrite.—Ward and Goldstone, Ltd. Aerial wire.
Akros.—Ward and Goldstone, Ltd. Circular flexible cord and insulating tape.
Alba.—A. J. Balcombe, Ltd. General trade mark.
Albemarle.—H. B. Hicking. General trade mark.
Alembic.—J. Millet. Crystal, meter, switch, headphones and speaker.
All-Steel.—Ward and Goldstone, Ltd. Display stand for radio conductors.
Allvalve.—Radiometers, Ltd. Valve tester.
Allwave.—Ward and Goldstone, Ltd. H.F. choke.
Alpha.—Reproducers and Amplifiers, Ltd. P.M. M.C. speaker.
Altham.—Altham Radio Co. General trade mark.
Altham Copparite.—Altham Radio Co. Wire.
Alto.—Daws, Clarke and Co. Cutters for fibre needles.
Ambassador.—Ambassador Radio Gramophones. General trade mark.
Amplion.—Amplion (1932), Ltd. General trade mark.
Amsocite.—Siemens Elec. Lamps and Supplies, Ltd. Composite insulating material.
Ancalite.—Callender's Cable and Construction Co., Ltd. Electric cable.
Ankaflex.—Callender's Cable and Construction Co., Ltd. Unkinkable flexible cord.
Anodex.—S. Smith and Sons (M.A.), Ltd. Dry batteries.
Antistatic.—Anti-Static Installation, Ltd. General trade mark.
Ardente.—Ardente Acoustic Laboratories. Sound amplification equipment and group hearing aids.
Ardwick.—Runbaken Magneto Co., Ltd. Battery chargers.
Arrow.—Claude Lyons, Ltd. QMB radio switches.
Ashton.—Aerialite, Ltd. Wires and cables.
Ashton.—Ashton's Wireless Depot. General trade mark.
Ash.—Ellison Insulations, Ltd. Insulating and constructional material.
Athco.—A. T. Harrison and Co. Bakelite mouldings, stampings and sleeving.
Atlantis.—John E. Dallas and Sons, Ltd. P.A. equipment.
Atlas.—Atlas Carbon and Battery Co. Batteries.
Atlas.—H. Clarke and Co. (Manchester), Ltd. General trade mark.
Atlas.—O. Ruhl (1922), Ltd.
Atwater, Kent.—Portland Radio Co., Ltd. Receivers, radiograms and chassis.
Audak.—Claude Lyons, Ltd. Electric pick-ups.
Audiola.—Amplion (1932), Ltd. Moving coil speaker.
Audion. — Graham Farish, Ltd. Resistance capacity unit.
Austin.—City Accumulator Co., Ltd. Receivers and radiograms.
Auto-Bat.—Climax Radio Electric, Ltd. Mains supply units.
Autocel.—Primus Manufacturing Co., Ltd. H.T. batteries.
Autocharger.—Sound Sales, Ltd. Car battery charger.
Autocontrolla.—Benjamin Electric, Ltd. Automatic battery economy unit.
Autokoil.—A. W. Hambling and Co. Tuning coils.
Automatic Tension.—J. G. Beddoes, Ltd. Locks for cabinets.
Autotrope.—Self-Changing Gramophones, Ltd. Auto-radiograms.
Autovalve.—Westinghouse Electric International Co. Lightning arrestors.
Avodapter.—Automatic Coil Winder and Electrical Equipment Co., Ltd. Valve tester.
Avometer.—Automatic Coil Winder and Electrical Equipment Co., Ltd. Combination measuring instrument.
Avominor.—Automatic Coil Winder and Electrical Equipment Co., Ltd. Testing instruments.
Axiom. — Goodman's Industries, Ltd. Components.
A.A.—Linolite, Ltd. Earth clip.
A.E.F.—A.E.F. Manufacturing Co. Accumulators.
A.E.W.—Watmel Wireless Co., Ltd. Electrical accessories.
A.R.G.—Ambassador Radio Gramophones. General trade mark.
A.J.D.—A. J. Dew and Co., Ltd. Products.

Bakelite.—Bakelite, Ltd. Insulating materials.
Ballsok.—Lionel Robinson and Co., Ltd. Insulating beads.
Bandmaster.—Lugton and Co., Ltd. Accumulators and sound boxes.
Barto.—J. G. Coates, Ltd. Relay apparatus and components.
Bartype.—Wingrove and Rogers, Ltd. Gang condensers.
Baty.—E. J. Baty. Mains units.
Beatall.—Manufacturers' Accessories Co. (1928), Ltd. Earth tubes.
Bedford.—Reproducers and Amplifiers, Ltd. P.M. cabinet speakers for relay operation.
Beethoven.—Beethoven Radio, Ltd. General trade mark.
Belco.—Nobel Chemical Finishes, Ltd. Wood finishes for cabinets.
Bell.—J. and J. Laker Co., Ltd. Insulators.
Belling Lee.—Belling and Lee, Ltd. General trade mark.

Beltona.—Murdoch Trading Co. Gramophone records.
Bennett Television.— Bennett Television Co. General trade mark.
Bepu.—Multitone Electric Co., Ltd. Class B driver transformers.
Berclif.—Berclif, Ltd. Sets and components.
Bi-Duplex.—Varley. Resistances.
Big Ben.—Stockall, Marples and Co., Ltd. Gramophones and sound boxes.
Bijou.—Wharfedale Wireless Works, Extension speakers.
Binode.—Mullard Wireless Service Co., Ltd. Valves.
Bisolac.—Bakelite, Ltd. Lacquer.
Blackley.—Connollys (Blackley), Ltd. Insulating tape.
Bliley.—Claude Lyons, Ltd. Quartz crystals.
Blue Spot.—British Blue Spot Co., Ltd. General trade mark.
Booster.—Graham Farish, Ltd. H.T. unit.
Border Radio.—Elliotts O' Maryport.
Bowspring.—Belling and Lee, Ltd. Wanderplugs.
Braylec.—Lawrence and Bray. Fuses.
Breaknot.—Gordon Equipments, Ltd. Hydrometers.
Breisgau.—McLeod and McLeod, Ltd.
Bridge Megger.—Evershed and Vignoles, Ltd. Testing instruments.
Brilliant Label.—Columbia Graphophone Co., Ltd. Needles.
Brimar.—Standard Telephones and Cables, Ltd. Valves.
Britannia.—Britannia Batteries, Ltd. Dry batteries.
Britannic.—Ever Ready Co. (Great Britain), Ltd. Dry cell.
Bronzian.—Wharfedale Wireless Works. Extension speakers.
Brownie.—Radio Electric Products Co.
Brunpoint.—Brunswick, Ltd. Long-playing needles.
Buckingham.—Reproducers and Amplifiers, Ltd. P.M. cabinet speakers for relay operation.
Bulgin.—A. F. Bulgin and Co., Ltd. Registered trade mark.
Bull-Dog.—Pomona Rubber Co. Black adhesive tapes.
Bull-Dog.—Ward and Goldstone, Ltd. Spring connectors.
Bulldog.—Britannia Batteries, Ltd. Salammoniac H.T. Batteries and refills for flashlights and torches.
Burgess.—Burgess Products Co., Ltd. Batteries and Deaf aid batteries.
Burndept.—Burndept, Ltd. Receivers and radiograms.
Bush.—Bush Radio, Ltd. General trade mark.
Bush Ranger.—Bush Radio, Ltd. Sets.
Busy Bee.—Price and Co. (M/c), Ltd.
Byldurone.—J. J. Eastick and Sons. Cabinets.
B.A.A.—F. W. Berk and Co., Ltd. Accumulator acid.
B.A.T.—Claude Lyons, Ltd. Components.
B.I.—British Insulated Cables, Ltd. General trade mark.
B.S.R.—Birmingham Sound Reproducers, Ltd. General trade mark.
B.T.-H.—British Thomson-Houston Co., Ltd. Set components, accessories, amplifiers, valves, speakers and headphones.
B.T.R.—British Tyre and Rubber Co., Ltd. General trade mark.

Cadet.—Columbia Graphophone Co., Ltd. Portable gramophone.
Cadison.—R. Cadisch and Sons. Accumulators, Accumulator carriers, batteries, battery switches, earth tubes, valve holders, etc.
Callender.—Callender's Cable and Construction Co., Ltd. General trade mark.
Cambridge.—Cambridge Instrument Co., Ltd. Instruments.
Camco.—Carrington Manufacturing Co., Ltd. Cabinets, panels and brackets.
Camel.—Camel Accumulators, Ltd. Accumulators.
Capitol.—Hobday Bros., Ltd. Components and accessories.
Carfax.—British Rectifiers Eng. Co. A.C. battery charging plant.
Carl Lindstrom.—Parlophone Co., Ltd. Gramophones, motors, etc.
Carlo Carsine.—Rose Morris and Co., Ltd. Musical instrument.
Carlton.—Fred Bulmer. General trade mark.
Carp.—Ellison Insulation, Ltd.
Carpet.—Ward and Goldstone, Ltd. Flat insulating conductor.
Castaphone.—G. Castagnoli. Public address outfits, valve sets, amplifiers and components.
Celec.—Curtis Manufacturing Co., Ltd. General trade mark.
Celestion.—Celestion, Ltd. General trade mark.
Cellbest.—Cellgrave Co. Flex and terminal labels.
Cellotone.—Runwell Cycle Co. (Birmingham), Ltd. Gramophones, sound boxes and needles.
Cellwell.—Cellgrave Co. Flex and terminal labels.
Centralab.—British Centralab, Ltd. General trade mark.
Centralab.—R. A. Rothermel, Ltd. Volume controls and resistances.
Centuron.—Saxon Radio Co. Insulated aerial wire.
Chakophone.—Eagle Engineering Co., Ltd. Sets and components.
Chakotrope.—Eagle Engineering Co., Ltd. Amplifiers.
Chalgrove.—C. G. Chalkley. Sets, components, speakers and accessories.
Challenger.—Riddiough and Son. Batteries.
Champion.—Hobday Bros., Ltd. Portable receiver.
Chaslyn.—J. H. Collie and Co. Hydrometers.
Choice of Critics.—A. F. Bulgin and Co., Ltd. General trade mark.
Chrome.—E. A. Wood. Accumulators, L.T.
Clan.—Elliotts O'Marypont. Receivers.
Clarion.—Clarion Radio Valve Co. Valves.
Claristal.—Ward and Goldstone, Ltd. Aerial set.
Clarostat.—Claude Lyons, Ltd. Components.
Clearer-Tone.—Benjamin Electric, Ltd. Valve holder.
Clearertone.—Benjamin Electric, Ltd. Anti-microphonic valveholders.
Cleartone.—Davies, Brickwood and Davies, Ltd. General trade mark.
Clifton.—Hobday Bros., Ltd. Switches.
Climax.—Climax Radio Electric, Ltd. General trade mark.
Clipon.—Belling and Lee, Ltd. Pickup.
Clix.—Lectro Linx, Ltd. General trade mark.
Clutch Brand.—Hellesens, Ltd. Insulating tape.
Collaro.—Collaro, Ltd. General trade mark.
Collett.—S. H. Collett Manufacturing Co. Terminals and panel brackets.
Colpak.—Colvern, Ltd. Radio frequency and super-het tuning units.
Columbia Graphophone.—Columbia Graphophone Co., Ltd. Radio-gramophones and electric reproducing gramophones.
Columbia Radio.—Columbia Graphophone Co., Ltd. Radio receivers, gramophones and power units. Speakers.
Colverdynes.—Colvern, Ltd. Band-pass intermediates for super-het receivers.
Colvern.—Colvern, Ltd. Coils.
Colverstats.—Colvern, Ltd. Fixed and variable resistances.
Compax.—Wingrove and Rogers, Ltd. Condensers.
Competa.—A. F. Bulgin and Co., Ltd. Components.
Concord.—Concordia Electric Wire Co., Ltd. Extension flexibles and cables.
Concordin.—Concordia Electric Wire Co., Ltd. Resistance wire.
Condensite.—Bakelite, Ltd. Insulating materials.
Connectite.—Concordia Electric Wire Co., Ltd. Connecting wire.
Connexit.—Saxon Radio Co. Insulated wire.
Connoisseur.—A. F. Bulgin and Co., Ltd. Transformer.

TRADE NAMES

Constant.—Varley. Inductance chokes.
Constantan.—Concordia Electric Wire Co., Ltd. Resistance wire.
Contralotone.—A. F. Bulgin and Co., Ltd. Variable tone control.
Convertogram.—Thompson Diamond Butcher. Conversion unit.
Cop.—Clifford Pressland Sales, Ltd. Aerial control.
Copex.—Peto Scott and Co., Ltd. Coils and coil screens.
Copparite.—Altham Radio Co. Insulated copper aerial wire.
Coraline.—British Insulated Cables, Ltd. Soldering paste.
Coronet.—Wharfedale Wireless Works. Extension speakers.
Cosmocord.—Cosmocord, Ltd. Pick-ups.
Cosmogram.—Cosmocord, Ltd. Playing desks.
Cossor.—A. C. Cossor, Ltd. General trade mark.
Crabtree.—J. A. Crabtree and Co., Ltd. General trade mark.
Crawford.—Romac Motor Accessories, Ltd. Jacks.
Crow.—Ellison Insulations, Ltd.
Crypton.—Crypton Equipment, Ltd. General trade mark.
Crystacel.—Siemens Electric Lamps and Supplies, Ltd. L.T. accumulators.
Crystalate.—Crystalate Gramophone Record Manufacturing Co., Ltd. Mouldings.
Cylda.—H. C. Daly. Aerial eliminator.
Cyldon.—Sydney S. Bird and Sons, Ltd. Variable condensers.
C.A.C.—City Accumulator Co. General trade mark.
C.A.V.—C. A. Vandervell, Ltd. H.T., L.T. accumulators and dry batteries.
C.R.L.—R. A. Rothermel, Ltd. Rheostat, potentiometer and modulator.

Dagenite.—Peto and Radford. Accumulator.
Daly.—H. C. Daly. General trade mark.
Damarda.—Bakelite, Ltd. Lacquer.
Dania.—Atlas Carbon and Battery Co., Ltd. Battery.
Dario.—Impex Electrical, Ltd. General trade mark.
Davenset.—Partridge, Wilson and Co., Ltd. General trade mark.
Davensign.—Partridge, Wilson and Co., Ltd. Electric shop sign.
Daventog.—Partridge, Wilson and Co., Ltd. Battery charging labels.
Daventry.—Carrington Mfg. Co., Ltd. Cabinet.
Decca-Polydor.—Decca Record Co., Ltd. Records.
Dece-meter.—Radiometers, Ltd. D.C. meter.
Decko.—A. F. Bulgin and Co., Ltd. Components.
Deckorem.—A. F. Bulgin and Co., Ltd. Components.
Decpoint.—Decca Record Co., Ltd. Long playing steel needles.
De Luxe Label.—Columbia Graphophone Co., Ltd. Needles.
Dialite.—A. F. Bulgin and Co., Ltd. Panel mounting light.
Diana.—Rose, Morris and Co., Ltd. Musical instruments.
Disc.—Graham Farish, Ltd. H.F. choke.
Disque.—Disque Cabinet Co. Record filing cabinets.
Doelcam.—McLeod and McLeod. Sleeving (Varnished insulating).
Douglas.—Automatic Coil Winder and Electrical Equipment Co., Ltd. Automatic coil winders, both hand and power.
Dragon.—Burgoyne Wireless (1930), Ltd. Receivers.
Drott.—Gothic Electrical Supplies, Ltd. General trade mark.
Drummer.—Edge Radio, Ltd. General trade mark.
Drydex.—Chloride Electrical Storage Co., Ltd. Dry battery.
Dubilier.—Dubilier Condenser Co. (1925), Ltd. General trade mark.
Duco.—Brown Brothers, Ltd. Components.
Dulcet.—Rose, Morris and Co., Ltd. Musical instruments.
Dulcetto.—Dulcetto Polyphon, Ltd. General trade mark.
Dumolite.—Dew and Co., Ltd., A. J. Accumulators.
Dumont.—R. A. Rothermel, Ltd. Cathode ray equipment.
Duonicore.—Varley. Coils.
Duosphere.—Mervyn Sound and Vision Co., Ltd. Television scanning devices.
Duplex.—McMichael Radio, Ltd. Receivers.
Duralife.—Camel Accumulators, Ltd. Accumulators.
Duragold.—Columbia Graphophone Co., Ltd. Needles.
Dwarf.—Everett, Edgcumbe and Co., Ltd. Portable measuring instruments.
Dynamotone.—Murdoch Trading Co. Talkie needles.
Dynatone.—Scientific Supply Stores (Wireless), Ltd. Air cored auto S.W. inductance.
Dynatron.—H. Hacker and Sons. Radiograms and receivers.
D.E.U.—McLeod and McLeod. Bobbins, boxes, etc., for batteries, etc., in papier maché.

Eagle.—Eagle Engineering Co., Ltd. H.T. dry batteries.
Easifil.—S. Guiterman and Co. Distilled water carrier.
Easifix.—Ward and Goldstone, Ltd. Lead-in bracket.
Easistrip.—Ward and Goldstone, Ltd. Connecting wire.
Eburite.—Eburite Corrugated Containers, Ltd. Corrugated fireboard containers.
Eby.—R. A. Rothermel, Ltd. Valve holders.
Eddystone.—Stratton and Co., Ltd. Short wave apparatus.
Edison.—Edison Storage Battery Dist., Ltd. L.T. accumulators.
Ediswan.—Edison Swan Electric Co., Ltd. General trade mark.
Editor.—Peto Scott Co., Ltd. Kits.
Eedee.—Edward Doherty and Sons. Radio cabinets.
Eelex.—J. J. Eastick and Sons. Components and accessories.
Eisler.—McLeod and McLeod, Ltd.
Ekco.—E. K. Cole, Ltd. General trade mark.
Electrad.—R. A. Rothermel, Ltd. Resistances and potentiometers.
Electravox.—Amplion (1932), Ltd. Receiver and pick-up.
Electro Dynamic.—Electro-Dynamic Construction Co., Ltd. General trade mark.
Electro-Graphophone.—Columbia Graphophone Co., Ltd. Electric reproducing gramophone.
Electron.—New London Electron Works, Ltd. Aerial wire, earth and insulator pins, globe, and all-wave aerial.
Electron Wire.—New London Electron Works, Ltd. Insulated aerial.
Electronic.—Varley. Resistances.
Elim-O-Stats.—A. H. Hunt, Ltd. Interference suppressors.
Elimmaise.—Belling and Lee, Ltd. Anti-interference aerial all-wave.
Ella.—Lionel Robinson and Co., Ltd. Meters.
Elliott.—Elliotts O'Maryport. Sets and components.
Elliott.—Elliott Radio Mfg. Co., Ltd. Receivers and components.
Elrad.—Elliott Radio Mfg. Co., Ltd. Components.
Eltic.—E. A. Wood. Components.
Embassy.—British Needle Co., Ltd. Gramophone needles.
Emitta.—Barnard Accumulator Co. Accumulators.
Emo.—George Emmott (Pawsons), Ltd. Mainsprings for gramophone motors.
Empire Sixty.—Efandem Co., Ltd. H.T. battery.
Empiric.—Empiric, Ltd. Midget receivers and car radio.

Energex.—Saxon Radio Co. H.T. batteries, L.T. accumulators, mains transformers and L.F. chokes.
Eon.—Eon Vacuum Wireless Co. General trade mark.
Epoch.—Epoch Reproducers, Ltd. Speakers and microphones.
Equilode.—Whiteley Electrical Radio Co., Ltd. Extension speakers.
Ericsson.—Ericsson Telephones, Ltd. Head phones.
Erie.—Radio Resistor Co. Components.
Erie.—Erie Resistor, Ltd. General trade mark.
Essex.—Reproducers and Amplifiers, Ltd. P.M. cabinet speakers for relay operation.
Estrella.—Thompson, Diamond and Butcher. Piano accordions and mouth organs.
Ethovernier.—Burndept, Ltd. Dials.
Eureka.—London Electric Wire Co. and Smiths, Ltd. Resistance wire.
Eureka.—L. Person and Son. General trade mark.
Everlock.—McLeod and MacLeod, Ltd. Washers.
Ever Ready.—Ever Ready Co. (Gt. Britain), Ltd. Primary and secondary batteries, H.T., L.T. and G.B.
Evrizone.—Evrizone Radio and Television Co., Ltd. General trade mark.
Ewebec.—Evington Electrical Mfg. Co. Formers and coils.
Excel.—S. H. Collett Manufacturing Co. Terminal tags and fuses.
Exide.—Chloride Electrical Storage Co., Ltd. Accumulators.
Extralife.—Edison Swan Electric Co., Ltd. L.T. accumulators.
Eze-tite.—S. H. Collett Manufacturing Co. Terminals.
E.A.W.—E. A. Wood. Components and accessories.
E.M.G.—E.M.G. Handmade Gramophones, Ltd. General trade mark.
E.85.—Reproducers and Amplifiers, Ltd. Speakers.

Facile.—Ross Courtney and Co., Ltd. Terminals.
Faraday Allwave.—Mervyn Sound and Vision Co., Ltd. Allwave Superhetrodynes.
Faraday Allwave.—Faraday All-wave Wireless. Receivers.
Faradohmeter.—Radiometers, Ltd. Resistance and capacity measuring bridge.
Farrex.—Farrex Radio, Ltd. General trade mark.
Feet o' Felt.—McLeod and McLeod. Felt feet for cabinets.
Ferguson.—Universal Radio Distributors, Ltd. Receivers.
Ferranti.—Ferranti, Ltd. General trade mark.
Ferrocart.—British Ferrocart Co., Ltd.
Ferrocart.—Colvern, Ltd. Iron core tuning coils and intermediates.
Fitzall.—Peto Scott Co., Ltd. Cabinets.
Filt.—Graham Farish, Ltd. Percolative earth.
Flag.—Ever Ready Co. (Great Britain), Ltd. Dry cell.
Flexella.—Lionel Robinson and Co., Ltd. Insulating beads.
Fluxite.—Fluxite, Ltd. Soldering paste and soldering set.
Fojas.—P. M. Lawrence. Aerial and earth equipment.
Fonatex.—Ashton and Co. (Est. 1787), Ltd. Gauze for wireless cabinets.
Formite.—Bakelite, Ltd. Insulating materials.
Formo.—Formo Products, Ltd. Components.
Fototune.—Kolster-Brandes, Ltd. Tuning devices.
Four in One.—British Homophone Co., Ltd. Records.
Franklin.—Franklin Electric Co., Ltd. General trade mark.
Froitzheim.—F. Whitelegg. Coil and armature winding machines and coil taping machines.
Fuller.—Fuller Accumulator Co. (1926), Ltd. Dry batteries and radio accumulators.
Full O' Power.—Siemens Electric Lamps and Supplies, Ltd. Dry batteries.
Full Vision Drives.—Wingrove and Rogers, Ltd. Slow motion drive.
F. and R.—F. Whitelegg. Coil and armature winding machines and coil taping machines.

Gabriel.—Halford Distributors, Ltd. Receivers and radio-grams.
Galloy.—Climax Radio Electric, Ltd. Earth tubes.
Gambrell.—Halford Distributors, Ltd. Receivers and radiograms.
Gard.—Graham Farish, Ltd. Lightning arrester.
Garrard.—Garrard Engineering and Mfg. Co., Ltd. Gramophone motors.
G. Burri.—McLeod and McLeod, Ltd. Instrument wire.
Gel-Cel.—Chloride Electrical Storage Co., Ltd. Jelly acid accumulator.
General Instruments.—R. A. Rothermel, Ltd. Variable condensers.
Georgian.—Halford Distributors, Ltd. Receivers.
Gladiator.—Metropolitan Distribution, Ltd. Accumulators.
Glazite.—London Electric Wire Co. and Smith's, Ltd. Insulated instrument wire.
Glorex.—British G.W.Z. Battery Co., Ltd. Dry batteries.
Gloria.—British G.W.Z. Battery Co., Ltd. Dry batteries.
Golden Arrow.—J. Toubkin. Accessories.
Golden Pigeon.—Price and Co. (M/c.), Ltd.
Golden Pyramid.—British Needle Co., Ltd. Radiogram needles.
Goldring.—Erwin Scharf. General trade mark.
Goltone.—Ward and Goldstone, Ltd. General trade mark.
Gordon.—Gordon Equipments, Ltd. Battery chargers.
Gothic.—Gothic Electrical Supplies, Ltd. General trade mark.
Grafonola.—Columbia Graphophone Co., Ltd. Gramophones.
Gramochassis.—Cosmocord, Ltd. Motor unit and pick-up.
Gramotube.—British Needle Co., Ltd. Gramophone needles.
Grampian.—Grampian Reproducers, Ltd. General trade mark.
Grantona.—R. O. Bridger and Co., Ltd. Seamless moulded diaphragms.
Greatrex.—R. G. Greatrex and Co. Receivers.
Greatrex, R.G.—R. G. Greatrex and Co. Speaker.
Grelco.—Grafton Electric Co. Components.
Gripon.—British Pix Co., Ltd. Aerials.
Grippleshell.—Partridge, Wilson and Co., Ltd. Aerial bracket.
Grosvenor.—Grosvenor Electric Batteries, Ltd. General trade mark.
Guardian.—Peto Scott Co., Ltd. Panel meter.
Guidor.—J. H. Collie and Co. Hydrometers.
G.E.C.—General Electric Co., Ltd. General trade mark.
G. & H.—Halford Distributors, Ltd. Superhet chassis.
G.I.—R. A. Rothermel, Ltd. Variable condensers.
G.R.—Claude Lyons, Ltd.,.. Laboratory equipment and industrial devices.
G.W.Z.—British G.W.Z. Battery Co., Ltd. Dry batteries.

Halford.—Halford Distributors, Ltd. General trade mark.
Hall.—Daws Clarke and Co. Fibre needles.
Halawax.—Bakelite, Ltd. Insulating materials.
Hammarlund.—R. A. Rothermel, Ltd. Trimmers, condensers, transmitting equipment and communication receivers.
Hammond.—R. A. Rothermel, Ltd. Electric clocks.
Hardale.—Hardman and Co., Ltd. Radio and electrical accessories.
Harlie.—Harlie, Ltd. Components and accessories.
Harmona.—Amplion (1932), Ltd. Moving coil speaker.
Hartley-Turner.—Hartley-Turner Radio, Ltd. General trade mark.
Heayberd.—F. C. Heayberd and Co. General trade mark.

TRADE NAMES

Hegra.—J. Millet. Cone unit, speakers, lightning arresters and grid-leak clips.
Heliogen.—P. M. Lawrence. Aerial and earth equipment.
Hellesen.—Hellesens, Ltd. General trade mark.
Henlog.—Baldwin Instrument Co. Inductance bridges.
Herculacker.—Concordia Elec. Wire Co., Ltd. Lacquered wires and cables.
Hercules.—Ever Ready Co. (Gt. Britain), Ltd. Low tension battery.
Hermes.—Transreceivers, Ltd. Midget transreceivers.
Hesco.—Octron, Ltd. Valves.
Hi-Life.—Hellesens, Ltd. H. T. batteries.
Hi Q.—Lissen, Ltd. Short wave components.
Hickok.—Claude Lyons, Ltd. Set testers.
Higgs Radio.—Charlton Higgs (Radio), Ltd. General trade mark.
His Master's Voice.—His Master's Voice. General trade mark.
Hivac.—High Vacuum Valve Co., Ltd. Valves.
Hobart.—Gordon Equipments, Ltd. Battery charger.
Holdtite.—S. H. Collett Mfg. Co. Clips.
Holmer.—Holliday and Hemmerdinger. P.A. equipment.
Huber.—McLeod and McLeod, Ltd. Wire (silk-covered).
Hum-dinger.—Claude Lyons, Ltd. Hum suppression devices.
Hunts.—A. H. Hunt, Ltd. Fixed condensers.
Hymax.—E. Allen and Co., Ltd. Magnet.
Hymeg.—Edison Swan Electric Co., Ltd. H.T. accumulator.
Hypernik.—Lissen, Ltd. Transformer.
Hyvoltstar.—Universal High Voltage Radio, Ltd. Universal all-wave radiograms and receivers, chassis and amplifiers.
H.B.—Cookson and Co. Syphon hydrometers.
H.B.—Hobday Bros., Ltd. Components and accessories.
H.M.S.—Graham Farish, Ltd. H.F. choke.
H.S.P.—H.S.P. Wireless Co. General trade mark.

Icall.—I. Calvete, Ltd. Small fractional horse power electric motors.
Ideal.—Columbia Graphophone Co., Ltd. Needles.
Igranic.—Igranic Electric Co., Ltd. General trade mark and super-het kit.
Igranite.—Igranic Electric Co., Ltd. Insulating varnish.
Imp.—Ultra Electric, Ltd. Speakers.
Imp.—Imp Radio Co. Resistances wire wound.
Imp Super.—Imp Radio Co. Crystals.
Impedance Matching.—Varley. Output transformers.
Imperi.—Hobday Bros., Ltd. Components and accessories.
Imperial-Broadcast.—Crystalate Gramophone Record Mfg. Co., Ltd. Gramophone records.
Imperial.—Watmel Wireless Co., Ltd. Components.
Indigraph.—Igranic Electric Co., Ltd. Recording tuning dial.
Indispenso.—Ward and Goldstone, Ltd. D.C. and car radio accumulator charger.
Inkwell.—Everett, Edgcumbe and Co., Ltd. Recording ammeters, voltmeters and wattmeters.
Invicta.—Invicta Radio, Ltd. General trade mark.
Isolantite.—R. A. Rothermel, Ltd. Insulating material.
Ivalek.—Ivory Electric. General trade mark.

Jacelite.—J. A. Crabtree and Co., Ltd. Switches, accessories and ironclad control gear.
Jacobean.—Halford Distributors, Ltd. Receivers and radiograms.
Janette.—R. A. Rothermel, Ltd. Rotary converters.
Jaydalene.—British Insulated Cables, Ltd. Soldering paste.
Jedson.—John E. Dallas and Sons, Ltd. Gramophones.
Jelectro.—Barnard Accumulator Co. (Jelly Electrolyte) accumulators.
Jockey.—Connollys (Blackley), Ltd. Adhesive tape.
Johnson.—Claude Lyons, Ltd. Valve sockets.
Junior.—Ward and Goldstone, Ltd. Lightning arrestor.
Jussrite.—Murdoch Trading Co. Record filing cabinets.
J. and A.—Claude Lyons, Ltd. Laboratory equipment and recording equipment.
J.M.—J. Millet. Condensers.

Kabi.—F. W. Lechner and Co., Ltd. General trade mark.
Kabilok.—W. and T. Lock, Ltd. Wireless cabinets.
Kadette.—Automobile and Home Radio, Ltd. Receivers.
Kador.—Vidor, Ltd. H.T. batteries.
Kalanite.—Callender's Cable and Construction Co., Ltd. Insulating material.
Kaleeco.—Callender's Cable and Construction Co., Ltd. Electric cable.
Kalgar.—Vidor, Ltd. H.T. batteries.
Kalibond.—Callender's Cable and Construction Co., Ltd. Electric cable.
Karna.—Appletons (Leeds), Ltd. Gramophones and speakers.
Kelsey. — Peto Scott Co., Ltd. Shortwave adaptor.
Kenyon.—R. A. Rothermel, Ltd. Transformers.
Keramot.—Siemens Elec. Lamps and Supplies, Ltd. Insulating material.
Kestra.—G. Castagnoli. Radio-gramophone outfits, valve sets, amplifiers and components.
Kestrolian.—Factors (Nottm.), Ltd. Receivers, radio-grams., and P.A. equipment.
Keystone.—Peto Scott Co., Ltd. Condensers and H.F. chokes.
Kidkord.—British Homophone Co., Ltd. Records.
Kingfisher.—Disque Cabinet Co. Record filing cabinets.
Kings of the Air.—A. C. Cossor, Ltd. Valves and receivers.
Kite.—Ellison Insulations, Ltd.
Kniffy.—Kniveton Cable Works, Ltd. General trade mark.
Koh-i-Noor.—Primus Manufacturing Co. H.T. batteries.
Konekap.—Graham-Farish, Ltd. Grid leak.
Konduotite.—City Accumulator Co. Metallic screening paper.
Kurz-Kasch.—R. A. Rothermel, Ltd. Bakelite mouldings.
K.-B.—Kolster-Brandes, Ltd. Receivers, speakers and other radio apparatus.

Lacoline.—Ward and Goldstone, Ltd. Coloured connecting wire.
Laminic.—Magnetic and Electrical Alloys, Ltd. Transformer laminations.
Leco.—London Electrical Co. (Sherborne Lane), Ltd. Domestic appliances.
Lecodyne.—London Electrical Co. (Sherborne Lane), Ltd. H.T. eliminators and radiograms.
Lecogloss.—London Elec. Co. (Sherborne Lane), Ltd. Wires and cables.
Leconite.—London Electrical Co. (Sherborne Lane), Ltd. Panels.
Lektrik. — A. P. Lundberg and Sons, Ltd. Switches and plugs and sockets.
Lektrite.—Ward and Goldstone, Ltd. Aerial wire.
Lelation.—H. B. Hicking. Speakers.
Lemco.—London Electrical Mfg. Co., Ltd. Components.
Lesdix-Chargers.—Leslie Dixon Switchgear Co. Battery chargers.
Lewcos.—London Electric Wire Co. and Smiths, Ltd. Radio products.
Lighthouse.—Vidor, Ltd. H.T. batteries.

Limpet.—Connollys (Blackley), Ltd. Adhesive tape.
Lincoln.—J. A. Crabtree and Co., Ltd. Switches, accessories and ironclad control gear.
Lindex.—Parlophone Co., Ltd. Sound boxes.
Linwood.—Dent and Co. and Johnson, Ltd. Speaker.
Lion.—Amplion (1932), Ltd. Moving-coil speaker.
Lion Super.—Amplion (1932), Ltd. Moving-coil speaker.
Lissen.—Lissen, Ltd. General trade mark.
Lithanode.—Lithanode Co., Ltd. Accumulators.
Litlos.—Graham-Farish, Ltd. Variable condensers.
Lively "O."—Oldham and Son, Ltd. Accumulators, L.T. and H.T.
Logohm.—Baldwin Instrument Co. Resistance bridges.
Lohys.—J. Sankey and Sons, Ltd. Transformer laminations.
Longlife.—Runwell Cycle Co.(Birmingham), Ltd. Batteries, accumulators, gramophone needles, and motor springs and insulating tape.
Lundberg.—A. P. Lundberg and Sons, Ltd. Switches, plugs and sockets.
Luxfilter.—Lissen, Ltd. Droitwich filter.
Lystan.—Lystan Products, Ltd. Chassis repair cradles and suppressor safety plugs.
L.E.M.—McLeod and McLeod, Ltd. Wound bobbins.
L.E.W.—London Electric Wire Co. and Smiths, Ltd. General trade mark.
L.M.S.—Graham-Farish, Ltd. H.F. choke.

Macadie.—Automatic Coil Winder and Electrical Equipment Co., Ltd. Coil winder.
Maco.—Manufacturers' Accessories Co. (1928), Ltd. Accumulators and earth tubes.
Magna.—E. A. Wood. Products, tables and gramophone springs.
Magna.—Benjamin Electric, Ltd. Speakers.
Magnafilter.—Burne-Jones and Co., Ltd. Wave trap.
Magnaflux.—Watson, Saville and Co., Ltd. Permanent magnets and magnet sheet.
Magnagram.—Burne-Jones and Co., Ltd. Radio-gramophones.
Magnavox.—Benjamin Electric, Ltd. Speakers.
Magnet.—General Electric Co., Ltd. Accumulators.
Magnum.—Burne-Jones and Co., Ltd. Receivers, components and accessories.
Major.—Ward and Goldstone, Ltd. Lightning arrestor.
Maklodone.—McLeod and McLeod. Bakelite mouldings and knobs.
Mallaroy.—R. A. Rothermel, Ltd. Dry, electrolytic condensers and vibrators.
Mandek.—McLeod and McLeod, Ltd. Choke, headphone, loudspeaker, and transformer bobbins.
Mandem.—McLeod and McLeod, Ltd. General trade mark.
Mandemite.—McLeod and McLeod, Ltd. Connecting wire.
Marconi.—M. O. Valve Co., Ltd. Valves.
Marconi.—Marconiphone Co., Ltd. Valves.
Marconiphone.—Marconiphone Co., Ltd. Sets, speakers.
Massicore.—W. Bryan Savage, Ltd. Transformers.
Mastertone.—John E. Dallas and Sons, Ltd. Gramophone.
Matched Tone.—Kolster-Brandes, Ltd. Headphones.
Max.—Graham-Farish, Ltd. Parallel feed transformer.
Mayfair.—Halford Distributors, Ltd. Cocktail set all-wave radio-gram.
Mazda.—Edison Swan Electric Co., Ltd. Valves.
Mazelite.—Feldman, M. (Radio XXX Supplies). Crystals.
Medium Resistance.—J. Sankey and Sons, Ltd. Transformer laminations.
Megger.—Evershed and Vignoles ,Ltd. Testing instruments.
Megite.—Graham-Farish, Ltd. Resistances and volume controls.
Mellow Tone.—The Mellow Tone Co. Permanent gramophone gold and iridium pointed needles.
Melodee.—Carrington Manufacturing Co., Ltd. Cabinet.
Melody Maker.—A. C. Cossor, Ltd. Kits and receivers.
Meraco.—Mervyn Sound and Vision Co., Ltd. Television neon lamps.
Mercury.—Grosvenor Electric Batteries, Ltd. H.T. battery.
Meritone.—Thompson, Diamond and Butcher. Gramophones.
Meritor.—Wharfedale Wireless Works. Extension speakers.
Mervyn.—Mervyn Sound and Vision Co., Ltd. General trade mark.
Metaplex.—Peto Scott Co., Ltd. Metallised baseboard.
Meteor.—Claude Lyons, Ltd. Plugs and sockets.
Metocel.—Ward and Goldstone, Ltd. Screened down lead.
Metrohm.—Everett, Edgcumbe and Co., Ltd. Insulation and resistance testing sets.
Micarta.—Westinghouse Electric International Co. Decorative sheet.
Microdenser.—Stratton and Co., Ltd. S.W. condenser.
Micro Drive.—Wingrove and Rogers, Ltd. Slow-motion drive.
Micro-Henlog.—Baldwin Instrument Co. Inductance bridges.
Microlode.—Whiteley Elec. Radio Co., Ltd. Speakers.
Micromesh.—Standard Telephone and Cables, Ltd. Valves.
Midget.—Belling and Lee, Ltd. Wanderplugs.
Midget.—Wingrove and Rogers, Ltd. Gang condensers.
Milnes.—Milnes Radio Co., Ltd. H.T. supply unit from L.T. accumulator. Speakers, battery sets, and mains sets.
Minor.—Wingrove and Rogers, Ltd. Variable gang condensers.
Minster.—Appletons (Leeds), Ltd. Gramophones and speakers.
Modula.—British Pix Co., Ltd. Volume control.
Monarch.—Ambassador Radio Gramophones. Receivers and Radio Gramophones.
Monosonic.—Primus Manufacturing Co. Sets.
Morganite-Stackpole.—Morgan Crucible Co., Ltd. Components.
Moto Radio.—Philips Lamps, Ltd. Car radio equipment.
Mouldensite.—Bakelite,Ltd. Insulating materials.
Mufer.—Baldwin Instrument Co. Capacity test sets.
Mullard.—Mullard Wireless Service Co., Ltd. General trade mark.
Multex.—Reproducers and Amplifiers, Ltd. Speakers.
Multi-Cellular.—Varley. H.F. chokes.
Multi-Coil.—A. F. Bulgin and Co., Ltd. Patent dual range tuner.
Multimu.—Reproducers and Amplifiers, Ltd. Speakers.
Multishell.—Ward and Goldstone, Ltd. Screened down lead.
Multi-Volt.—Varley. Power transformers.
Multitone.—Multitone Electric Co., Ltd. Deaf aids and deaf aid receivers.
Mum.—Graham Farish, Ltd. Interference suppressors.
Mumax.—Climax Radio Electric, Ltd. L.F. transformer.
Muter.—Radio Resistor Co. Resistance indicators.
M.A. Sound System.—Mobile Amplifiers, Ltd. Amplification apparatus.
M.H.—McMichael Radio, Ltd. Receivers.
M. and M.—McLeod and McLeod, Ltd. General trade mark.
M.R.—Mains Radio Mfg. Co. General mark.

National (U.S.A.).—Quartz Crystal Co., Ltd. Components.
National.—R. A. Rothermel, Ltd. Vernier dials.

TRADE NAMES

National Band.—Thompson, Diamond and Butcher. Gramophones.
National Union.—Universal Radio Distributors, Ltd. Valves.
Negrolac.—Ward and Goldstone, Ltd. Aerial wire.
Netaglass.—E. A. Wood. Valve holders and accumulators.
Netavox.—E. A. Wood. Receivers and speaker chassis.
Netax.—E. A. Wood. Valve and coil holders.
New Mascot.—Churchmans, Ltd. L.F. transformers.
Newilson.—Radio-Electric Products Co.
Nichoke.—Varley. L.F. choke.
Niclet.—Varley. L.F. transformers.
Nicore.—Varley. L.F. transformers.
Nicore I. and II.—Varley. L.F. intervalve transformers.
Ni-fe.—Batteries, Ltd. Battery.
Nipper.—Grampian Reproducers, Ltd.
Nodalizer.—Ward and Goldstone, Ltd. Hum control and suppressor.
Noise Master.—R. A. Rothermel, Ltd. Aerial kits.
No-Mast.—Central Equipment, Ltd. Aerial.
Norfolk.—Reproducers and Amplifiers, Ltd. P.M. cabinet speakers for relay operation.
Northumbria.—Novo Radio (1935), Ltd. Receivers.
Novo.—Novo Radio (1935), Ltd. Allwave receivers.
Nu-Glo.—Mervyn Sound and Vision Co., Ltd. Television neon lamps.
Nyhatex.—Maul and Murphy, Ltd. Synthetic resin fabric material sheets, rods and tubes.
Nyhax.—Maul and Murphy, Ltd. Synthetic resin laminated sheets, rods and tubes.
N.S.F.—Wingrove and Rogers, Ltd. Volume controls, resistors, electrolytic and tubular condensers.

Oak.—R. A. Rothermel, Ltd. Switches.
Octacros.—Synchrophone (1935), Ltd. Records.
Octave.—Claude Lyons, Ltd. Tone controls.
Odeon.—Parlophone Co., Ltd. Records.
Ohmite.—Graham Farish, Ltd. Resistances and volume control.
Oldham.—Oldham and Son, Ltd. Batteries.
Orel-Micro.—Orel-Micro Electric, Ltd. General trade mark.
Orgola.—Mullard Wireless Service Co., Ltd. General trade mark.
Oriole.—Levy's Sound Studios, Ltd. Records.
Ormond.—Ormond Engineering Co., Ltd. Components.
Osram.—General Electric Co., Ltd. Valves, photocells and lamps.
Osram.—M.O. Valve Co., Ltd. Valves.
Ostar-Ganz.—Eugene Forbat. General trade mark.
Overnight.—F. C. Heayberd and Co. Battery charger.
Overseas.—Ward and Goldstone, Ltd. All-wave aerial kit.
Ox.—Emmott (Pawsons), Ltd. Gramophone main springs.
Oxford.—Reproducers and Amplifiers, Ltd. P.M. cabinet speakers for relay operation.
O.K.—J. Toubkin. Accessories.
O.P. 58.—Reproducers and Amplifiers, Ltd. Transformers.

Pam.—Claude Lyons, Ltd. P.A. equipment.
Panatrope.—Brunswick, Ltd. Radio-gramophone.
Pantophone.—Parlophone Co., Ltd. Records, needles and pick-ups.
Parafilm.—Pomona Rubber Co. Insulating material.
Parlophone.—Parlophone Co., Ltd. Records and needles.
Parmeko.—Parmeko, Ltd. General trade mark.
Paxolin.—Micanite and Insulators Co., Ltd. General trade mark.
Peak.—W. Andrew, Bryce and Co. Condensers.
Peero.—Brown Brothers, Ltd. Pocket lamp batteries.
Pegasus.—Pegasus, Ltd. Receivers.
Pentex.—Celluloid Printers, Ltd. Scales.
Pentone.—Mullard Wireless Service Co., Ltd. Valves.
Pentrovol.—Igranic Electric Co., Ltd. Microphone.
Percolite.—Aerialite, Ltd. H.T. dry batteries.
Perfect.—Octron, Ltd. Valves.
Peridulce.—Murdoch Trading Co. Gramophones.
Permagold.—British Needle Co., Ltd. Radiogram needles.
Permalloy.—Standard Telephones and Cables, Ltd. High magnetic alloy for cores.
Permeability Tuning.—Varley. Three- and four-gong tuners.
Perpetuum.—Aladdin Gramophone and Accessories Co. Gramophone motors, spring and electric and pick-ups.
Pertinax.—G. L. Scott and Co., Ltd. Insulation and wire.
Pertrix.—Britannia Batteries, Ltd. Dry batteries and accumulators.
Petmecky.—Murdoch Trading Co. Gramophone needles.
Philco.—Philco Radio and Television Corp. of G.B., Ltd. General trade mark.
Philips.—Philips Industrial Ltd. (Philips Lamps, Ltd.). Battery chargers and rectifiers.
Philips.—Philips Lamps, Ltd. Sets, rectifying valves, components and accessories.
Philite.—Philips Lamps, Ltd. Synthetic resin moulding.
Pifco.—Provincial Incandescent Fittings Co., Ltd. Radio instruments.
Pilot.—Pilot Radio, Ltd. General trade mark.
Pilot Author.—Peto Scott Co., Ltd. Kits.
Pioneer Quality.—Pioneer Manufacturing Co. General trade mark.
Pioneer.—R. A. Rothermel, Ltd. Generators.
Pip.—Graham Farish, Ltd. L.F. transformers.
Pirouette.—A. W. Chapman, Ltd. Turntables, for portables.
Pirtoid.—H. Clarke and Co. (M/c), Ltd. Insulation.
Pix.—British Pix Co., Ltd. General trade mark.
Pix.—Pix Valves, Ltd. Valves.
Pixie.—L. R. Wood. General trade mark.
Plaza.—British Homophone Co., Ltd. Records.
Polar.—Wingrove and Rogers, Ltd. Condensers and drives.
Polar-N.S.F.—Wingrove and Rogers, Ltd. Components.
Polymet.—R. A. Rothermel, Ltd. Electrolytic condensers.
Pop.—Graham Farish, Ltd. Terminal mount.
Popular.—Ever-Ready Co. (Great Britain), Ltd. H.T. batteries.
Portable Radio Tourist.—Transreceivers, Ltd. Receivers.
Portadyne.—Portadyne Radio (Gorst Elec. Co., Ltd.). Sets.
Portatrope.—Self Changing Gramophones, Ltd. Portable automatic gramophones.
Portrola.—Decca Gramophone Co., Ltd. Portable radio-gram.
Powerlite.—Primus Manufacturing Co. H.T. pocket and torch batteries.
Power Puncher.—Varley. H.T. economiser.
Presto.—Ward and Goldstone, Ltd. Shock proof plug adaptor.
Primus.—Primus Manufacturing Co. H.T. batteries, cone units, and speakers.
Primus Autocel.—Primus Manufacturing Co. H.T. batteries.
Primustatic.—Primus Manufacturing Co. Loudspeaker.
Prism.—Electrical Equipment and Carbon Co., Ltd. Radio-grams.
Prism.—Prism Mfg. Co. General trade mark.
Puchoke.—Multitone Electric Co., Ltd. Universal push-pull output choke.
Puco.—Multitone Electric Co., Ltd. Tone control Q.P.P. transformers.

Pushback.—Ward and Goldstone, Ltd. Connecting wire.
Pye.—Pye Radio, Ltd. General trade mark.
P.B.—McLeod and McLeod, Ltd. Tapes (varnished).
P.H.B.—T.M.C. Harwell (Sales), Ltd. Bakelite plugs, sockets and adaptors.
P.M.—Mullard Wireless Service Co., Ltd. General trade mark.
P.P.M.—Celestion, Ltd. Speakers.

Quadrant.—Quadrant Carbon and Metal Products, Ltd. Valve holders and backstrips.
Quadwave.—British Television Supplies, Ltd. Four range tuning coils.
Quaker.—McLeod and McLeod, Ltd. Processing oils.
Queen Anne.—Halford Distributors, Ltd. Receivers and radio-grams.
Queen Anne "de luxe."—Halford Distributors, Ltd.—Allwave receiver and radiogram and 12 watt output sets.
Quickfix.—Aerialite, Ltd. Aerial erecting brackets.
Quick-Grip.—Ward and Goldstone, Ltd. Spring connector.
Quip.—Graham Farish, Ltd. Q.P.P. transformer.
Q.C.C.—Quartz Crystal Co. Crystals, laboratory instruments and components.
Q.J.—Wingrove and Rogers, Ltd. Condenser.

Radenite.—Radenite Batteries, Ltd.
Radial.—Aerialite, Ltd. Aerials. No-mast type.
Radio-Gramophone.—Columbia Graphophone Co., Ltd. Radio-gramophones.
Radiolab.—Everett Edgcumbe and Co., Ltd. Testing and service equipment.
Radiolux.—Amplion (1932), Ltd. Receiver and radio-gramophone.
Radio Record.—Record Radio, Ltd. Valves.
Radiovox.—Radiovox Wireless Services, Ltd. Amplifying equipment.
Radio XXX.—M. Feldman. Crystals.
Rally.—Decca Gramophone Co., Ltd. Portable gramophone and portable home and car radio.
Rapid-Flo.—S. Guiterman and Co., Ltd. Acid pump.
Ravald.—J. Moores and Co. Accessories.
Reactone.—Sylvex, Ltd.
Recepticon.—Concordia Electric Wire Co., Ltd. Insulated aerial wire.
Rectatone.—Varley. Transformer.
Redhead.—S. Guiterman and Co., Ltd. Battery fillers.
Red Kap.—London and Provincial Factors, Ltd. Transformers and speaker units.
Red Lion.—R. Cadisch and Sons. General trade mark.
Redmanol.—Bakelite, Ltd. Insulating materials.
Red Triangle.—Peto Scott Co., Ltd. Ebonite panels.
Refty.—Davis and Timmins, Ltd. Terminals.
Regal-Zonophone.—Columbia Graphophone Co., Ltd. Records.
Regentone Products.—Regentone Products, Ltd. Mains and battery receivers, etc.
Rejectostat.—Kolster Brandes, Ltd. Man-made static eliminator.
Reliability.—J. H. Taylor and Co. Batteries, variable and fixed condensers and ebonite.
Reliomac.—Manufacturers' Accessories Co. (1928), Ltd. Voltmeters and earth tubes.
Resinker.—British Insulated Cables, Ltd. Solder.
Rex.—Crystalate Gramophone Record Manufacturing Co., Ltd. Gramophone records.
Richtone.—London Radio Co. (Leeds), Ltd. General trade mark.
Rifanco.—Regent Fittings Co. Gramophones and accessories.
Ring.—Graham Farish, Ltd.
Rival.—Hobday Bros., Ltd. Components and accessories.
Riverside.—Carrington Mfg. Co., Ltd. Cabinet.
Rogers-Majestic.—Fourwave, Ltd. Receivers.
Rola.—British Rola Co., Ltd. Speakers.
Ross, Courtney.—Ross, Courtney and Co., Ltd, Terminals.
Rothermel.—R. A. Rothermel, Ltd. Genera trade mark.
Rothermel-Brush.—R. A. Rothermel, Ltd. Microphones, pickups, headphones and deaf aids.
Rotor-Ohms.—Rotor Electric, Ltd. Volume controls.
Royalty.—R. A. Rothermel, Ltd. Wirewound grid-leak, resistance and modulator.
R. and A.—Reproducers and Amplifiers, Ltd. Speakers.
R.A.P.—Export R.A.P., Ltd. General trade mark.
R.C.—Radio Electric Products Co. General trade mark.
R.D.C.—Radio Development Co. Service equipment.
R.E.G.—E. A. Wood. Products, batteries, aerial insulators and insulating tape.
R.G.D.—Radio Gramophone Development Co. General trade mark.
R.G. Greatrex.—R. G. Greatrex and Co. Portables, battery and mains and speakers.
R.I.—Aeronautical and General Instruments, Ltd. General trade mark.
R.K.—British Thomson-Houston Co., Ltd. Coil-driven speaker and amplifiers.
R.L.—R. Cadisch and Sons. Switches, terminals and plugs.
R.M.L.—Richardsons (R.M.L.), Ltd. Earth rods.

Sackville.—Halford Distributors, Ltd. Medium, long and all-wave receivers.
Salon Decca.—Decca Gramophone Co., Ltd. Gramophones.
Savage.—W. Bryan Savage, Ltd. Amplifiers, microphones and condensers.
Savana.—Rose, Morris and Co., Ltd. Musical instruments.
Saxoflex.—Saxonia Electric Wire Co., Ltd. Non-kinking flexible.
Scientific.—Scientific Supply Stores (Wireless), Ltd. General trade mark.
Scientific.—Stratton and Co., Ltd. Short wave apparatus and receivers.
Scott.—Keates and Co. (Radio), Ltd. Receivers.
Scott-Sessions.—G. Scott Sessions and Co. General trade mark.
Scrufuse.—Belling and Lee, Ltd. Long path wire fuse.
Segic.—S. Guiterman and Co., Ltd. Battery charging clips, battery fillers and hydrometers.
Sensity.—Formo Products, Ltd. Iron-coned coils.
Setaw.—London and Provincial Factors, Ltd. Meters.
Shaftesbury.—Shaftesbury Microphones, Ltd. General trade mark.
Shakeproof.—Barber and Colman, Ltd. Lock-washers and locking terminals.
Sickles.—R. A. Rothermel, Ltd. Coils, trimmers and transformers.
Siemens.—Siemens Electric Lamps and Supplies, Ltd. General trade mark.
Siemens and Halske.—Siemens Schuckert (Gt. Britain), Ltd. General trade mark.
Sieray.—Siemens Electric Lamps and Supplies, Ltd. Electric discharge lamps.
Siftron.—Amplion (1932), Ltd. Aerials.
Silcor.—Magnetic and Electrical Alloys, Ltd. Transformer laminations.
Silctron.—Giffens (London), Ltd. American valves.
Silktex.—Celluloid Printers, Ltd. Scales.
Siltit.—Central Equipment, Ltd. Earths.
Silverdome.—Octron, Ltd. Valves.
Silver Radio.—Hellesens, Ltd. H.T. batteries.
Simplat.—V.G. Mfg. Co., Ltd. Sound recording discs apparatus and accessories.
Simple-strip.—New London Electron Works, Ltd. Perforated instrument wire.
Simplicity.—S. Guiterman and Co., Ltd. Acid pump.
Simplicon.—Williams and Moffat, Ltd. Components.
Sinclair.—Sinclair Speakers.

TRADE NAMES

Skyscraper.—Lissen, Ltd. Kits.
Slipquik.—Concordia Elec. Wire Co., Ltd. Insulated connecting wire.
Slot.—Graham Farish, Ltd. Aerial filter.
Snail.—Formo Products, Ltd. Condenser drives.
Snap.—Graham Farish, Ltd. Switches.
Solex.—British Homophone Co., Ltd. Records.
Sonette.—Amplion (1933), Ltd. Moving coil speaker.
Sonia.—Murdoch Trading Co. Main springs.
Sonomac.—Sonomac Sound Products. Amplifiers and microphones.
Sopranist.—London and Provincial Factors, Ltd. Accumulators. batteries, components, and hydrometers.
Sound.—Sound Sales, Ltd. Speakers.
Sound Service.—Hillman Bros., Ltd. Accumulators and earth tubes.
Sovereign.—Atlas Carbon and Battery Co., Ltd. Batteries.
Spanall.—Ward and Goldstone, Ltd. Aerial wire.
Sparta.—Fuller Accumulator Co. (1926), Ltd. Dry batteries.
Sparton.—Globe Radio, Ltd. Receivers.
Speedway.—McLeod and McLeod, Ltd.
Spike.—Ward and Goldstone, Ltd. Stand-off insulator.
Spirohm.—Dubilier Condenser Co. (1925), Ltd. Wire-wound resistors.
Sprague.—R. A. Rothermel, Ltd. Electrolytic condensers, wet.
Springflat.—J. G. Beddoes, Ltd. Cabinet handles.
Springmore.—Igranic Electric Co., Ltd. Wander plug.
Square Peak.—Varley. Coils.
Stafford.—Reproducers and Amplifiers, Ltd. P.M. cabinet speakers for relay operation.
Stalloy.—Joseph Sankey and Sons, Ltd. Transformer laminations.
Standard.—Graham Farish, Ltd. Grid leak.
Standard Radio.—Standard Telephones and Cables, Ltd. General trade mark.
Standynia.—Geo. L. Scott and Co., Ltd. Dynamo and transformer sheets and stampings.
Stantranis.—Geo. L. Scott and Co., Ltd. Dynamo and transformer sheets and stampings.
Starmac.—Metal Agencies Co., Ltd. Accumulators.
Static High Test.—Static Condenser Co. Car radio suppression equipment and condensers fixed.
Static Universal A-C.—Static Condenser Co. Accumulator chargers A-C.
Statoformer.—Ward and Goldstone, Ltd. Noise reducing aerial kit.
Stentorian.—Whiteley Electrical Radio Co., Ltd. Speakers.
Sterling.—Sterling Batteries, Ltd. Batteries.
Sterno.—British Homophone Co., Ltd. Records.
Stokmar.—Stockall Marples and Co., Ltd. Synchronous clocks.
Stronkor.—Johnson & Phillips, Ltd. Flexible cable.
Strucktakit.—Peto Scott Co., Ltd. Kits.
Sturdy.—Sturdy Electric Co. Transformers and chokes.
Sunbeam.—Fuller Accumulator Co. (1926), Ltd. Dry batteries.
Sunco.—Sun Electrical Co., Ltd. General trade mark.
Sunray.—Sunbeam Wireless Service. Receivers and radiograms.
Super.—Hellesens, Ltd. H.T. batteries.
Super 1.—Ever-Ready Co. (Gt. Britain), Ltd. H.T. battery.
Superbe Label.—Columbia Graphophone Co., Ltd. Needles.
Supercell.—Runwell Cycle Co. (Birmingham), Ltd. Accumulators.
Super-ferrodyne.—A. C. Cossor, Ltd. Receivers.
Superial.—New London Electron Works, Ltd. Aerials.
Superscale.—Everett, Edgcumbe and Co., Ltd. Ammeters and voltmeters.
Supertex.—Price and Co. (M/c), Ltd.
Suprecision.—F. C. Heayberd and Co. Measuring instruments.
Supreme.—Vee Cee Dry Cell Co. (1927), Ltd.
Supremus.—Supremus Specialities, Ltd. General trade mark.
Swan.—Ellison Insulations, Ltd.
Sylvania.—Portland Radio Co., Ltd. Valves.
Sylvania.—Claude Lyons, Ltd. Vacuum tubes.
Sylverex.—Sylvex, Ltd.
Symphonion.—Dulcetto Polyphon, Ltd. Gramophones.
Synchronomains.—Synchronome Co., Ltd. Synchronous plug-in clocks.
Synchronome.—Synchronome Co., Ltd. Electrical impulse clocks.
Synchrophone.—Synchrophone (1935), Ltd. Home talkie apparatus.
Synclock.—Everett, Edgcumbe, and Co., Ltd. Time devices.
Synobel.—Nobel Chemical Finishes, Ltd. Insulating varnish.
S.R.S.—Stonehouse Radio Supplies. General trade mark.

Talkie Label.—Columbia Graphophone Co., Ltd. Needles for cinema use.
Tannoy.—Tannoy Products. General trade mark.
Telecontrol.—Halford Distributors, Ltd. Receivers and radiograms.
Telefilter.—Belling and Lee, Ltd. Interference suppressor.
Telenduron.—Thos. De la Rue and Co., Ltd. Bakelite, insulating compounds and mouldings.
Televisor.—Baird Television, Ltd. Television receiving apparatus.
Temco.—Telephone Mfg. Co., Ltd. A.C. electric clocks.
Temco T.M.C.—Harwell (Sales), Ltd. Switches and accessories.
Thermo-Breaknot.—S. Guiterman and Co., Ltd. Hydrometer.
Thinker Statue Device.—Mullard Wireless Service Co., Ltd. General trade mark.
Thordarson.—R. A. Rothermel, Ltd. L.F. transformers and chokes.
Toco.—Multitone Electric Co., Ltd. Tone control transformers.
Topsel Unit.—E. Francis, Ltd. Accumulator acid pumps.
Torex.—Lissen, Ltd. Transformers.
Tortoise.—Kingsway Electricals, Ltd. Display turntables A.C.
Tournaphone.—Murdoch Trading Co. Gramophones.
Trancesco.—Rose, Morris and Co., Ltd. Musical instruments.
Transchoke.—Varley Q.P.P. Output components.
Transfeeda.—Benjamin Electric, Ltd. Parallel feed transformer.
Trantalini.—Rose, Morris and Co., Ltd. Musical instruments.
Trapeze.—Aerialite, Ltd. Aerials, no-mast type.
Trefoil.—Bakelite, Ltd. Laminated sheet.
Triad.—Amerad (Great Britain), Ltd. Valves.
Trix.—Trix Electrical Co., Ltd., P.A. Equipment, receivers, components, transformers.
Truescrews.—True Screws, Ltd. General trade mark.
Truphonic.—Truphonic Radio, Ltd. General trade mark.
Truqual.—Wharfedale Wireless Works. Volume controls.
Trutone.—Richardsons (R.M.L.), Ltd., Gramophones, covered aerials, accumulators, and sound boxes.
Truvolt.—R. A. Rothermel, Ltd. Resistance.
Truvox.—Universal Gramophone and Radio Co., Ltd. General trade mark.
Tufnol.—Ellison Insulations, Ltd. Insulating and constructional materials.
Tungar.—British Thomson-Houston Co., Ltd. Battery charger.
Tungsram.—Tungsram Electric Lamp Works (Great Britain), Ltd., and British Tungsram Radio Works, Ltd. Valves.
Twingrip.—J. G. Beddoes, Ltd. Safety lock for cabinets.

T.C.C.—Telegraph Condenser Co., Ltd. Fixed condenser.
T.E.C.—Efandem Co., Ltd. Dry cell and accumulator.
T.I.M.—London Electric Clock Co. Electric clocks.
T.M.C.—Telephone Mfg. Co., Ltd. Condensers and radio interference suppressors.
Type C. } Wingrove and Rogers, Ltd. S.W.
Type E. } Condensers.
T.S.L. Products.—True Screws, Ltd. General trade mark.
T.X.—T.X. Products Co., Ltd. Adaptors.

Unic.—Richardsons (R.M.L.), Ltd. Springs.
Unicore.—Varley. Coils.
Unicorn.—British Needle Co., Ltd. Gramophone needles.
Unigram.—Cosmocord, Ltd. Playing desks.
Unipivot.—Cambridge Instrument Co., Ltd. Galvanometers.
Unirad.—Union Radio Co., Ltd. Allwave and short wave receivers, mains and battery operated ; short wave converters, A.C. mains.
Unisphere.—Mervyn Sound and Vision Co., Ltd. Television scanning devices.
Unit.—Belling and Lee, Ltd. Pick-up.
United Press.—R. A. Rothermel, Ltd. Moulded cones.
Universal Avominor.—Automatic Coil Winder and Electrical Equipment Co., Ltd. Testing instrument.
Univolt.—Univolt Elec., Ltd. Radiogram units.
Uvet.—Radiometers, Ltd. Universal all-valve tester.

Van Raden.—Radenite Batteries, Ltd. H.T. and L.T. accumulators.
Variband.—Varley. Variable selectivity I.F. unit.
Vari Dep.—Telephone Manufacturing Co., Ltd. Microphones.
Vee Cee.—Vee Cee Dry Cell Co. (1927), Ltd. H.T. dry cell batteries.
Vega.—Octron, Ltd. Valves.
Venauto.—Venner Time Switches, Ltd. Automatic programme selector.
Vibro.—Burne Jones and Co., Ltd. Valve-holder.
Vibrolder.—Benjamin Electric, Ltd. Anti-microphonic valve holders.
Viceroy.—Rose, Morris and Co., Ltd. Musical instrument.
Vicor.—Magnetic and Electrical Alloys, Ltd. Transformer laminations.
Victor.—R. and A., Ltd. P.M.-M.C. speakers.
Victory.—Grosvenor Electric Batteries, Ltd. General trade mark.
Vidor.—Vidor, Ltd. General trade mark.
Violute.—E. A. Wood. Loudspeakers, cabinets and gramophones.
Viophone.—E. A. Wood. Loudspeakers.
Visitron.—Claude Lyons, Ltd. Photo-electric cells.
Vit Bond.—Zenith Electric Co., Ltd. Embedded wire-wound resistance units.
Viva-Radio.—Columbia Graphophone Co., Ltd. Dry batteries.
Viva-Tonal.—Columbia Graphophone Co., Ltd. Portable gramophone.
Viva-Tonic.—Columbia Graphophone Co., Ltd. Soft-tone needles.
Volamp.—Lithanode Co., Ltd. Accumulators.
Vole.—Ellison Insulations, Ltd.
Volpus.—Hobday Bros., Ltd. Batteries.
Voluphone.—Wharfedale Wireless Works. M.C. headphone.

Wanderfuse.—Belling and Lee, Ltd. Wander-plug with fuse.
Warwick.—Reproducers and Amplifiers, Ltd. P.M. cabinet speaker for relay operation.
Watmel.—Watmel Wireless Co., Ltd. Components.
Wavemaster.—Webb Condenser Co., Ltd.
Waveola.—Aladdin Gramophone and Accessories Co. Amplifiers.
Waverley.—M. Sanger and Son. L.T. accumulators and covered aerial wire.
Wayfarer.—London Electric Appliances, Ltd. Portable midget receivers.
Webber.—R. A. Rothermel, Ltd. Oscillators.
Wego.—Wego Condenser Co., Ltd. Condensers.
Westbury-Ware.—Reliance Mfg. Co. (Southwark) Ltd. Mouldings.
Westector.—Westinghouse Brake and Signal Co., Ltd. H.F. metal rectifier.
Westinghouse.—Westinghouse Brake and Signal Co., Ltd. Metal rectifiers and battery chargers.
Westmor.—Quadrant Carbon and Metal Products, Ltd. Resistors.
Westric.—Westinghouse Brake and Signal Co., Ltd. Car battery chargers.
Weston.—Weston Electrical Instrument Co., Ltd. Measuring instruments.
Whale.—Ellison Insulations, Ltd.
William and Mary.—Halford Distributors, Ltd. Receivers and radiograms.
Wilson.—Radio-Electric Products Co.
Winner.—Ever-Ready Co. (Gt. Britain), Ltd. H.T. and G.B. dry batteries.
Wirelect.—Wireless Electric (Wholesale), Ltd. Aerial wire and accumulators.
Wirt.—Amerad (Gt. Britain), Ltd. Volume controls.
Wisi.—P. M. Lawrence. Aerial and earth equipment.
Wurlitzer.—Wurlitzer Lyric Radio, Ltd. Receivers.
W.B.—Walter Balmford, Ltd. General mark.
W.B.—Whitcley Electrical Radio Co., Ltd. General trade mark.

Yaxley.—R. A. Rothermel, Ltd. Wave change switches.
Yeoman.—Hillman Bros., Ltd. H.T. and G.B. batteries.

Zenite.—Zenith Electric Co., Ltd. Embedded resistance unit.
Zenith.—Zenith Electric Co., Ltd. General mark.
Zenohm.—Zenith Elec. Co., Ltd. Heavy duty strip resistance units and regulators for furnace and speed control.
Zetavox.—Radio Service and Television, Ltd. Receivers and radiograms.
Zeva.—Automatic Coil Winder and Electrical Equipment Co., Ltd. Electric soldering iron.
Zwietusch.—Siemens Schuckert (Gt. Britain), Ltd. Condensers and factory conveyers.

RADIO PRODUCTS SUPPLIED

ACCUMULATORS, L.T. and H.T.

A.E.F. Mfg. Co.
Accumulators Elite.
Barnard Accumulator Co.
Batteries, Ltd.
Block Batteries, Ltd.
Britannia Batteries, Ltd.
Camel Accumulators, Ltd.
Chloride Elec. Storage Co., Ltd.
Chorlton Metal Co., Ltd.
Cossor, Ltd., A.C.
Edison Storage Battery Distributors, Ltd.
Edison Swan Electric Co., Ltd.
Efandem Co., Ltd.
Eon Vacuum Wireless Co.
Ever Ready Co. (Great Britain), Ltd.
Fuller Accumulator Co. (1926), Ltd.
General Electric Co., Ltd.
Gilbert & Co., Ltd., C.
Grosvenor Electric Batteries, Ltd.
Hellesens, Ltd.
Kolster-Brandes, Ltd.
Lissen, Ltd.
Lithanode Co., Ltd.
Lugton & Co., Ltd.
Manufacturers Accessories Co. (1928), Ltd.
Milnes Radio, Ltd.
Oldham & Son, Ltd.
Peto & Radford.
Price & Co. (M/C), Ltd.
Radenite Batteries, Ltd.
Richardsons (R.M.L.), Ltd.
Riddiough & Son, F.
Siemens Elec. Lamps & Supplies Co., Ltd.
Smith & Son (M/A), Ltd., S.
Three Star Accumulators, Ltd.
Wood, E. A.
Young Accumulator Co. (1929), Ltd.

ACCUMULATOR ACID.

Barnard Accumulator Co.
Riley & Sons, Ltd., John.
Wireless Elec. (Wholesale), Ltd.

ACCUMULATOR CARRIERS.

Barnard Accumulator Co.
Diehl, H.
Elliotts O'Maryport.
Smith & Sons (M/A), Ltd., S.

ACCUMULATOR CHARGERS, A.C. and D.C.

Baty, E. J.
British Rectifiers Eng. Co.
Clarke & Co. (M/C), Ltd., H.
Correx Amplifiers.
Crypton Equipment, Ltd.
Davis, L. W.
Diggle & Co., Ltd., A.
Eagle Engineering Co., Ltd.
Electro Dynamic Construction Co., Ltd.
Elliotts O'Maryport.
Eon Vacuum Wireless Co.
General Electric Co., Ltd.
Heayberd & Co., F.C.
Higgs Motors, Ltd.
Meritus (Barnet), Ltd.
Partridge, Wilson & Co., Ltd.
Philips Industrial (Philips Lamps, Ltd.).
Smurthwaite, Ltd., F. W.
Sound Sales, Ltd.
Static Condenser Co.
Tannoy Products.
Trix Electrical Co., Ltd.
Ward & Goldstone, Ltd.
Westinghouse Brake & Signal Co., Ltd.
Zenith Elec. Co., Ltd.

ACCUMULATOR PARTS AND ACCESSORIES.

A.E.F. Mfg., Co.
Barnard Accumulator Co.
Collie & Co., J. H.
Cookson & Co.
Lithanode Co., Ltd.
Radenite Batteries, Ltd.
Richardsons (R.M.L.), Ltd.
Smith & Sons (M/A), Ltd., S.
Three Star Accumulators, Ltd.

ADAPTORS, VALVE.

Advance Components, Ltd.
Aerialite, Ltd.
Belling & Lee, Ltd.
Bulgin & Co., Ltd., A. F.
Chorlmet Radio Elec., Ltd.
Elliott Radio Mfg. Co., Ltd.
Farrex Radio, Ltd.
General Electric Co., Ltd.
Harrison & Co., A.T.
Henry Ford Radio, Ltd.
Lectro Linx, Ltd.
Lissen, Ltd.
Lyons, Ltd., C.
McLeod & McLeod, Ltd.
Tannoy Products.
Unit Radio.

AERIALS (frame, indoor and portable).

Aerialite, Ltd.
Altham Radio Co.
Amplion (1932), Ltd.
Anti Static Installation, Ltd.
Beethoven Radio, Ltd.
British Blue Spot Co., Ltd.
British Pix Co., Ltd.
British Radiophone, Ltd.
British Television Supplies.
Bulgin & Co., Ltd., A. F.
Castagnoli, G.
Chorlmet Radio Elec., Ltd.
Concordia Elec. Wire Co., Ltd.
Daly, H. C.
Davis, L. W.
Eastick & Sons, J. J.
Elliotts O'Maryport.
Elvy, C. L.
Farrex Radio, Ltd.
Franklin Elec. Co., Ltd.
Gilbert & Co., Ltd., C.
His Master's Voice.
International Majestic Radio Corp., Ltd.
Ivory Electric, Ltd.
Kniveton Cable Works, Ltd.
Laker Co., Ltd., J. & J.
Lawrence, P. M.
Lissen, Ltd.
London Elec. Mfg. Co., Ltd.
Lugton & Co., Ltd.
Metal Agencies Co., Ltd.
Price & Co. (M/C), Ltd.
Pye Radio, Ltd.
Radio Elec. Products Co.
Reliance Elec. Wire Co., Ltd.
Stratton & Co., Ltd.
Toubkin, J.
Transreceivers, Ltd.
Wright & Weaire, Ltd.

BATTERIES (dry).

Aerialite, Ltd.
Atlas Carbon & Battery Co., Ltd.
Britannia Batteries, Ltd.
British G.W.Z. Battery Co., Ltd.
Burgess Products Co., Ltd.
Burndept, Ltd.
Chloride Electrical Storage Co., Ltd.
Chorlton Metal Co., Ltd.
Cossor, Ltd., A. C.
Eagle Engineering Co., Ltd.
Efandem Co., Ltd.
Eon Vacuum Wireless Co.
Ever Ready Co. (Great Britain), Ltd.
Fuller Accumulator Co. (1926), Ltd.

PRODUCTS SUPPLIED

General Electric Co., Ltd.
Gilbert & Co., Ltd., C.
Grosvenor Electric Batteries, Ltd.
Hellesens, Ltd.
Kolster-Brandes, Ltd.
Lissen, Ltd.
Marconiphone Co., Ltd.
Oldham & Son, Ltd.
Price & Co. (M/C), Ltd.
Primus Mfg. Co.
Riddiough & Son, F.
Siemens Electric Lamps & Supplies, Ltd.
Sterling Batteries, Ltd.
Three Star Accumulators, Ltd.
Toubkin, J.
Victor Battery Co.
Vidor, Ltd.
Vulco Dry Battery Co., Ltd.
Wood, E. A.

BOBBINS (headphone, loudspeaker or transformer).

Advance Components, Ltd.
Amplion (1932), Ltd.
Bromley-Langton Electric Wire & Insulator Co., Ltd.
Bulgin & Co., Ltd., A. F.
Chorlmet Radio Elec., Ltd.
Correx Amplifiers.
Davis, L. W.
Elvy, C. L.
General Electric Co., Ltd.
General Mouldings Co., Ltd.
Goodmans Industries, Ltd.
Harrison & Co., A. T.
Healey Mouldings, Ltd.
Ivory Electric, Ltd.
Lechner & Co., Ltd., F. W.
Lissen, Ltd.
London Transformer Products, Ltd.
McLeod & McLeod.
Millet, J.
Radio Development Co.
Sound Sales, Ltd.
Sturdy Elec. Co.
Tannoy Products.
Trix Electrical Co., Ltd.
Weedon's Radio Repair Service.
Whiteley Elec. Radio Co., Ltd.

CABINETS (wood).

Ace Radio.
Allied Elec. & Furniture Industries.
Ambassador Radio Gramophones,
Bond & Sons, Ltd.
British East Light, Ltd.
Carrington Mfg. Co.
Castagnoli, G.
City Accumulator Co.
Doherty & Sons, E.
Eagle Engineering Co., Ltd.
Elliott Radio Mfg. Co., Ltd.
Elliotts O'Maryport.
Elvy, C. L.
Empiric, Ltd.
Eon Vacuum Wireless Co.
E.M.G. Handmade Gramophones, Ltd.
Ferranti, Ltd.
Gilbert & Co., Ltd., C.
Halford Distribution, Ltd.
Holmes Bros. (London), Ltd.
Joseph, H.
Lissen, Ltd.
Lock, Ltd., W. & T.
Lugton & Co., Ltd.
Margolin, J. & A.
Montague, Ltd., S. & D.
Northampton Plating Co.
Ramsey, F. W.
Regent Fittings Co.
Self-Changing Gramophones, Ltd.
Unit Radio.
Waterhouse, F.
Whiteley Elec. Radio Co., Ltd.
Wood, E. A.

CABINETS (moulded).

Cole, Ltd., E. K.
Ferranti, Ltd.
General Electric Co., Ltd.
General Mouldings Co., Ltd.
Healey Mouldings, Ltd.
Lissen, Ltd.
Lukely Engineering & Moulding Co., Ltd.
Montague, Ltd., S. & D.
Whiteley Elec. Radio Co., Ltd.

CAR RADIO.

Altham Radio Co.
Beethoven Radio, Ltd.
British Belmont Radio, Ltd.
Castagnoli, G.
Chorlton Metal Co., Ltd.
City Accumulator Co.
Cole, Ltd., E. K.
Davis, L. W.
Electro Dynamic Construction Co., Ltd.
Empiric, Ltd.
Eon Vacuum Wireless Co.
Ferranti, Ltd.
General Electric Co., Ltd.
Henry Ford Radio, Ltd.
International Majestic Radio Corp., Ltd.
Kolster-Brandes, Ltd.
Marconiphone Co., Ltd.
Philco, Ltd.
Philips Lamps, Ltd.
Price & Co. (M/C), Ltd.
Trix Electrical Co., Ltd.

CAR RADIO SUPPRESSION EQUIPMENT.

Cole, Ltd., E. K.
Dubilier Condenser Co. (1935), Ltd.
Elliott Radio Mfg. Co., Ltd.
Elliotts O'Maryport.
Eon Vacuum Wireless Co.
Ferranti, Ltd.
General Electric Co., Ltd.
International Majestic Radio Corp., Ltd.
Kolster-Brandes, Ltd.
Lyons, Ltd., Claude.
Static Condenser Co.
Tannoy Products.
Toubkin, J.
Transreceivers, Ltd.
Ward & Goldstone, Ltd.

CATHODE RAY TUBES.

Anglo-American Industries Corp.
Cossor, Ltd., A. C.
Edison Swan Electric Co., Ltd.
Ferranti, Ltd.
General Electric Co., Ltd.
Henry Ford Radio, Ltd.
Lyons, Ltd., Claude.
Marconiphone Co., Ltd.
Mullard Radio Valve Co., Ltd.
Mullard Wireless Service Co., Ltd.
Standard Telephones & Cables, Ltd.

CHATTERTON'S COMPOUND.

British Insulated Cables, Ltd.
Bromley-Langton Elec. Wire & Insulator Co., Ltd.
Clarke & Co., (M/C), Ltd., H.
General Electric Co., Ltd.
Kniveton Cable Works, Ltd.
Pomona Rubber Co.

CHOKES.

Advance Components, Ltd.
Aerodyne Radio, Ltd.
Aeronautical & General Instruments, Ltd.
Altham Radio Co.
Amplion (1932), Ltd.
Beethoven Radio, Ltd.
Belling & Lee, Ltd.
Benjamin Electric, Ltd.
Birmingham Sound Reproducers, Ltd.
British Rola Co., Ltd.
British Television Supplies, Ltd.
Bryce & Co., W. Andrew.
Bulgin & Co., Ltd., A. F.
Burne Jones & Co., Ltd.
Castagnoli, G.
Chorlmet Radio Elec., Ltd.
Clarke & Co. (M/C), Ltd.
Climax Radio Electric, Ltd.
Correx Amplifiers.
Eagle Engineering Co., Ltd.
Elliott Radio Mfg. Co., Ltd.
Elliotts O'Maryport.
Farrex Radio, Ltd.
Ferranti, Ltd.
Film Industries, Ltd.
Formo Products, Ltd.
General Electric Co., Ltd.
Goodmans Industries, Ltd.
Graham Farish, Ltd.
Grampian Reproducers, Ltd.
Harrison & Co., A. T.
Haynes Radio, Ltd.
Heayberd & Co., F. C.
Igranic Radio Electric, Ltd.
Ivory Electric, Ltd.
Kingsway Electricals, Ltd.
Lissen, Ltd.
London Transformer Products, Ltd.
Lyons, Ltd., Claude.
Mervyn Sound and Vision Co., Ltd.
Metal Agencies, Ltd.
Multitone Elec. Co., Ltd.
Novo Radio (1935), Ltd.
Partridge, N.
Partridge, Wilson & Co., Ltd.
Radio Development Co.
Radiovox Wireless Services, Ltd.
Regentone Products, Ltd.
Reproducers & Amplifiers, Ltd.
Rich & Bundy, Ltd.
Robsons Trade Radio Services.
Savage, W. B., Ltd.
Sifam Elec. Instrument Co., Ltd.
Sound Sales, Ltd.
Stratton & Co., Ltd.
Sturdy Elec. Co.
Tannoy Products.
Trix Electrical Co., Ltd.
Varley.
Waterhouse, Ltd., F.
Webber, Ltd., R. A.
Weedon's Radio Repair Service.
Whiteley Electrical Radio Co., Ltd.
Wright & Weaire, Ltd.
Zenith Elec. Co., Ltd.
Zetavox.

COILS.

Advance Components, Ltd.
Aerodyne Radio, Ltd.
Aeronautical & General Instruments, Ltd.
Allied Elec. and Furniture Inds.
Altham Radio Co.
Amplion (1932), Ltd.
Beethoven Radio, Ltd.
Berclif, Ltd.
British Ferrocart Co., Ltd.
British Radiophone, Ltd.
British Television Supplies, Ltd.
Bulgin & Co., Ltd., A. F.
Burne-Jones & Co., Ltd.
Castagnoli, G.
Chorlmet Radio Elec., Ltd.
Eagle Engineering Co., Ltd.
Elliott Radio Mfg. Co., Ltd.
Elliotts O'Maryport.
Evington Elec. Mfg. Co.
Farrex Radio, Ltd.
Formo Products, Ltd.
General Electric Co., Ltd.
Graham Farish, Ltd.
Harrison & Co., A. T.
Henry Ford Radio, Ltd.
Igranic Elec. Co., Ltd.
Ivory Electric, Ltd.
Lissen, Ltd.
Northampton Plating Co.
Novo Radio (1935), Ltd.
Parsonage, W. F.
Plessey Co., Ltd.
Radio Development Co.
Rothermel, Ltd., R. A.
Sound Sales, Ltd.
Stratton & Co., Ltd.
Tannoy Products.
Varley.
Ward & Goldstone, Ltd.
Weedon's Radio Repair Service.
Whiteley Elec. Radio Co., Ltd.
Wright & Weaire, Ltd.
Zetavox.

COIL WINDING MACHINES.

Anglo-American Industries Corp.
Lawrence, P. M.
Plessey Co., Ltd.
Whitelegg, F.

CONDENSERS (fixed).

Altham Radio Co.
Amplion (1932), Ltd.
British Insulated Cables, Ltd.
British N.S.F. Co., Ltd.
Bryce & Co., W. A.
Bulgin & Co., Ltd., A. F.
Chorlmet Radio Elec., Ltd.
Daly, H. C.
Davis, L. W.
Dubilier Condenser Co. (1925), Ltd.
Ferranti, Ltd.
Formo Products, Ltd.

PRODUCTS SUPPLIED

Franklin Elec. Co., Ltd.
Graham Farish, Ltd.
Hunt, Ltd., A. H.
International Majestic Radio Corp., Ltd.
Ivory Electric, Ltd.
Lechner & Co., Ltd., F. W.
Lissen, Ltd.
London Elec. Mfg. Co., Ltd.
Millet, J.
Muirhead & Co., Ltd.
Radio Development Co.
Savage, W. B., Ltd.
Static Condenser Co.
Supremus Specialities, Ltd.
Telegraph Condenser Co., Ltd.
Telephone Mfg. Co., Ltd.
Wego Condenser Co., Ltd.
Wingrove & Rogers, Ltd.

CONDENSERS (electrolytic).

Altham Radio Co.
British Insulated Cables, Ltd.
British N.S.F. Co., Ltd.
British Radiophone, Ltd.
Bryce & Co., W. A.
Bulgin & Co., Ltd., A. F.
Chorlton Metal Co., Ltd.
Daly, H. C.
Dubilier Condenser Co. (1925), Ltd.
Ferranti, Ltd.
Franklin Elec, Co. Ltd.
Henry Ford Radio, Ltd.
Hunt, Ltd., A. H.
International Majestic Radio Corp., Ltd.
London Elec. Mfg. Co., Ltd.
Millet, J.
Norman Rose Electrical, Ltd.
Plessey Co., Ltd.
Radio Development Co.
Rothermel, Ltd., R. A.
Telegraph Condenser Co., Ltd.
Telephone Mfg. Co., Ltd.
Toubkin, J.
Wingrove & Rogers, Ltd.

CONDENSERS (variable).

Anglo American Industries Corp.
Altham Radio Co.
Bird & Sons, Sidney S.
British Pix Co., Ltd.
British Radiophone, Ltd.
British N.S.F. Co., Ltd.
Bulgin & Co., Ltd., A. F.
Burne-Jones & Co., Ltd.
Castagnoli, G.
Chorlmet Radio Elec., Ltd.
Chorlton Metal Co., Ltd.
Ferranti, Ltd.
Formo Products, Ltd.
Franklin Elec. Co., Ltd.
Graham Farish, Ltd.
Henry Ford Radio, Ltd.
Ivory Electric, Ltd.
Jackson Bros. (London), Ltd.
Lissen, Ltd.
Morton, Ltd., E. R.
Muirhead & Co., Ltd.
Plessey Co., Ltd.
Quartz Crystal Co., Ltd.
Reliance Mfg. Co. (Southwark), Ltd.
Rothermel, Ltd., R. A.
Stratton & Co.
Trix Electrical Co., Ltd.
Webb Condenser Co., Ltd.
Wilkins & Wright, Ltd.
Williams & Moffat, Ltd.
Wingrove & Rogers, Ltd.

CRYSTAL (quartz oscillating).

Altham Radio Co.
Brookes Measuring Tools.
Empiric, Ltd.
Eves Radio, Ltd.
Hilger, Ltd., Adam.
Imp. Radio Co.
Millet, J.
Quartz Crystal Co., Ltd.
Toubkin, J.

DEAF AIDS.

Ardente Acoustic Laboratories.
British Television Supplies, Ltd.
Bulgin & Co., Ltd., A. F.
Cole, Ltd., E. K.
Distavox Radio.
Elvy, C. L.
Empiric, Ltd.
Film Industries, Ltd.
Kingsway Electricals, Ltd.
Multitone Elec. Co., Ltd.
Ossicaide, Ltd.
Prism Mfg. Co.
Radiovox Wireless Services, Ltd.
Reliance Mfg. Co. (Southwark), Ltd.
Rothermel, Ltd., R. A.
Tannoy Products.
Transreceivers, Ltd.
Wharfdale Wireless Works.

DIAPHRAGMS (headphone and speaker).

Amplion (1932), Ltd.
Ferranti, Ltd.
Film Industries, Ltd.
General Electric Co., Ltd.
Goodmans Industries, Ltd.

EARTH TUBES (plates, mats and clips).

Aerialite, Ltd.
Altham Radio Co.
British Blue Spot Co., Ltd.
British Insulated Cables, Ltd.
British Pix Co., Ltd.
Chorlton Metal Co., Ltd.
Climax Radio Electric, Ltd.
Francois, E. J.
General Electric Co., Ltd.
Gilbert & Co., Ltd., A.
Ivory Electric, Ltd.
Kniveton Cable Works, Ltd.
Laker Co., Ltd., J. & J.
Lawrence, P. M.
Lilley & Son. Ltd., S.
Manufacturers' Accessories (1928), Ltd.
Millet, J.
Price & Co. (M/c), Ltd.
Richardson's (R.M.L.), Ltd.
Toubkin, J.
Trix Electrical Co., Ltd.
Ward & Goldstone, Ltd.
Watmel Wireless Co., Ltd.
Wright & Weaire, Ltd.

ELECTRO-PLATING.

Ferranti, Ltd.
General Electric Co., Ltd.
Telephone Manufacturing Co., Ltd.
Whiteley Electrical Radio Co.

ENGRAVING.

Burne-Jones & Co., Ltd.
Castagnoli, G.
Cellgrave Co.
Celluloid Printers, Ltd.
Dyson & Co., Ltd., J.
H.S.P. Wireless Co.
Jeacocks.
Stebbings, J. R.
Stilwell & Sons.
United Chemical Engraving Co., Ltd.

ENGRAVING MACHINES.

Davis L. Westacolt.
Ward & Goldstone, Ltd.

FITTINGS FOR CABINETS,

Aladdin Gramophone Accessories Co.
Beddoes Ltd., J. G.
Lilley & Son, Ltd., S.
Margolin, J. & A.
Regent Fittings Co.
Whiteley Electrical Radio Co.

FUSES.

Advance Components, Ltd.
Altham Radio Co.
Amplion (1932), Ltd.
Belling & Lee, Ltd.
Beswick, Ltd., K. E.
Bromley-Langton Electric Wire & Insulator Co., Ltd.
Bulgin & Co., Ltd.
Chorlton Metal Co., Ltd.
Collett Manufacturing Co., S. H.
Crabtree & Co., Ltd., J. A.
Franklin Electric Co., Ltd.
General Electric Co., Ltd.
Ivory Electric, Ltd.
Lawrence, P. M.
Lawrence & Bray.
Lechner & Co., Ltd., F. W.
Lissen, Ltd.
McLeod & McLeod, Ltd.
Millet, J.
Reliance Mfg. Co. (Southwark), Ltd.
Siemens Electric Lamps & Supplies, Ltd.
Sifam Electrical Instrument Co., Ltd.
Ward & Goldstone, Ltd.

GENERATORS (rotary).

Crypton Equipment, Ltd.
Electro-Dynamic Construction Co., Ltd.
General Electric Co., Ltd.
Mortley Sprague & Co., Ltd.
Newton Bros. (Derby), Ltd.
Rothermel, Ltd., R. A.

HEADPHONES.

Altham Radio Co.
Ardente Acoustic Laboratories.
British Television Supplies, Ltd.
Chorlton Metal Co., Ltd.
Cole, Ltd., E. K.
Edison Swan Electric Co., Ltd.
Ericsson Telephones, Ltd.
General Electric Co., Ltd.
Goodmans Industries, Ltd.
Ivory Electric, Ltd.
Kolster-Brandes, Ltd.
Lissen, Ltd.
McMillan & Co., J.
Millet, J.
Multitone Electric Co., Ltd.
Price & Co. (M/C), Ltd.
Regent Fittings Co.
Rothermel, Ltd., R. A.
Toubkin, J.
Ward & Goldstone, Ltd.
Wharfedale Wireless Works.

HETERODYNE FILTERS.

Advance Components Ltd.
British Television Supplies, Ltd.
Bulgin & Co., Ltd., A. F.
Sound Sales, Ltd.

HOME RECORDING APPARATUS.

Ardente Acoustic Laboratories.
Cosmocord, Ltd.
Holiday & Hemmerdinger.
Kingsway Electricals, Ltd.
Prism Mfg. Co.
Radiovox Wireless Services, Ltd.
Sound Sales, Ltd.
Trix Electrical Co., Ltd.

INSULATING MATERIALS.

Altham Radio Co.
Bakelite, Ltd.
Belling & Lee, Ltd.
British Insulated Cables, Ltd.
Bromley-Langton Electric Wire & Insulator Co., Ltd.
Clarke & Co. (M/C), Ltd., H.
Concordia Electric Wire Co., Ltd.
De La Rue & Co., Ltd.
Ellison Insulations. Ltd.
Elvy, C. L.
Ferranti, Ltd.
General Electric Co., Ltd.
General Mouldings Co., Ltd.
Harrison & Co., A. T.
Healey Mouldings, Ltd.
Lawrence, P. M.
Lectro Linx, Ltd.
McLeod & McLeod, Ltd.
Maul & Murphy, Ltd.
Micanite & Insulators Co., Ltd.
Pomona Rubber Co.
Quartz Crystal Co., Ltd.
Radio Development Co.
Riddiough & Son, F.
Rothermel, Ltd., R. A.
Scott & Co., Ltd., G. L.
Siemens Elec. Lamps & Supplies. Ltd.
Steatite & Porcelain Products, Ltd.
Stratton & Co., Ltd.

INTERFERENCE SUPPRESSORS.

Anti-Static Installations, Ltd.
Belling & Lee, Ltd.
British Insulated Cables, Ltd.
British Pix Co., Ltd.
British N.S.F. Co., Ltd.
Bulgin & Co., Ltd., A. F.

PRODUCTS SUPPLIED

Chorlmet Radio Elec., Ltd
Cooper & Son (Wolverhampton), Ltd., R.
Distavox Service & Television Co.
Dubilier Condenser Co. (1925), Ltd.
Elliotts O'Maryport.
Franklin Electric, Ltd.
General Electric Co., Ltd.
Hunt, Ltd., A. H.
Kolster-Brandes, Ltd.
Meritus (Barnet), Ltd.
Muirhead & Co., Ltd.
Radio Development Co.
Radio Resistor Co.
Sifam Electrical Instrument Co., Ltd.
Tannoy Products.
Telegraph Condenser Co., Ltd.
Trix Electrical Co., Ltd.
Wego Condenser Co., Ltd.

LABORATORY INSTRUMENTS.

Aerodyne Radio, Ltd.
Birmingham Sound Reproducers, Ltd.
Cambridge Instrument Co., Ltd.
Chorlmet Radio Elec., Ltd.
Cole, Ltd., E. K.
Cossor, Ltd., A. C.
Ferranti, Ltd.
General Electric Co., Ltd.
Goodmans Industries, Ltd.
London Electrical Mfg. Co., Ltd.
Lyons, Ltd., Claude.
Muirhead & Co., Ltd.
Plessey Co., Ltd.
Quartz Crystal Co.
Robsons Trade Radio Service.
Rothermel, Ltd., R. A.
Salford Electrical Instruments, Ltd.
Tannoy Products.
Time Switches & Instruments, Ltd.
Waterhouse, Ltd., F.
Weston Electrical Instrument Co., Ltd.

LEAD-IN TUBES.

Altham Radio Co.
British Insulated Cables, Ltd.
Bulgin & Co., Ltd., A. F.
Castle Fuse & Engineering Co., Ltd.
Chorlton Metal Co., Ltd.
Coates, Ltd., J. G.
Clifford Pressland (Sales), Ltd.
Francois, E. J.
General Electric Co., Ltd.
Ivory Electric, Ltd.
Laker Co., Ltd., J. & J.
Lawrence, P. M.
Lilley & Son, Ltd., S.
Pioneer Mfg., Co.
Price & Co. (M/C), Ltd.
Radio Development Co.
Richardsons (R.M.L.), Ltd.
Sparkes & Co., J.
Stratton & Co., Ltd.
Trix Electrical Co., Ltd.
Ward & Goldstone, Ltd.
Wright & Weaire, Ltd.

LIGHTNING ARRESTERS.

British Pix Co., Ltd.
Bulgin & Co., Ltd., A. F.
Castagnoli, G.
Christie & Sons, Ltd., Jas.
Clifford Pressland (Sales) Ltd.
Formo Products, Ltd.
General Electric Co., Ltd.
Graham Farish, Ltd.
Ivory Electric, Ltd.
Laker Co., Ltd., J. & J.
Lawrence, P. M.
Lissen, Ltd.
Millet, J.
Philips Lamps, Ltd.
Pioneer Mfg., Co.
Price & Co. (M/C), Ltd.
Ward & Goldstone, Ltd.

MAINS SUPPLY UNITS, A.C. and D.C.

Anti Static Installation, Ltd.
British Radiophone, Ltd.
Chorlmet Radio Elec. Ltd.
Chorlton Metal Co., Ltd.
Clarke & Co. (M/C), Ltd., H.
Cole, E. K., Ltd.
Climax Radio Electric, Ltd.
Dyson & Co. (Works), Ltd., J.
Eagle Engineering Co., Ltd.
Elliotts O'Maryport.
Evrizone Radio and Television Co., Ltd.
Farrex Radio, Ltd.
General Electric Co., Ltd.
Heayberd & Co., F. C.
Lissen, Ltd.
Meritus (Barnet), Ltd.
Mervyn Sound & Vision Co., Ltd.
Price & Co. (M/C), Ltd.
Regentone Products, Ltd.
Smurthwaite, Ltd., F. W.
Sound Sales, Ltd.
Stratton & Co., Ltd.
Supreme Specialities, Ltd.
Tannoy Products.
Trix Electrical Co., Ltd.
Westinghouse Brake & Signal Co., Ltd.
Whiteley Electrical Radio Co., Ltd.

METERS.

Aerialite, Ltd.
Anglo-American Industries Corpn.
Bulgin Co., Ltd., A. F.
Cambridge Instrument Co., Ltd.
Chorlmet Radio Elec., Ltd.
Chorlton Metal Co., Ltd.
Cole, Ltd., E. K.
Everett, Edgcumbe & Co.
Ferranti, Ltd.
General Electric Co., Ltd.
Healey, Ltd., P.
Ivory Electric. Ltd.
Lyons, Ltd., Claude.
McMillan & Co., J.
Millet, J.
Price & Co. (M/C), Ltd.
Pye Radio, Ltd.
Robsons Trade Radio Service.
Runbaken Products.
Salford Electrical Instruments, Ltd.
Siemens Electric Lamps & Supplies, Ltd.
Sifam Electrical Instrument Co., Ltd.
Stadium, Ltd.
Weston Electrical Instrument Co., Ltd.
Wilkinson, L.

MICROPHONES.

Amplion (1932), Ltd.
Ardente Acoustic Laboratories.
Bowyer-Lowe & A.E.O., Ltd.

The M.R. PIEZO-CRYSTAL MICROPHONE is a high-fidelity instrument which is acknowledged to be a technical triumph. The combination of the special Rochelle crystal element with the unique housing of solid magnesian stone produces a microphone which is remarkable for its extremely wide frequency response, complete absence of background and fine appearance. Neither transformer nor energising current are required. Here is a real "class" microphone at a moderate price. Write for List MR/PC.

List No. MR/223

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M·R PIEZO-CRYSTAL MICROPHONE

(Manufactured by arrangement with R. A. Rothermel Ltd., utilising Brush Development Co.'s patents.)

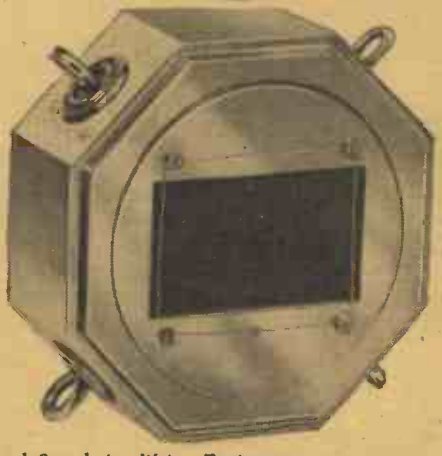
TWO OF THE MOST POPULAR MICROPHONES IN THE WORLD

M·R TRANSVERSE CURRENT MICROPHONE

The M.R. TRANSVERSE CURRENT MICROPHONE has probably the greatest sale of all carbon microphones produced in this country and it has long been a most popular member of the famous M.R. range. The instrument is precision built to a laboratory standard, the housing being a highly-finished special alloy casting, robust and enduring, making the microphone particularly suitable for all forms of Public Address work. Practically the whole of the audio-scale is reproduced within 3 db. Write for list MR/1436.

List No. MR/204

Price £2.15.0



M.R. SUPPLIES

Manufacturers of Microphones and Sound Amplifying Equipment,

11, NEW OXFORD ST., LONDON, W.C.1. (Telephone: HOLborn 7058)

PRODUCTS SUPPLIED

British Television Supplies, Ltd.
Bulgin & Co., Ltd., A. F.
Castagnoli, G.
Chorlmet Radio Elec., Ltd.
Chorlton Metal Co., Ltd.
Cooper & Son (Wolverhampton), Ltd., R.
Correx Amplifiers.
Cosmocord, Ltd.
Edison Swan Electric Co., Ltd.
Eon Vacuum Wireless Co.
Epoch Reproducers, Ltd.
Farrex Radio, Ltd.
Film Industries, Ltd.
Forbat, E.
General Electric Co., Ltd.
Goodmans Industries, Ltd.
Grampian Reproducers, Ltd.
Heayberd & Co., F. C.
Igranic Electric Co., Ltd.
Ivory Electric, Ltd.
Lyons, Ltd., Claude.
M.R. Supplies.
Magnaphone Production Co.
Marconiphone Co., Ltd.
Prism Mfg. Co.
Radio-Electric Products Co.
Radio Gramophone Development Co., Ltd.
Radiovox Wireless Services, Ltd.
Rothermel, Ltd., R. A.
Savage, Ltd., W. B.
Scientific Supply Stores (Wireless), Ltd.
Shaftesbury Microphones, Ltd.
Sound Sales, Ltd.
Tannoy Products.
Transreceivers, Ltd.
Trix Electrical Co., Ltd.
Truvoice, Ltd.
Voigt Patents, Ltd.
Waterhouse, Ltd., F.
Webber, Ltd., R. A.
Wharfedale Wireless Works.
Whiteley Electrical Radio Co., Ltd.

MOTOR AND PICK-UP UNITS.

Aladdin Gramophone & Accessories Co.
Collaro, Ltd.
Cosmocord, Ltd.
General Electric Co., Ltd.
London Electrical Mfg. Co., Ltd.
Regent Fittings Co.
Telephone Mfg. Co., Ltd.

MOTORS (gramophone, electric).

Aladdin Gramophone & Accessories Co.
Collaro, Ltd.
Cosmocord, Ltd.
Garrard Engineering & Manufacturing Co., Ltd.
General Electric Co., Ltd.
Kingsway Electricals, Ltd.
London Electrical Mfg., Co., Ltd.
Margolin, J. & A.
Regent Fittings Co.
Wood, E. A.

MOTORS (gramophone spring).

Aladdin Gramophone & Accessories Co.
Collaro, Ltd.
Diehl, H.
Garrard Engineering & Manufacturing Co., Ltd.
Lugton & Co., Ltd.
Margolin, J. & A.
Regent Fittings Co.
Wood, E. A.

MOULDINGS.

Bowyer-Lowe & A.E.D., Ltd.
Bulgin & Co., Ltd., A. F.
Charlesworth Mouldings, Ltd.
Clarke & Co. (M/C), Ltd., H.
Cole, Ltd., E. K.
De-La-Rue & Co., Ltd., Thos.
Elvy, C. L.
Ferranti, Ltd.
General Electric Co., Ltd.
General Mouldings Co., Ltd.
Harrison & Co., A. T.
Healey, Ltd., P.
Healey Mouldings, Ltd.
Kolster-Brandes, Ltd.
Lissen, Ltd.
London Electrical Mfg., Co., Ltd.
Maul & Murphy, Ltd.
McLeod & McLeod, Ltd.
Pooley, G. J.
Radiamp Co., Ltd.
Reliance Mfg. Co. (Southwark), Ltd.
Stratton & Co., Ltd.
Telephone Mfg., Co., Ltd.
Watmel Wireless Co., Ltd.
Whiteley Electrical Radio Co., Ltd.
Wilkins & Wright, Ltd.
Wright & Weaire, Ltd.

NEEDLES.

Aladdin Gramophones & Accessories Co.
British Needle Co., Ltd.
Brunswick, Ltd.
Decca Gramophone Co., Ltd.
Gilbert & Co., Ltd., C.
His Master's Voice.
Lugton & Co., Ltd.
Radiovox Wireless Services, Ltd.
Regent Fittings Co.
Scharf, E.

OSCILLATORS.

Advance Components, Ltd.
Aerodyne Radio, Ltd.
Beethoven Radio, Ltd.
Berclif, Ltd.
Birmingham Sound Reproducers, Ltd.
British Television Supplies, Ltd.
Bulgin & Co., Ltd., A. F.
Burne-Jones & Co., Ltd.
Cambridge Instrument Co., Ltd.
Castagnoli, G.
Cole, Ltd., E. K.
Correx Amplifiers.
Cossor, Ltd., A. C.
Elliotts O'Maryport.
Everett, Edgcumbe & Co., Ltd.
Ferranti, Ltd.
Haynes Radio, Ltd.
Henry Ford Radio, Ltd.
Lyons, Ltd., Claude.
Muirhead & Co., Ltd.
Plessey Co., Ltd.
Pye Radio, Ltd.
Quartz Crystal Co., Ltd.
Radio Development Co.
Robsons Trade Radio Service.
Rothermel, Ltd., R. A.
Salford Electrical Instruments, Ltd.
Tannoy Products.
Toubkin, J.
Weston Electrical Instrument Co., Ltd.
Wright & Weaire, Ltd.

PEDESTALS FOR SETS.

City Accumulator Co.
Eagle Engineering Co., Ltd.
Halford Distributors, Ltd.
Margolin, J. & A.
Richardson (R.M.L.), Ltd.
Waterhouse, Ltd., F.

PHOTO-ELECTRIC CELLS.

Anglo-American Industries Corporation.
Forbat, E.
General Electric Co., Ltd.
Lyons, Ltd., Claude.
Salford Electrical Instruments, Ltd.
Weston Electrical Instrument Co., Ltd.

PICK-UPS.

Aerialite, Ltd.
Aladdin Gramophone & Accessories Co.

Amplion (1932), Ltd.
Balcombe, Ltd., A. J.
Belling & Lee, Ltd.
Bowyer, Lowe & A.E.D., Ltd.
British Blue Spot Co., Ltd.
British Goldring Products, Ltd.
British Radiophone, Ltd.
Castagnoli, G.
Celestion, Ltd.
Chorlmet Radio Elec., Ltd.
Chorlton Metal Co., Ltd.
Collaro, Ltd.
Cosmocord, Ltd.
E.M.G. Hand-Made Gramophones, Ltd.
Formo Products, Ltd.
Garrard Engineering & Mfg. Co., Ltd.
General Electric Co., Ltd.
Graham Farish, Ltd.
Henry Ford Radio, Ltd.
His Master's Voice.
Ivory Electric, Ltd.
Kingsway Electricals, Ltd.
Kolster-Brandes, Ltd.
Lissen, Ltd.
London Electrical Mfg. Co., Ltd.
Lugton & Co., Ltd.
Lyons, Ltd., Claude.
Marconiphone Co., Ltd.
Margolin, J. & A.
Philips Lamps, Ltd.
Plessey Co., Ltd.
Price & Co. (M/C), Ltd.
Regent Fittings Co.
Rothermel, Ltd., R.A.
Scharf, E.
Tannoy Products.
Toubkin, J.
Varley.

PLAYING DESKS.

Ardente Acoustic Laboratories.
Balcombe, Ltd., A. J.
Beethoven Radio Ltd.
Bowyer Lowe & A.E.D., Ltd.
Castagnoli, G.
City Accumulator Co.
Cosmocord, Ltd.
Eagle Engineering Co., Ltd.
Elliott Radio Mfg. Co., Ltd.
E.M.G. Hand-Made Gramophones, Ltd.
General Electric Co., Ltd.
Grampian Reproducers, Ltd.
Haynes Radio, Ltd.
Kingsway Electricals, Ltd.
Margolin, J. & A.
Prism Mfg. Co.
Radiovox Wireless Services, Ltd.
Regent Fittings Co.
Savage, Ltd., W. B.
Smurthwaite, Ltd., F. W.
Tannoy Products.
Thompson Diamond & Butcher.
Trix Electrical Co., Ltd.
Waterhouse, Ltd., F.

PLUGS AND SOCKETS

Becker, Ltd., G.
Belling & Lee, Ltd.
Bulgin, Ltd., A. F.
Castle Fuse & Engineering Co., Ltd.
Crabtree, J. A. & Co., Ltd.
Eastick & Sons, J. J.
Francois, E. J.
Grafton Elec. Co.
Lawrence, P. M.
Lectro Linx, Ltd.
Lilley & Son, Ltd., S.
Lissen, Ltd.
Lundberg & Sons, Ltd., A.P.
Lystan Products, Ltd.
Millet, J.
Price & Co. (M/C), Ltd.
Richardsons (R.M.L.), Ltd.
True Screws, Ltd.
Ward & Goldstone, Ltd.
Watmel Wireless Co., Ltd.
Whiteley Electrical Radio Co., Ltd.

POTENTIOMETERS.

British Centralab, Ltd.
British Goldring Products, Ltd.
British Radiophone, Ltd.
Bulgin & Co., Ltd., A. F.
Burne-Jones & Co., Ltd.
Castagnoli, G.
Climax Radio Electric, Ltd.
Eagle Engineering Co., Ltd.
Erie Resistor, Ltd.
Ferranti, Ltd.
General Electric Co., Ltd.
Graham Farish, Ltd.
Haynes Radio, Ltd.
Igranic Electric Co., Ltd.
Ivory Electric, Ltd.
Lawrence, P. M.
Lechner & Co., Ltd., F. W.
Lissen, Ltd.
Lyons, Ltd., Claude.
Morgan Crucible Co., Ltd.
Partridge, Wilson & Co., Ltd.
Plessey Co., Ltd.
Reliance Mfg. Co. (Southwark), Ltd.
Scharf, E.
Tannoy Products.
Varley.
Waterhouse, Ltd., F.
Watmel Wireless, Ltd.
Wingrove & Rogers, Ltd.
Wright & Weaire, Ltd.

PUBLIC ADDRESS AND KINEMA EQUIPMENT.

Ardente Acoustic Laboratories.
Beethoven Radio, Ltd.

PRODUCTS SUPPLIED

Birmingham Sound Reproducers, Ltd.
Celestion, Ltd.
Correx Amplifiers.
Elec. Equip. & Carbon Co., Ltd.
Elliott Radio Mfg. Co., Ltd.
E.M.G. Hand-Made Gramophones, Ltd.
Factors (Nottingham), Ltd.
Farrex Radio Ltd.,
Ferranti, Ltd.
Film Industries, Ltd.
Forbat, E.
General Electric Co., Ltd.
Grampian Reproducers, Ltd.
Hacker & Sons, H.
Hartley Turner Radio, Ltd.
Haynes Radio, Ltd.
Heayberd & Co., F. C.
Holiday & Hemmerdinger.
Kingsway Electricals, Ltd.
Kolster-Brandes, Ltd.
Lyons, Ltd., Claude.
Magnaphone Production Co.
Marconiphone Co., Ltd.
Metal Agencies Co., Ltd.
Metropolitan Radio Service Co,
Midgley Harmer, Ltd.
M.R. Supplies.
Plessey Co., Ltd.
Price & Co. (M/c) Ltd.
Prism Mfg. Co.
Radio Development Co.
Radio Gramophone Development Co., Ltd.
Radiovox Wireless Services, Ltd.
Reproducers & Amplifiers, Ltd.
Rothermel, Ltd., R. A.
Savage, Ltd., W. B.
Scientific Supply Stores (Wireless), Ltd.
Scott-Sessions & Co., G.
Shaftesbury Microphones, Ltd.
Sifam Electrical Instrument Co., Ltd.
Smurthwaite, Ltd., F. W.
Sound Sales, Ltd.
Tannoy Products.
Toubkin, J.
Trix Electrical Co., Ltd.
Truvoice, Ltd.
Universal High Voltage Radio, Ltd.
Voigt Patents, Ltd.
Waterhouse, Ltd., F.
Webber, Ltd., R. A.

PUBLIC ADDRESS EQUIPMENT (to hire).

Ardente Acoustic Laboratories.
Brunswick, Ltd.
Castagnoli, G.
Correx Amplifiers.
Davis, L. W.
Factors (Nottm.) Ltd.
Film Industries, Ltd.
General Electric Co., Ltd.
Grampian Reproducers, Ltd.
H.S.P. Wireless Co.
Hacker & Sons, H.
Heayberd & Co., F. C.
His Master's Voice.
Holiday & Hemmerdinger.
Kolster-Brandes, Ltd.
Londona, Ltd.
Lyons, Ltd., Claude.
Magnaphone Production Co.
Marconiphone Co., Ltd.
Metal Agencies Co., Ltd.
Metropolitan Radio Service Co.
Price & Co. (M/c.) Ltd.
Prism Mfg. Co.
Radiovox Wireless Services, Ltd.
Robson's Radio Trade Services.
Shaftesbury Microphones, Ltd.
Tannoy Products.
Transreceivers, Ltd.
Truvoice, Ltd.

RADIO-GRAMOPHONES. (Spring and Battery-driven)

Aerodyne Radio, Ltd.
Altham Radio Co.
Balcombe, Ltd., A. J.
Berclif, Ltd.
British Radiophone, Ltd.
Castagnoli, G.
City Accumulator Co.
Elliott Radio Mfg. Co.
Eon Vacuum Wireless Co.
Evrizone Radio & Television Co., Ltd.
General Electric Co., Ltd.
Gilbert & Co., Ltd., C.
Halford Distributors, Ltd.
Lissen, Ltd.
Milne's Radio Co., Ltd.
Plessey Co., Ltd.
Smurthwaite, Ltd., F. W.
Tannoy Products.
Trix Electrical Co., Ltd.
Union Radio Co., Ltd.

RADIO-GRAMOPHONES.

Ace Radio.
Aerodyne Radio, Ltd.
Aeronautical & General Instruments., Ltd.
Aladdin Gramophone & Accessories, Co.
Allied Elec. & Furniture Industries.
Altham Radio Co.
Ambassador Radio Gramophones.
Amplion (1932), Ltd.
Balcombe, Ltd., A. J.
Beethoven Radio, Ltd.
Berclif, Ltd.
British Blue Spot Co., Ltd.
British Radiovision Corp.
British Radiophone, Ltd.
Brunswick, Ltd.
Burgoyne Wireless (1930), Ltd.
Burndept, Ltd.
Burne Jones & Co., Ltd.
Castagnoli, G.
Charlton Higgs (Radio), Ltd.
Chorlton Metal Co., Ltd.
City Accumulator Co.
Clarke & Co. (M/c), Ltd., W.
Cole, Ltd., E. K.
Cooper & Son (Wolverhampton), Ltd., R.
Cossor, Ltd., A. C.
Davis, L. W.
Decca Gramophone Co., Ltd.
Distavox Radio.
Eagle Eng. Co., Ltd.
Edge Radio, Ltd.
Elec., Equip. & Carbon Co., Ltd.
Elliott Radio Mfg. Co.
E.M.G. Hand Made Gramophones, Ltd.
Evrizone Radio & Television Co., Ltd.
Export, R. A. P., Ltd.
Factors (Nottm.), Ltd.
Farrex Radio, Ltd.
Ferranti, Ltd.
Film Industries, Ltd.
Fourwave, Ltd.
General Electric Co., Ltd.
Gilbert & Co., Ltd., C.
Hacker & Sons, H.
Halcyon Radio, Ltd.
Halford Distributors, Ltd.
His Master's Voice.
Hartley Turner Radio, Ltd.
Haynes Radio, Ltd.
H.S.P. Wireless Co.
International Majestic Radio Corp., Ltd.
Invicta Radio, Ltd.
Keates & Co. (Radio), Ltd.
Kenwell Radio, Ltd.
Kolster-Brandes, Ltd.
Lawrence, P. H.
Lissen, Ltd.
London Radio Development Services, Ltd.
McMichael Radio, Ltd.
Manufacturing R.A.P., Ltd.

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Marconiphone Co., Ltd.
Midgeley Harmer, Ltd.
Milnes Radio Co., Ltd.
Murphy Radio, Ltd.
Philips Lamps, Ltd.
Pilot Radio, Ltd.
Plessey Co., Ltd.
Portland Radio Co., Ltd.
Prism Mfg. Co.
Pye Radio.
Radio Development Co.
Radio Gramophone Development Co., Ltd.
Radiomonic, Ltd.
Regentone Products, Ltd.
Scott Sessions & Co., G.
Self Changing Gramophones, Ltd.;
Smurthwaite, Ltd., F. W.
Sound Sales, Ltd.
Sunbeam Wireless Service.
Tannoy Products.
Trix Electrical Co., Ltd.
Truphonic Radio, Ltd.
Ultra Electric, Ltd.
Union Radio Co., Ltd.
Universal High Voltage Radio, Ltd.
Vidor, Ltd.
Voigt Patents, Ltd.

RADIO-GRAMOPHONES (portable).

British Radiophone, Ltd.
Castagnoli, G.
Decca Gramophone Co., Ltd.
Factors (Nottingham), Ltd.
Halford Distributors, Ltd.
Scott Sessions & Co., G.
Sound Sales, Ltd.
Tannoy Products.
Trix Electrical Co., Ltd.

RECEIVERS (crystal).

Altham Radio Co.
British Radiophone, Ltd.
Burne-Jones & Co., Ltd.
Castagnoli, G.
Chalkley, C. G.
Charlton Higgs Radio, Ltd.
Elliott Radio Manufacturing Co.
Ivory Electric, Ltd.
Pooley, G. J.
Price & Co. (M/c.), Ltd.
Radio Elect. Products Co.
Ward & Goldstone, Ltd.
Wood, E. A.
Wood, L. R.

RECEIVERS.

Ace Radio.
Aerodyne Radio, Ltd.
Aeronautical & General Instruments, Ltd.
Altham Radio Co.
Ambassador Radio Gramophones.
Amplion (1932), Ltd.
Balcombe, Ltd., A. J.
Beethoven Radio, Ltd.
Berclif, Ltd.
British Blue Spot Co., Ltd.
British Radiophone, Ltd.
Brunswick, Ltd.
Burgoyne Wireless (1930), Ltd.
Burndept, Ltd.
Burne-Jones & Co., Ltd.
Bush Radio, Ltd.
Castagnoli, G.
Charlton Higgs (Radio), Ltd.
Chorlmet Radio Elec., Ltd.
Chorlton Metal Co., Ltd.
City Accumulator Co.
Clarke & Co. (M/c) Ltd., H.
Climax Radio Electric, Ltd.
Cole, Ltd., E. K.
Cooper & Son (Wolverhampton) Ltd.
Cossor, Ltd., A. C.
Davis, L. W.
Decca Gramophone Co., Ltd.
Distavox Radio.
Eagle Engineering Co., Ltd.
Edge Radio, Ltd.
Elliott Radio Mfg. Co. ;
E.M.G. Hand-Made Gramophones, Ltd.
Eon Vacuum Wireless Co.
Eves Radio ,Ltd.
Evrizone Radio & Television Co., Ltd.
Export R.A.P., Ltd.
Farrex Radio, Ltd.
Ferranti, Ltd.
Fourwave, Ltd.
Factors (Nottm.) Ltd.
General Electric Co., Ltd.
Gilbert & Co., Ltd., C.
Hacker & Sons, H.
Halcyon Radio, Ltd.
Halford Distributors, Ltd.
Hartley Turner Radio, Ltd.
Haynes Radio, Ltd.
His Master's Voice.
H.S.P. Wireless Co.
Invicta Radio, Ltd.
Keates & Co., (Radio), Ltd.
Kenwell Radio, Ltd.
Kolster-Brandes, Ltd.
Lawrence, P. Harold.
Lissen, Ltd.
London Radio Development Services, Ltd.
McMichael Radio, Ltd.
Mains Radio Mfg. Co.
Manufacturing R.A.P., Ltd.
Marconiphone Co., Ltd.
Mervyn Sound & Vision Co., Ltd.
Midgley Harmer, Ltd.
Milnes Radio Co., Ltd.
Multitone Electric Co., Ltd.
Murphy Radio, Ltd.
Novo Radio (1935), Ltd.
Parsonage, W. F.
Pegasus, Ltd.
Philips Lamps, Ltd.
Pilot Radio, Ltd.
Plessey Co., Ltd.
Portadyne Radio, Ltd.
Portland Radio Co., Ltd.
Price & Co. (Manchester), Ltd.
Prism Mfg. Co.
Pye Radio, Ltd.
Radio Development Co.
Radio Gramophone Development Co., Ltd.
Radiomonic, Ltd.
Regentone Products, Ltd.
Scott, Sessions & Co., G.
Self Changing Gramophones, Ltd.
Smurthwaite, Ltd., F. W.
Sound Sales, Ltd.
Stonehouse Radio Supplies.
Stratton & Co., Ltd.
Sunbeam Wireless Service.
Tannoy Products.
Transreceivers, Ltd.
Trix Electrical Co., Ltd.
Truphonic Radio, Ltd.
Ultra Electric, Ltd.
Union Radio Co., Ltd.
Universal High Voltage Radio, Ltd.
Universal Radio Distributors, Ltd.
Vidor, Ltd.
Wood, L. R.

RECEIVERS (portable).

Altham Radio Co.
Betterset Radio, Ltd.
British Radiophone, Ltd.
Bulmer, F.
Burgoyne Wireless (1930), Ltd.
Burndept, Ltd.
Burne-Jones & Co., Ltd.
Castagnoli, G.
Cole, Ltd., E. K.
Eagle Engineering Co., Ltd.
Empiric, Ltd.
Eon Vacuum Wireless Co.

Factors (Nottingham), Ltd.
Farrex Radio, Ltd.
General Electric Co., Ltd.
H.S.P. Wireless Co.
Imperial Transportables (London).
International Majestic Radio Corp., Ltd.
Invicta Radio, Ltd.
Kolster-Brandes, Ltd.
Lissen, Ltd.
London Elec. Appliances, Ltd.
McMichael Radio, Ltd.
Price & Co. (M/c.), Ltd.
Pye Radio, Ltd.
Scott Sessions & Co., G.
Self Changing Gramophones, Ltd.
Tannoy Products.
Transreceivers, Ltd.
Trix Electrical Co., Ltd.
Universal Radio Distributors, Ltd.
Vidor, Ltd.
Wood, L. R.

RECORDS.

British Homophone Co., Ltd.
Brunswick, Ltd.
Crystalate Gramophone Record Mfg. Co., Ltd.
Decca Gramophone Co., Ltd.
His Master's Voice.
Holiday & Hemmerdinger.
Kingsway Electricals, Ltd.
Levy's Sound Studios, Ltd.
Parlophone Co., Ltd.
Radiovox Wireless Services, Ltd.

RECORD CHANGERS.

Brunswick, Ltd.
Collaro, Ltd.
Decca Gramophone Co., Ltd.
Garrard Engineering & Mfg. Co., Ltd.
General Electric Co., Ltd.
Margolin, J. & A.
Regent Fittings Co.
Self Changing Gramophones, Ltd.

RECORD FILING CABINETS.

British East Light, Ltd.
Disque Cabinet Co.
E.M.G. Hand-Made Gramophones, Ltd.
Halford Distributors, Ltd.
His Master's Voice.
Self Changing Gramophones, Ltd.
Thompson, Diamond & Butcher.
Waterhouse, Ltd., F.

RECTIFIERS (metal).

British Rectifiers Eng. Co.
Clarke & Co. (M/c.), Ltd., H.
Supremus Specialities, Ltd.
Westinghouse Brake & Signal Co., Ltd.

RELAY APPARATUS.

Ardente Acoustic Laboratories.
Birmingham Sound Reproducers, Ltd.
Bulgin & Co., Ltd., A. F.
Castagnoli, G.
Ferranti, Ltd.
Film Industries, Ltd.
General Electric Co., Ltd.
Goodmans Industries, Ltd.
Harrison & Co., A. T.
London Radio Development Services, Ltd.
London Transformer Products, Ltd.
Marconiphone Co., Ltd.
Philips Industrial (Philips Lamps), Ltd.
Plessey Co., Ltd.
Prism Manufacturing Co.
Radio Development Co.
Radio Furniture and Fittings, Ltd.
Radiovox Wireless Services, Ltd.
Reproducers & Amplifiers, Ltd.
Savage, Ltd., W. B.
Scott, Sessions & Co., G.
Sifam Electrical Instrument Co., Ltd.
Smurthwaite, Ltd., F. W.
Tannoy Products.
Trix Electrical Co., Ltd.
Waterhouse, Ltd., F.
Whiteley Elec. Radio Co., Ltd.

REMOTE CONTROL UNITS.

Aerodyne Radio, Ltd.
Bulgin & Co., Ltd., A. F.
Castagnoli, G.
General Electric Co., Ltd.
Harrison & Co., A. T.
Lawrence, P. M.
Prism Manufacturing Co.
Radio Furniture & Fittings, Ltd.
Self Changing Gramophones, Ltd.
Tannoy Products.
Whiteley Elec. Radio Co., Ltd.
Wright & Weaire, Ltd.

REPAIRS FOR THE TRADE.

Altham Radio Co.
Amplion (1932), Ltd.
Anti Static Installation, Ltd.
Castagnoli, G.
Davis, L. W.
Distavox Service & Television Co.
Dyson & Co., Ltd., J.
Elvy, C. L.
E.M.I. Service, Ltd.
Eon Vacuum Wireless Co.
Evrizone Radio & Television Co., Ltd.
Faulkner, Knight, Ltd.
Goodmans Industries, Ltd.
Graham's Radio.
Henry Ford Radio, Ltd.
Holiday & Hemmerdinger.
H.S.P. Wireless Co.
International Majestic Radio Corp., Ltd.
London Transformer Products, Ltd.
Majestic Service Co.
Metropolitan Radio Service Co.
Parsonage, W. F.
Radio Development Co.
Robson's Trade Radio Services.
Scott, Sessions & Co., G.
Sturdy Electric Co.
Transreceivers, Ltd.
Universal Services.
Weedon Radio Repair Service.
Zetavox.

RESISTANCES (composition).

Amplion (1932), Ltd.
British Centralab, Ltd.
British N.S.F. Co., Ltd.
Bulgin & Co., Ltd., A. F.
Dubilier Condenser Co. (1925), Ltd.
Elliotts O'Maryport.
Erie Resistor, Ltd.
Ferranti, Ltd.
Formo Products, Ltd.
Franklin Elec. Co., Ltd.

PRODUCTS SUPPLIED

Harrison & Co., A. T.
International Majestic Radio Corp., Ltd.
Lechner & Co., F. W.
Lyons, Ltd., Claude.
McLeod & McLeod, Ltd.
Morgan Crucible Co., Ltd.
Price & Co. (M/c.), Ltd.
Quadrant Carbon & Metal Products, Ltd.
Radio Resistor Co.
Reliance Mfg. Co. (Southwark), Ltd.
Salford Elec. Instruments, Ltd.
Telephone Mfg. Co., Ltd.
Varley.
Watmel Wireless Co., Ltd.
Wingrove & Rogers, Ltd.

RESISTANCES (wire-wound).

Amplion (1932), Ltd.
Berclif, Ltd.
British N.S.F. Co., Ltd.
British Radiophone, Ltd.
British Television Supplies, Ltd.
Bulgin & Co., Ltd., A. F.
Burne-Jones & Co., Ltd.
Castagnoli, G.
Chorlton Metal Co., Ltd.
Colvern, Ltd.
Concordia Elec. Wire Co., Ltd.
Curtis Mfg. Co., Ltd.
Daly, H. C.
Dubilier Condenser Co. (1923), Ltd.
Elliotts O'Maryport.
Erie Resistor Co.
Ferranti, Ltd.
Franklin Elec. Co., Ltd.
Graham Farish, Ltd.
Harrison & Co., A. T.
Haynes Radio, Ltd.
Heayberd & Co., F. C.
Henry Ford Radio, Ltd.
Igranic Elec. Co., Ltd.
Imp Radio Co.
International Majestic Radio Corp., Ltd.
Lechner & Co., F. W.
Lissen, Ltd.
London Elec. Mfg. Co., Ltd.
London Transformer Products, Ltd.
Lyons, Ltd., Claude.
McMillan & Co., J.
Partridge Wilson & Co., Ltd.
Plessey Co., Ltd.
Price & Co. (M/c.), Ltd.
Radio Resistor Co.
Reliance Mfg. Co. (Southwark), Ltd.
Supremus Specialities, Ltd.
Truwind Products, Ltd.
Varley.
Watmel Wireless Co., Ltd.
Wingrove & Rogers, Ltd.
Wright & Weaire, Ltd.
Zenith Electric Co., Ltd.

SCRATCH FILTERS.

Beethoven Radio, Ltd.
Bulgin & Co., Ltd., A. F.
H.S.P. Wireless Co.
Radiovox Wireless Services, Ltd.
Sound Sales, Ltd.
Tannoy Products.
Trix Electrical Co., Ltd.

SERVICE EQUIPMENT.

Anglo American Industries Corp.
Cole, Ltd., E. K.
Cossor, Ltd., A. C.
Everett Edgcumbe & Co., Ltd.
E.M.I. Service, Ltd.
Ferranti, Ltd.
General Electric Co., Ltd.
Holiday & Hemmerdinger.
Hunt, Ltd., A. H.
Norman Rose Electrical, Ltd.
Plessey Co., Ltd.
Pye Radio, Ltd.
Radio Development Co.
Robson's Trade Radio Services.
Scott, Sessions & Co., Ltd.
Sifam Elec. Instrument Co., Ltd.
Weston Elec. Instrument Co., Ltd.

SHORT WAVE ADAPTORS.

Aerodyne Radio, Ltd.
Aeronautical & General Instruments, Ltd.
British Radiovision Corp.
British Radiophone, Ltd.
British Television Supplies, Ltd.
Bulgin, Ltd., A. F.
Chorlmet Radio Elec, Ltd.
Chorlton Metal Co., Ltd.
City Accumulator Co.
Eagle Eng. Co.
Elliott Radio Mfg. Co., Ltd.
Evrizone Radio & Television Co., Ltd.
E.M.G. Hand Made Gramophones, Ltd.
Farrex Radio, Ltd.
Halford Distributors, Ltd.
Haynes Radio, Ltd.
International Majestic Radio Corp., Ltd.
Kolster Brandes, Ltd.
London Radio Development Services, Ltd.
Mains Radio Mfg., Co.
Mervyn Sound & Vision Co., Ltd.
Rothermel, Ltd., R. A.
Scott, Sessions & Co., G.
Stonehouse Radio Supplies.
Stratton & Co., Ltd.
Tannoy Products.
Trix Elec. Co., Ltd.

SLEEVING (insulating).

Bromley Langton Elec. Wire & Insulator Co., Ltd.
Chorlton Metal Co., Ltd.
Clarke & Co. (M/c), Ltd., H.
Concordia Elec. Wire Co., Ltd.
Harrison & Co., A. T.
Ivory Elec., Ltd.
Kniveton Cable Works, Ltd.
London Elec. Wire Co., & Smith, Ltd.
McLeod & McLeod.
Millet, J.
Price & Co. (M/c), Ltd.
Reliance Elec. Wire Co., Ltd.

SOLDERING MATERIALS.

British Insulated Cables.
Fluxite, Ltd.

SPEAKERS (extension types in cabinets).

Aerodyne Radio, Ltd.
Ambassador Radio Gramophones.
Amplion (1932), Ltd.

PRODUCTS SUPPLIED

British Blue Spot Co., Ltd.
British Radiophone, Ltd.
British Rola Co., Ltd.
Castagnoli, G.
Celestion, Ltd.
Charlton Higgs (Radio), Ltd.
Chorlmet Radio Elec., Ltd.
City Accumulator Co.
Dent & Co., and Johnson, Ltd.
Distavox Service & Television Co.
Eon Vacuum Wireless Co.
Epoch Reproducers, Ltd.
Ferranti, Ltd.
Film Industries, Ltd.
Fourwave, Ltd.
General Electric Co., Ltd.
Goodmans Industries, Ltd.
Hartley Turner Radio, Ltd.
His Master's Voice.
Kolster-Brandes, Ltd.
Lissen, Ltd.
Milnes Radio Co., Ltd.
Philips Industrial (Philips Lamps, Ltd.).
Plessey Co., Ltd.
Prism Mfg. Co.
Pye Radio, Ltd.
Radio Gramophone Development Co., Ltd.
Radiovox Wireless Services, Ltd.
Reproducers & Amplifiers, Ltd.
Self Changing Gramophones, Ltd.
Sound Sales, Ltd.
Waterhouse, Ltd., F.
Wharfedale Wireless Works.
Whiteley Elec. Radio Co., Ltd.

SPEAKERS (gauze for).

Altham Radio Co.
Chorlton Metal Co., Ltd.
Goodmans Industries, Ltd.
Ivory Elec., Ltd.
Pioneer Mfg. Co.
Price & Co. (M/c), Ltd.
Regent Fittings Co.
Whiteley Elec. Radio Co., Ltd.

SPEAKERS, MOVING COIL.

Aerialite, Ltd.
Ambassador Radio Gramophones.
Amplion (1932), Ltd.
Benjamin Electric, Ltd.
British Radiophone, Ltd.
British Rola Co., Ltd.
Castagnoli, G.
Celestion, Ltd.
Chorlmet Radio Elec., Ltd.
Chorlton Metal Co., Ltd.
Clarke & Co. (M/c), Ltd., H.
Davis, L. H.
Dent & Co., and Johnson, Ltd.
Edison Swan Electric Co., Ltd.
Eon Vacuum Wireless Co.
Epoch Reproducers, Ltd.
Ferranti, Ltd.
Film Industries, Ltd.
General Electric Co., Ltd.
Goodmans Industries, Ltd.
Grampian Reproducers, Ltd.
Hartley Turner Radio, Ltd.
Haynes Radio, Ltd.
International Majestic Radio Corp., Ltd.
Kolster-Brandes, Ltd.
Lissen, Ltd.
London Elec. Mfg. Co., Ltd.
Londona, Ltd.
Marconiphone Co., Ltd.
Midgely Harmer, Ltd.
Milne's Radio Co., Ltd.
Plessey Co., Ltd.
Price & Co. (M/c), Ltd.
Reproducers & Amplifiers, Ltd.
Robson's Trade Radio Services.
Sound Sales, Ltd.
Stratton & Co., Ltd.
Tannoy Products.
Ultra Electric, Ltd.
Voigt Patents, Ltd.
Waterhouse, Ltd., F.
Wharfedale Wireless Works.
Whiteley Electrical Radio Co., Ltd.
Wood, E. A.

SPRINGS (Motor).

Aladdin Gramophone & Accessories Co.
Emmott (Pawsons), Ltd., G.
Garrard Engineering & Manufacturing Co., Ltd.
Gilbert & Co., Ltd., C.
Lugton & Co., Ltd.
Radiovox Wireless Service Co., Ltd.
Regent Fittings Co.
Richardsons (R.M.L.), Ltd.
Wood, E. A.

STOPS (automatic).

Collaro, Ltd.
Diehl, H.
Garrard Engineering & Manufacturing Co., Ltd.
Lugton & Co., Ltd.
Regent Fittings Co.
Toubkin, J.

SWITCHES.

Altham Radio Co.
Becker Ltd., G.
Beethoven Radio, Ltd.
British Centralab, Ltd.
British Radiophone, Ltd..
British Television Supplies, Ltd.
Bromley Langton Elec. Wireless Co., Ltd.
Bulgin & Co., Ltd., A. F.
Burne-Jones & Co., Ltd.
Busby & Co., Ltd.
Castagnoli, G.
Chalkley, C. G.
Christie & Sons, Ltd., Jas.
Colvern, Ltd.
Crabtree & Co., Ltd., J. A.
Diehl, H.
Eagle Engineering Co., Ltd.
Farrex Radio, Ltd.
Ferranti, Ltd.
Formo Products, Ltd.
Francois, E. J.
General Electric Co., Ltd.
Graham Farish, Ltd.
H.S.P. Wireless Co.
Igranic Elec. Co., Ltd.
Ivory Electric, Ltd.
Joseph, H.
Lawrence, P. M.
Lechner & Co., Ltd., F. W.
Lectro Linx, Ltd.
Lissen, Ltd.
Lyons, Ltd., Claude.
McLeod & McLeod, Ltd.
McMillan & Co., J.
Millet, J.
Morton, Ltd., E. R.
Person & Son, L.
Pioneer Mfg. Co.
Plessey Co., Ltd.
Price & Co. (M/C), Ltd.
Rothermel, Ltd., R. A.
Stadium, Ltd.
Trix Electrical Co., Ltd.
Ward & Goldstone, Ltd.
Watmel Wireless Co., Ltd.
Whiteley Electrical Radio Co., Ltd.
Wright & Weaire, Ltd.

TELEVISION RECEIVERS.

Allied Electrical & Furniture Industries, Ltd.
Baird Television, Ltd.
Beethoven Radio, Ltd.
Bennett Television Co.
British Radiovision Corpn.
British Television Supplies, Ltd.
Bulmer, F.

Castagnoli, G.
Cossor, Ltd., A. C.
Distavox Radio.
Elliott Radio Mfg. Co., Ltd.
Eon Vacuum Wireless Co.
Ferranti, Ltd.
General Electric Co., Ltd.
Haynes Radio, Ltd.
His Master's Voice.
London Radio Development Services, Ltd.
Mains Radio Mfg. Co.
Marconiphone Co., Ltd.
Mervyn Sound & Vision Co., Ltd.
Price & Co. (M/C), Ltd.
Pye Radio, Ltd.
Radio Gramophone Development Co., Ltd.
Scophony, Ltd.

TERMINALS, CONNECTORS AND TAGS.

Belling & Lee, Ltd.
Bulgin & Co., Ltd., A. F.
Busby & Co., Ltd.
Castle Fuse & Engineering Co., Ltd.
Collett Mfg. Co., S. H.
Eastick & Sons, J. J.
Francois, E. J.
General Electric Co., Ltd.
Grafton Electric Co.
Ivory Electric, Ltd.
Kniveton Cable Works, Ltd.
Lectro Linx, Ltd.
Lilley & Son, Ltd., S.
Lissen, Ltd.
McLeod & McLeod, Ltd.
Price & Co. (M/C), Ltd.
Prideaux, Junr., R.
Quadrant Carbon & Metal Products, Ltd.
Radiamp Co., Ltd.
Ripaults, Ltd.
Ross, Courtney & Co., Ltd.
Trix Electrical Co., Ltd.
True Screws, Ltd.
Ward & Goldstone, Ltd.
Whiteley Electrical Radio Co., Ltd.

TIME SWITCHES.

Everett, Edgcumbe & Co., Ltd.
Ferranti, Ltd.
General Electric Co., Ltd.
Millet, J.
Siemens Electric Lamps & Supplies, Ltd.
Stockall Marples & Co., Ltd.
Time Switches & Instruments, Ltd.
Wright & Weaire, Ltd.

TONE COMPENSATORS.

Bulgin & Co., Ltd., A. F.
Castagnoli, G.
Lissen, Ltd.
Radiovox Wireless Services, Ltd.
Tannoy Products.
Whiteley Electrical Radio Co., Ltd.

TONE CONTROLS.

Bowyer-Lowe & A.E.D., Ltd.
British Centralab, Ltd.
British N.S.F. Co., Ltd.
Bulgin & Co., Ltd., A. F.
Castagnoli, G.
Climax Radio Electric, Ltd.
Davis, L. Westacott.
Dubilier Condenser Co. (1925), Ltd.
Ferranti, Ltd.
Goodmans Industries, Ltd.
Igranic Electric Co., Ltd.
Lissen, Ltd.
Morgan Crucible Co., Ltd.
Multitone Electric Co., Ltd.
Plessey Co., Ltd.
Radiovox Wireless Services, Ltd.
Reliance Mfg. Co. (Southwark), Ltd.
Tannoy Products.
Trix Electrical Co., Ltd.
Watmel Wireless Co., Ltd.
Whiteley Electrical Radio Co., Ltd.

TOOLS (Insulated).

Bulgin & Co., Ltd., A. F.
Davis, L. Westacott.
Fry's (London), Ltd.
General Electric Co., Ltd.
Whiteley Electrical Radio Co., Ltd.

TRANSFERS.

Eagle Transfer, Ltd.
McLeod & McLeod, Ltd.

TRANSFORMERS.

Aerodyne Radio, Ltd.
Aeronautical & General Instruments, Ltd.
Allied Electrical and Furniture Industries, Ltd.
Anglo-American Industries Corporation.
Anti Static Installations, Ltd.
Beethoven Radio, Ltd.
Birmingham Sound Reproducers, Ltd.
British Radiophone, Ltd.
British Television Supplies, Ltd.
Bryce & Co., W. A.
Bulgin & Co., Ltd., A. F.
Burnand & Sons, W. E.
Castagnoli, G.
Chorlmet Radio Elec., Ltd.
Clarke & Co., (M/c), Ltd., H
Climax Radio Electric, Ltd.
Coates, Ltd., J. G.
Correx Amplifiers.
Daly, H. C.
Dyson & Co., Ltd., J.
Eagle Engineering Co., Ltd.
Elliott Radio Mfg., Co., Ltd.
Elliotts O'Maryport.
Elvy, C. L.
Ferranti, Ltd.
Formo Products, Ltd.
General Electric Co., Ltd.
Graham Farrish, Ltd.
Heayberd & Co., F. C.
Haynes Radio, Ltd.
Igranic Electric Co., Ltd.
Kingsway Electricals, Ltd.
London Transformer Products, Ltd.
Mains Radio Mfg. Co.
Meritus (Barnet), Ltd.
Mervyn Sound & Vision Co., Ltd.
Metal Agencies Co., Ltd.
Multitone Electric Co.
M.R. Supplies.
Novo Radio (1935), Ltd.
Parsonage, W. F.
Partridge, N.
Partridge, Wilson & Co., Ltd.
Plessey Co., Ltd.
Pye Radio, Ltd.
Radio Development Co.
Radiovox Wireless Services, Ltd.
Regentone Products, Ltd.
Reproducers and Amplifiers, Ltd.
Rich & Bundy, Ltd.
Robsons Trade Radio Services.
Rothermel, Ltd., R. A.
Savage, W. B., Ltd.
Sifam Electrical Instrument Co., Ltd.
Sound Sales, Ltd.
Sturdy Electric Co.
Supremus Specialities, Ltd.
Tannoy Products.
Trix Electrical Co., Ltd.
Varley.
Waterhouse, Ltd., F.

PRODUCTS SUPPLIED

Webber, Ltd., R. A.
Weedon's Radio Repair Service.
Whiteley Elec. Radio Co., Ltd.
Wright & Weaire, Ltd.
Zenith Electric Co., Ltd.
Zetavox.

TURNTABLES FOR PORTABLES.

Aladdin Gramophone & Accessories Co.
Beethoven Radio, Ltd.
Chapman, Ltd., A. W.
Lissen, Ltd.
Lugton & Co., Ltd.
Regent Fittings, Co.

VALVES.

Altham Radio Co.
Amerad (Gt. Britain), Ltd.
Anglo-American Industries Corpn.
British Pix Co., Ltd.
British Tungsram Radio Works, Ltd.
Chorlton Metal Co., Ltd.
Clarion Radio Valve Co.
Cossor, Ltd., A. C.
Edison Swan Electric Co., Ltd.
Ferranti, Ltd.
Forbat, E.
Formo Products, Ltd.
General Electric Co., Ltd.
Graham Farish, Ltd.
Henry Ford Radio, Ltd.
Impex Electrical, Ltd.
International Majestic Radio Corpn., Ltd.
Lissen, Ltd.
Lyons, Ltd., Claude.
Majestic Service Co.
Marconiphone Co., Ltd.
Mullard Radio Valve Co., Ltd.
Mullard Wireless Service Co., Ltd.
M.O. Valve Co., Ltd.
Octron, Ltd.
Pix Valves, Ltd.
Portland Radio Co., Ltd.
Price & Co. (M/c), Ltd.
Record Radio, Ltd.
Siemens Electric Lamps & Supplies, Ltd.
Standard Telephone and Cables, Ltd.
Tungsram Electric Lamp Works (Gt. Britain), Ltd
Universal Radio Distributors, Ltd.
Zelco, Ltd.
362 Radio Valve Co., Ltd.

VALVE-HOLDERS.

Advance Components, Ltd.
Altham Radio Co.
Belling & Lee, Ltd.
Benjamin Electric, Ltd.
British Radiophone, Ltd.
British Television Supplies, Ltd.
Bulgin & Co., Ltd., A. F.
Chorlmet Radio Electric, Ltd.
Chorlton Metal Co., Ltd.
Christie & Sons, Ltd., Jas.
Climax Radio Electric, Ltd.
Ferranti, Ltd.
Forbat, E.
Formo Products, Ltd.
General Mouldings Co., Ltd.
Graham Farish, Ltd.
Harrison & Co., A. T.
Ivory Electric, Ltd.
Lectro Linx, Ltd.
Lissen, Ltd.
Person & Son, L.
Plessey Co., Ltd.
Price & Co. (M/c.), Ltd.
Quadrant Carbon & Metal Products, Ltd.
Rothermel, Ltd., R. A.
Stratton & Co., Ltd.
Ward & Goldstone, Ltd.
Whiteley Elec. Radio Co., Ltd.
Wood, E. A.

VALVE TESTERS.

Bulgin & Co., Ltd., A. F.
Chorlmet Radio Electric, Ltd.
Clifford Pressland (Sales), Ltd.
Distavox Service & Television Co.
Everett Edgcumbe & Co., Ltd.
Ferranti, Ltd.
General Electric Co., Ltd.
Millet, J.
Plessey Co., Ltd.
Pye Radio, Ltd.
Robson's Trade Radio Services.
Wright & Weaire, Ltd.

VARNISHES (Insulating).

Bakelite, Ltd.
British Insulated Cables, Ltd.
Ellison Insulations, Ltd.
Grampian Reproducers, Ltd.
Micanite & Insulators, Ltd.
Nobel Chemical Finishes, Ltd.

VOLUME CONTROLS.

Amerad (Gt. Britain), Ltd.
Anglo-American Industries Corpn.
Bowyer, Lowe & A.E.D., Ltd.
British Centralab, Ltd.
British Goldring Products, Ltd.
British N.S.F. Co., Ltd.
British Pix Co., Ltd.
British Radiophone, Ltd.
Bulgin & Co., Ltd., A. F.
Burne-Jones & Co., Ltd.
Castagnoli, G.
Chorlmet Radio Electric, Ltd.
Davis L. Westacott.
Dubilier Condenser Co. (1925), Ltd.
Ferranti, Ltd.
Franklin Electric, Ltd.
Goodmans Industries, Ltd.
Graham Farish, Ltd.
Haynes Radio, Ltd.
Igranic Electric Co., Ltd.
Lawrence, P. M.
Lechner & Co., F. W.
Lisser, Ltd.
Lyons, Ltd., Claude.
Morgan Crucible Co., Ltd.
Plessey Co., Ltd.
Radio Development Co.
Radio Resistor Co.
Reliance Mfg. Co. (Southwark), Ltd.
Reproducers & Amplifiers, Ltd.
Tannoy Products.
Truwind Products, Ltd.
Varley.
Ward & Goldstone, Ltd.
Waterhouse, Ltd., F.
Watmel Wireless Co., Ltd.
Wharfedale Wireless Works.
Whiteley Electrical Radio Co., Ltd.
Wingrove & Rogers, Ltd.
Wright & Weaire, Ltd.

WAVEMETERS.

Beethoven Radio, Ltd.
Castagnoli, G.
Elliot Radio Mfg. Co., Ltd.
Eves Radio, Ltd.
Haynes Radio, Ltd.
Lyons, Ltd., Claude.
Muirhead & Co., Ltd.
Quartz Crystal Co.
Stratton & Co., Ltd.
Tannoy Products.
Wright & Weaire, Ltd.

WAVE TRAPS.

Altham Radio Co.
Berclif, Ltd.
Castagnoli, G.
Elliott Radio Mfg. Co., Ltd.
Eon Vacuum Wireless Co.

Ferranti, Ltd.
H.S.P. Wireless Co.
Kolster-Brandes, Ltd.
Whiteley Electrical Radio Co., Ltd.
Wright & Weaire, Ltd.

WIRE (aerial).

Aerialite, Ltd.
Altham Radio Co.
British Insulated Cables, Ltd.
British Pix Co., Ltd.
British Ropes, Ltd.
Bromley-Langton Electric Wire & Insulator Co., Ltd.
Chorlton Metal Co., Ltd.
Concordia Electric Wire Co., Ltd.
Connollys (Blackley), Ltd.
Elvy, C. L.
General Electric Co., Ltd.
Kniveton Cable Works, Ltd.
Laker Co., Ltd., J. & J.
Lugton Co., Ltd.
Millet, J.
Price & Co. (M/c.), Ltd.
Richardsons (R. M. L.), Ltd.
Ripaults, Ltd.
Siemens Electric Lamps & Supplies, Ltd.
Toubkin, J.
Trent Electric Wire Works, Ltd.
Trix Electrical Co., Ltd.
Ward & Goldstone, Ltd.
Wireless-Electric (Wholesale), Ltd.
Wood, L. R.

WIRE (connecting).

Aerialite, Ltd.
Altham Radio Co.,
British Insulated Cables, Ltd.
British Ropes, Ltd.
Bromley-Langton Electric Wire & Insulator Co., Ltd.

Bulgin & Co., Ltd., A. F.
Chorlton Metal Co., Ltd.
Concordia Electric Wire Co., Ltd.
Elvy, C. L.
General Electric Co., Ltd.
Ivory Electric, Ltd.
Kniveton Cable Works, Ltd.
McLeod & McLeod, Ltd.
Millet, J.
Reliance Electrical Wire Co., Ltd.
Saxonia Electrical Wire Co., Ltd.
Siemens Electric Lamps & Supplies, Ltd.
Trent Electric Wire Works, Ltd.
Trix Electrical Co., Ltd.
Ward & Goldstone, Ltd.

WIRE (fuse).

Altham Radio Co.
British Insulated Cables, Ltd.
Bromley-Langton Electric Wire & Insulator Co., Ltd.
Collett Mfg. Co., S. H.
Elvy, C. L.
General Electric Co., Ltd.
Kniveton Cable Works, Ltd.
McLeod & McLeod, Ltd.
Saxonia Electrical Wire Co., Ltd.
Siemens Electric Lamps & Supplies, Ltd.
Trent Electric Wire Works, Ltd.
Ward & Goldstone, Ltd.

WIRE (galvanised stay).

British Ropes, Ltd.
Bromley-Langton Electric Wire & Insulator Co., Ltd.
Elvy, C. L.
General Electric Co., Ltd.
Laker Co., Ltd., J. & J.

WIRE (instrument).

British Insulated Cables, Ltd.
British Ropes, Ltd.
Bromley-Langton Electric Wire & Insulator Co., Ltd.
Connollys (Blackley), Ltd.
Elvy, C. L.
General Electric Co., Ltd.
McMillan & Co., J.
Saxonia Electrical Wire, Co., Ltd.
Scott Insulated Wire Co., Ltd.
Trent Electric Wire Works, Ltd.
Ward & Goldstone, Ltd.

WIRE (resistance).

Anglo-American Industries Corporation.
British Ropes, Ltd.
Bromley-Langton Electric Wire & Insulator Co., Ltd.
Concordia Electric Wire Co., Ltd.
Elvy, C. L.
General Electric Co., Ltd.
International Majestic Radio Corpn., Ltd.
Kniveton Cable Works, Ltd.
London Electric Wire Co. & Smiths, Ltd.
McLeod & McLeod, Ltd.
Maul & Murphy, Ltd.
Saxonia Electrical Wire Co., Ltd.
Trent Electric Wire Works, Ltd.
Ward & Goldstone, Ltd.

WIRE (screened).

Aerialite, Ltd.
Anti-Static Installation, Ltd.
British Insulated Cables, Ltd
British Pix Co., Ltd.
Bromley-Langton Electric Wire & Insulator Co., Ltd.
Elvy, C. L.
Kniveton Cable Works, Ltd.
McLeod & McLeod, Ltd.
Reliance Electrical Wire Co., Ltd.
Ripaults, Ltd.
Saxonia Electrical Wire Co., Ltd.
Scott Insulated Wire Co., Ltd.
Trent Electric Wire Works, Ltd.
Ward & Goldstone, Ltd.

U.K. ELECTRICITY SUPPLY VOLTAGE DIRECTORY

There are two Sections to this Voltage Directory. The first, below and opposite, deals only with about 600 towns which have their own supply undertakings.

The Main Section of the Voltage Directory, commencing on page 208, deals with some seven thousand districts, making a total of nearly 8,000.

This is the only Directory of its kind which deals so completely with the whole country. It is reproduced by courtesy of the "Practical Electrician's Pocket Book."

At the same time it must be understood that half a million new homes are being electrified every year, and another half-million are changing from D.C. to A.C., so that no directory of this kind can be absolutely complete.

Districts are arranged in alphabetical order throughout, and the letters "A" or "C" are used to denote whether the supply is alternating or continuous (direct).

Voltage Directory (Special Section)

Aberangell .. 230C
Aberayron .. 230C
Aberdeen .. 220C
230A
Abertillery .. 250A
Aberystwyth .. 220C
Abingdon .. 230A
Accrington .. 230A
Acton Grange .. 250A
Adwick-le-Street 230A
Aldeburgh .. 200C
Alderley Edge .. 230C
Aldershot .. 210C
230C
Altrincham .. 100A
200A
Alva 250A
Amble 250A
Amesbury .. 220C
Ammanford .. 230A
250C
Annfield Plain .. 250A
Arbroath .. 250A
250C
Ascot 220C
Ashford .. 230A
Ashton-in-Makerfield .. 230A
Ashton-under-Lyne 240C
240A
Ashton-upon-Mersey .. 240A
Askam 230A
Aston Grange .. 250A
Atherton .. 240A
Aylesbury .. 220A
220C
Bacup 230A
Bangor 230A
Barking .. 230A
Barlborough .. 250A
Barnes 210C
Barnoldswick .. 230A
Barnsley .. 230C
230A
Barnstaple .. 230C
Barrow-in-Furness .. 220C
220A
Barry 230A
Barton-on-Humber .. 220C
Basingstoke .. 230C
230A
Bath 230C
230A
Batley 220C
230A
Battersea .. 230C
230A
Beaconsfield .. 230A
Beckenham .. 200A
Bedford .. 105A
210A
Bedwas .. 230A
Bedwellty .. 230A
Bermondsey .. 230A
240C
205A
205C
220A
Bethesda .. 230A
Bethnal Green 240A
Bettws-y-Coed 110A
Bexhill 220C
230A
Bexley 200A
Bideford .. 230A
Bingley 230A
Birkdale .. 230C
230A
Birkenhead .. 230C
230A
Birmingham .. 220C
Blackburn .. 110A
220A
230C
230A
Blackpool .. 200A
Blair Atholl .. 220C
Blandford .. 230A
Blundell .. 230A
Bodmin .. 230A
Bognor Regis .. 230A
Bolsover .. 240A
Bolton 230A
Bolton (Lancs.) 105A
210A
230A
230C
Borrowstounness 230C
Borth 230C
Bourn 240A
Bournemouth .. 200A
Bourton-on-the-Water .. 110C
Bradwell-juxta-Mare 230A
Bradworthy .. 110C
Brechin .. 240C
Brecon 230A
Bredbury .. 230A
Bridgend .. 200A
Bridlington .. 230A
Bridport .. 230A
Brighouse .. 230A
Brightlingsea .. 230A
Brighton .. 115C
230C
230A
Bristol 210C
210A
230A
Brixham .. 220C
Bromley .. 210A
230A
Brompton (London) .. 100A
Brynamman .. 220A
Buckie 250C
Bude 200C
210A
Buglawton .. 230A
Bumbles Green 240A
Burford .. 110C
230A
Burgess Hill .. 230A
Burnham (Essex) 230A
Burnley .. 220C
230A
Bury St. Edmunds 200C
230A
Caernarvon .. 230A
Caerphilly .. 230A
Caldy 230A
Callington .. 230A
Calne 220C
Camborne .. 230A
Cambridge .. 200A
Cannock .. 230A
Canterbury .. 220C
230A

Cardiff 230A
240A
250A
200A
200C
Cark 230A
Carlisle.. .. 230C
230A
Carmarthen .. 220C
230A
Celynin .. 220C
Chasetown .. 250A
Chelsea.. .. 230A
200C
Cheltenham .. 210A
Chepstow .. 230A
Chesham .. 200A
240A
Chester.. .. 230A
Chesterfield .. 240A
240C
Chichester .. 230A
Chiswick .. 230A
Cirencester .. 240A
Clacton .. 230A
230C
Cleethorpes .. 230A
Clitheroe .. 230A
Clowne 240A
Coatbridge .. 220A
240C
Colchester .. 230A
210C
Colne (Lancs.).. 230A
240C
Colwyn Bay .. 230A
220C
Congleton .. 230A
Connah's Quay 250A
Conway .. 230A
Cookham .. 230A
Corwen.. .. 230A
Crewe 230A
230C
Crieff 240C
Crook 250A
Croydon .. 230A
230C
Darlington .. 230C
230A
Dartford .. 230C
230A
Dartmouth .. 240A
Darwen .. 230C
230A
Delabole .. 200C
230C
Denny 230A
Derby 230C
200A
230A
Dewsbury .. 220C
230A
Dolywern .. 230A
Doncaster .. 230C
230A
Dorchester .. 220C
Dorking .. 230C
240C
Douglas .. 230C
230A
Dover 100A
200A
230A
Dumfries .. 230C
230A
Dundee .. 200C
200A
Dunoon .. 230A
Durrington (Wilts.) .. 200A
Ealing 230A
Earby 230A
Eastbourne .. 200A
East Dereham .. 230A
East Grinstead 230C
230A
East Ham .. 230C
230A

Ebbw Vale .. 240C
Eccles 230A
Edinburgh .. 230C
230A
Egham 100A
230A
Elland 240C
230A
Ely Valley .. 230A
Epsom 230A
230C
Erith 200A
Eston 250A
Exeter 210A
Falkirk.. .. 250A
Falmouth .. 240C
Fareham .. 220A
Fellxstowe .. 200C
240A
Finchley .. 250C
Fleetwood .. 200C
230A
Fochabers .. 200C
Folkestone .. 210C
210A
Foots Cray .. 200A
Formby 230A
Fort Augustus.. 130C
Fort William .. 150C
Fulham .. 200A
Gainsborough .. 230A
Gellygaer .. 230A
Glasgow .. 250C
250A
Glossop.. .. 230A
Gloucester .. 220C
230A
Gorseinon .. 200C
230A
Gosport .. 240C
Grantown-on-Spey 200C
Gravesend .. 230C
230A
Grays 230A
230C
Great Yarmouth 200A
230A
Greenock .. 250A
250C
Grimsby .. 230A
230C
Guernsey .. 210C
230A
Guildford .. 220C
230A
Hackney .. 240C
230A
Halifax.. .. 230C
230A
Hamilton .. 240C
230A
Hammersmith.. 110A
230A
Hampstead .. 105A
210A
Harrogate .. 100A
200A
Harrow.. .. 230C
240A
Harwich .. 240A
Haslingden .. 230A
Hastings .. 200A
230A
Hawarden .. 230A
Hawes 230A
Hawick.. .. 240C
Haworth .. 230A
Hebden Bridge 230A
Heckmondwike 230A
Henbury .. 210A
Hendon .. 240A
Herne Bay .. 230A
Heston 230A
Hindley .. 230A
Holmfirth .. 230A
Holsworthy .. 230A
Holyhead .. 200C
230A
Horley 230A

Hornsey .. 240A
Hoylake .. 230A
Huddersfield .. 100A
200A
Ilford 230A
230C
Ilfracombe .. 240C
Ilkley 230A
Inverness .. 240C
Ipswich .. 230A
230C
Islington .. 200A
Ivybridge .. 230C
Jersey 240A
Keighley .. 230A
230C
Kendal.. .. 230A
Kettering .. 230A
230C
Kettlewell .. 230C
King's Lynn .. 230A
200C
Kirkcaldy .. 230A
Kirkcaly .. 230C
Kirkcudbright.. 230A
Lancaster .. 230A
Launceston .. 200C
Leatherhead .. 230C
Ledbury .. 230A
Leek 230C
Leicester .. 100A
200A
240A
Leominster .. 230A
Lerwick .. 230C
Letchworth .. 240A
250C
Lewes 230C
Leyburn .. 230A
Leyton 150C
230A
Lincoln.. .. 230C
230A
Littleborough.. 230A
Liverpool .. 230A
230C
Llandrindod Wells .. 230C
Llandudno Junction .. 230A
Llanelly .. 250C
250A
Llanfairfechan.. 230A
Llangollen .. 220C
Llanidloes .. 230C
Llanrwst .. 230C
230A
Llansantffraid.. 220C
Llantarnam .. 230A
Long Eaton .. 230A
Looe (Cornwall) 230A
Lossiemouth .. 230C
Loughborough.. 230A
200C
Louth 230A
Lowestoft .. 230A
230C
Luton 240A
250C
Lyme Regis .. 220C
Lymington .. 230A
Lynton.. .. 100A
200A
Lytham .. 240A
Machynlleth .. 230A
Maesteg .. 230A
Maidenhea .. 230C
230A
Maidstone .. 230C
230A
Malvern Link .. 100A
200A
Malvern Wells.. 100A
200A
Manchester .. 200C
230A
Mansfield .. 240C
250A
230A

Mansfield Woodhouse .. 250A
240C
Market Drayton 230A
230C
Marlborough .. 220C
230A
Mevagissey .. 230A
Mexborough .. 220C
230A
Middlesbrough 220C
230A
Mildenhall .. 220C
Millom.. .. 230A
Milnrow .. 230A
Minehead .. 230A
Mirfield.. .. 200A
230A
Mold 230A
Monmouth .. 230A
Montrose .. 240C
Morecambe .. 230A
Mountain Ash.. 230A
Musselburgh .. 230C
Nayland .. 210C
Neath 220A
Newark .. 230A
Newmarket .. 440A
Newquay .. 230A
Normanton .. 230A
Northampton .. 210C
210A
230A
Northwood .. 240A
Norwich .. 230A
220C
Nottingham .. 230A
200C
Notting Hill .. 200C
230A
Nuneaton .. 230A
220C
Oakham .. 230A
Oldham .. 210C
230A
Ormskirk .. 230A
Oswestry .. 230A
Oxford .. 230A
Padiham .. 230A
Paignton .. 230A
Paisley .. 200A
250A
Peacehaven .. 230A
Penarth 230C
Penmaenmawr 230A
Penrith.. .. 230A
Penybont .. 230A
Perth 230C
Peterborough .. 200C
230A
Peterhead .. 230A
Plympton St. Mary .. 230A
Plymouth .. 200A
230C
Plymouth .. 230A
Pontardawe .. 230A
Pontypool .. 230A
Pontypridd .. 230C
Poplar 230C
Porlock .. 230A
Porthcawl .. 230A
Portsmouth .. 230A
200A
Port Talbot .. 240A
Preesall .. 230A
Prestatyn .. 230A
Pudsey .. 230A
Ramsgate .. 240C
Rawtenstall .. 230A
Reading .. 200A
200A
Redcar .. 250A
Redruth .. 240A
Ringmer .. 230A
Ringwood .. 230A
Risca 230A
Rochdale .. 230A
Rotherham .. 230A

Rothesay .. 230C
Rugby 230A
Rushden .. 210C
210A
Ruskington .. 230A
Ruthin .. 230C
Saffron Walden 230A
St. Andrews .. 225C
St. Austell .. 220C
230A
St. James .. 220C
230A
St. Marylebone 240C
240A
St. Weekes .. 230A
Salcombe .. 230A
Sale 240A
Salisbury .. 210C
230A
Scarborough .. 230A
Scunthorpe .. 250A
Seaham Harbour 250A
Sedbergh .. 230A
Settle 230A
Seven Oaks (Ches.) .. 250A
Sheffield .. 200A
Shoeburyness .. 230A
230C
Shoreditch .. 240C
Shrewsbury .. 210C
Skelmorlie .. 230A
Skipton .. 230A
Sleaford .. 230C
230A
Slough 230A
Southampton .. 200A
200C
240A
Southend .. 230C
230A
Southport .. 220A
South Shields .. 110A
220A
Spalding .. 230A
Spenborough .. 230A
Stafford .. 210C
230A
Stalybridge .. 230A
Stanley (York.) 230A
Stepney .. 240C
Steyning .. 230A
Stirling .. 230C
Stockport .. 230C
230A
Stoke Newington 240C
230A
Stornbridge .. 200A
Stornoway .. 230C
Stretford .. 230C
230A
Stroud 230A
Sunderland .. 230A
Surbiton .. 230A
Swansea .. 220C
220A
Tadcaster .. 230C
Tanfield .. 250A
Taunton .. 230A
Teignmouth .. 230A
Thornbury .. 230A
Tobermory .. 230C
Tonbridge .. 220A
220C
Torquay .. 200A
Totnes 200A
225C
Tredegar .. 230A
Truro 240A
Tunbridge Wells 220A
Turton .. 230A
Twickenham .. 240C
Tynemouth .. 240A
Uckfield .. 230A
Ulverston .. 230A
Uttoxeter .. 230A
Uxbridge .. 200A
Wakefield .. 200A
230A

Wallasey .. 200A
230A
Walthamstow 230A
230C
Wantage .. 230A
Warmley .. 230A
Warrington .. 230C
250A
Watford .. 200A
Wellingborough 230A
230C
Wellington .. 230A
West Bromwich 230A
230C
West Ham .. 200A
West Hartlepool 230A
230C
Westminster .. 230A
200C
Weston-Super-Mare .. 230A
230C
Weymouth .. 230A
Whitby .. 230C
230A
Whitehaven .. 230A
210C
Whitstable .. 230A
Whitwood .. 230A
Whitworth .. 230A
Willesden .. 240A
240C
Wilton 230A
Wimbledon .. 220A
Winchester .. 210C
230A
Windermere .. 100A
200A
Wisbech .. 240C
Witney .. 220C
230A
Woodbridge .. 230A
Woodstock .. 230A
Woolwich .. 220A
Worcester .. 200A
Workington .. 240A
Worksop .. 220A
220C
230A
Yeovil 230A
240C
York 230A
230C
Yorktown .. 250A

Voltage Directory (Main Section)

Abberlady .. 230A
Abberton .. 230A
Abbey Wood .. 200A
220A
Abbeytown .. 230A
Abbots Bromley 230A
Abbots Langley 200A
240A
Abbots Leigh .. 230A
Abbotsham .. 230A
Abbotskerswell 200A
Abdie 250A
Aberbargoed .. 230A
Aberbeeg .. 250C
Abercanaid .. 250A
Abercarn .. 230A
Abercrave .. 240C
Abercynon .. 230A
Aberdour .. 250A
Aberdylais .. 220A
Aberfan .. 250A
Aberford .. 230A
Abergwili .. 230A
Abergwynfi .. 230A
Abersychan .. 230A
Aberthin .. 230A
Abertridwr .. 230A
Abinger .. 230A
Abinghall .. 230A
Abington Piggotts 240A
Abram 230A
Abthorpe .. 230A
Acklam .. 230A
Ackworth .. 230A
Acle 230A
Acomb (N'land) 250A
Acomb (Yorks) 230A
Acresford .. 230A
Acton (Ches.) .. 220A
Acton (London) 230C
230A
Acton (Staffs.).. 230A
Acton Turville.. 230A
Addlewell .. 230A
Addingham .. 230A
Addington .. 230A
Addington Great 230A
Addington Little 230A
Addlestone .. 200A
Adlington (Ches.) 230A
Adlington (Lancs.) 230A
Adstock .. 230A
Adstone .. 230A
Adswood .. 240A
Agden 250A
Aglionby .. 230A
Ahewas .. 230A
Aikton 230A
Ailsworth .. 230A
Ainsworth .. 230A
Airedale .. 230A
Airdrie 240C
Airmyn .. 230A
Airth 250A
Airton 230A
Akeley 230A
Albrighton .. 230A
Albury 230A
240A
Alby-with-Thwaite 230A
Alciston .. 230A
Aldborough .. 230A
Aldbrough .. 230A
Aldeby 230A
Aldenham .. 200A
Aldersey .. 230A
Aldersford .. 230A
Alderton .. 230A
Aldingham .. 230A
Aldford.. .. 230A
Aldham .. 230A
Aldridge .. 230A
Aldringham .. 230A
Aldwark .. 230A
Aldwick .. 230A
Aldwickbury .. 240A
Aldwinkle .. 230A
Alexandria .. 240A
Aley Green .. 240A
Alcombe .. 230A
Alford 230A
Alfriston .. 230A
Algarkirk .. 230A
Alkham .. 230A
Allanton .. 240A
Aller 230A
Allerford .. 230A
Allerthorpe .. 230A
Allerton Bywater 230A
Allesley .. 230A
Allestree .. 200A
Allhallows .. 230A
Allington .. 230A
Allithwaite .. 230A
Allonby .. 230A
Alltwen .. 230A
Almondsbury .. 210A
Alne 230A
Alnesbourne Priory 230A
Alphington .. 210A
Alresford .. 230A
Alston 230A
230A
Altcar 230A
Altham.. .. 230A
Althorne .. 230A
Altofts 230A
Alvanley .. 250A
Alvaston .. 200A
Alverdiscott .. 230A
Alverstoke .. 240C
Alverthorpe .. 230A
230A
Alverston .. 230A
Alwalton .. 240A
Alwoodley .. 230A
Amberley .. 230A
Amblecote .. 200A
Ambleside .. 100A
200A
Amersham .. 200A
Amersham Hill 200A
Amington .. 250A
Ampthill .. 230A
Amwell .. 240A
Ancrum .. 250A
Anderton .. 220A
Andover .. 230A
Anerley.. .. 200A
Angmering .. 230A
Anlaby .. 230A
Annables .. 240A
Annbank .. 240A
Ansley 250A
Anslow .. 230A
Anstey 250A
Anstey Pasture 240A
Anston .. 230A
Anstruther .. 250A
Ansty 250A
Antrobus .. 250A
Appleby .. 230A
Appleby Fields 250A
Appleby Magna 250A
Appleby Parva 250A
Appledore .. 230A
Appleford .. 230A
Appleton .. 250A
230A
Apuldram .. 230A
Arbury .. 250A
Ardingly .. 230A
Ardleigh .. 230A
Ardrossan .. 240A
Ardsley.. .. 230A
Argoed .. 230A
Arkendale .. 230A
Arkholme .. 230A
Arkley 240A
Arlesey .. 240A
Arlington .. 230A
Armadale .. 250A
Armitage .. 230A
Armthorpe .. 230A
Arnesby .. 250A
Arnold (Notts.) 230A
Arnold (Yorks.) 230A
Arnside.. .. 230A
Arrad Foot .. 230A
Arthington .. 230A
Arthingworth .. 230A
Arundel .. 230A
Ascott 240A
Asfordby .. 230A
Ash 230A
Ash (Somerset) 230A
Ash Bank .. 230A
Ashburnham .. 230A
Ashburton .. 240A
Ashby-de-la Zouch 240A
Ashby Folville.. 250A
Ashby Magna .. 250A
Ashby Parva .. 250A
Ashby-with-Oby 230A
Ashby Woulds.. 250A
Ashcombe .. 230A
Ashill 230A
Ashingdon .. 230A
Ashington .. 230A
Ashley 230A
Ashley (Ches.) 220A
Ashley (Shrops.) 230A
Ashley Green .. 200A
Ashow 250A
Ashtead .. 230C
Ashton (Ches.).. 230A
Ashton (Lancs.) 230A
Ashton-on-Ribble 230A
Ashton-with-Stodday 230A
Ashurst (Hants.) 230A
Ashurst (Kent) 220A
Ashurst Wood.. 230A
Ashwell (Herts.) 240A
Ashwell (Leics.) 230A
Ashwellthorpe 230A
Ashwick .. 230A
Askam 250A
Askern 230A
Askrigg.. .. 230A
Askwith .. 230A
Aspatria .. 230A
Aspenden .. 240A
Aspley Guise .. 230A
Aspley Heath (Beds.) .. 230A
Aspley Heath (Warwicks.) 230A
Aspull 230A
Astcote .. 230A
Astley (Lancs.) 230A
Astley (Warwk.) 250A
Aston (Herts.) 240A
Aston (Lancs.).. 250A
Aston (London) 240A
Aston (Staffs.).. 230A
Aston Clinton .. 220A
Aston-cum-Aughton 230A
Aston Flamville 250A
Athelstoneford 230A
Atherstone .. 250A
Attleborough .. 230A
Atworth .. 230A
Auchencairn .. 230A
Auchendinny .. 230A
Auchenbeath .. 240A
Auchinleck .. 240A
Auchterderran.. 250A
Auchtermuchty 250A
Audenshaw .. 230A
Aughton .. 230A
Austrey .. 250A
Austwick .. 230A
Aveley 230A
Avening .. 230A
Aveton Gifford 240A
Avonbridge .. 250A
Avoncliffe .. 230A
Avondale .. 230A
Awlescombe .. 230A
Axbridge .. 230A
Axminster .. 250A
Aylburton .. 230A
Aylesford .. 230A
Aylsham .. 230A
Aynho 230A
Ayot St. Lawrence .. 240A
Ayr 240A
240C
Ayton 250A
Babraham .. 240A
Babworth .. 230A
Bache 230A
Backbarrow .. 230A
Backford .. 230A
Backwell .. 230A
Bacton .. 230A
Badby 230A
Baddeley .. 230A
Baddesley Ensor 250A
Badgemore .. 230A
Badgeworth .. 210A
Badminton .. 230A
Badshot Lea .. 230A
Baginton .. 230A
Bagnall.. .. 230A
Bagshot .. 230A
Bagworth .. 250A
Baildon .. 230A
Ballieston .. 240A
Bainton .. 230A
Balcombe .. 230A
Balderstone .. 230A
Baldock .. 240A
Baldrina .. 230A
Baldwinholme 230A
Balerno .. 230A
Balham .. 250A
230A
Ballater .. 220C
Ballaugh .. 230A
Balmaclellan .. 230A
Balmalcolm .. 230A
Balmerino .. 250A
Balmore .. 240A
Balsall Common 230A
Bampton .. 230A
Banavie .. 150C
Banningham .. 230A
Bannockburn .. 250A
Banstead .. 230A
Banwell .. 230A
Bapchild .. 230A
Barassie .. 240A
Barbon .. 230A
Barby 230A
Barclose .. 230A
Bardney .. 230A
Bardon .. 250A
Bardsea .. 230A
Bardsey .. 230A
Bardsley .. 240A
Barford (Norfolk) 230A
Barford (Warwicks.) 250A
Bargeddie .. 240A
Bargoed .. 230A
Barkby .. 250A
Barkisland .. 230A
Barkley Thorpe 240A
Barkston .. 230A
Barkston Ash 230A
Barkway .. 240A
Barlaston .. 230A
Barlby 230A
Barlestone .. 250A
Barley 240A
Barleythorpe .. 240A
Barnby Moor .. 230A
Barming .. 230A
Barmbarrock .. 230A
Barmston .. 230A
Barnby .. 230A
Barnby Dun .. 230A
Barnby Moor .. 230A

Barnet 240A
240C
Barnham .. 230A
Barnham Broom 230A
Barnoldby-le-Beck .. 230A
Barnton .. 220A
Barnwell All Saints .. 230A
Barnwell St. Andrew .. 230A
Barnwood .. 230A
Barrow (Ches.) 230A
Barrowby .. 230A
Barrowfield .. 240A
Barrowford .. 230A
Barrow Gurney 230A
Barrymarbor .. 230A
Barsby .. 230A
Barston .. 230A
Barton (Beds.) 240A
Barton (Cambs.) 240A
Barton (Ches.) 230A
Barton (Lancs.) 230A
Barton (Som.) 230A
Barton Mills .. 220C
Barton-on-Sea .. 230A
Barton St. David 230A
Barton Seagrave 230A
Barton-under-Needwood .. 230A
Barwell 250A
Barwick .. 230A
Barwick-in-Elmet .. 230A
Basford .. 230A
Bashall Eaves 230A
Basildon .. 230A
Basing .. 230A
Bassett's Pole .. 250A
Basingbourne .. 240A
Baston 230A
Batcombe .. 230A
Batford 240A
Bathampton .. 230A
Batheaston .. 230A
Bathford .. 230A
Bathgate .. 230A
Battle 230A
Batts Corner .. 230A
Bawburgh .. 230A
Bawdeswell .. 230A
Bawdsey .. 230A
Bawtry 230A
Baxterley .. 250A
Bayford .. 240A
Bayfordbury .. 240A
Beachy Head .. 230A
Beaconsfield .. 230A
Beal 230A
Beaminster .. 230A
Beanacre .. 230A
Beare Green .. 230A
Bearley 250A
Bearsden .. 240A
Bearstead .. 230A
Bearstones .. 230A
Beaufort .. 240C
Beaumont .. 230A
Beaumont Leys 240A
Bebington .. 230A
Beccles .. 230A
Beckermet .. 230A
Beckington .. 230A
Beckley .. 230A
Beckswell .. 230A
Beckwithshaw 230A
Beddingham .. 230A
Beddington .. 205A
Bedfont .. 200A
230A
Bedhampton .. 230A
Bedingham .. 230A
Bedlars Green .. 240A
Bedlinog .. 230A
Bedworth .. 230A
Beeding .. 230A
Beeford 230A
Beer 230A
Beeston (Beds.) 210A
Beeston (Ches.) 208A
Beeston St. Andrew .. 230A
Beetham .. 230A
Beetley .. 230A
Belghton .. 200A
Beith 240A
Bellshill .. 240A
Bellsquarry .. 230A
Belmont (Lanc.) 230A
Belstone .. 230A
Belton (Derby) 250A
Belton (Lincs.) 230A
Belton (Norfolk) 230A
Belvedere .. 200A
Bembridge .. 240A
Bempton .. 230A
Bendish .. 240A
Benenden .. 230A
Benfleet .. 230A
Bengeo .. 240A
Benhall 230A
Beningborough 230A
Benington .. 230A
Benninghoime 230A
Ben Rhydding .. 230A
Bentham .. 230A
Bentley (Surrey) 230A
Bentley (Staffs.) 200A
Bentley-with-Arksey .. 230A
Benwell .. 240A
Bere Alston .. 230A
Bere Ferrers .. 230A
Bergh Apton .. 230A
Berkley .. 230A
Berkswick .. 230A
Berrow .. 230A
Berry Hill .. 230A
Berwick .. 230A
Berwick-on-Tweed .. 240C
Berwick Station 230A
Bessacarr .. 230A
Besthorpe .. 230A
Bestwood .. 230A
Betchworth .. 230A
Bethersden .. 230A
Betley 230A
Betsham .. 230A
Bettws 230A
Bevere 200A
Beverley .. 230A
Bewerley .. 230A
Bexleyheath .. 200A
Bickenhill .. 230A
Bicker 230A
Bickerstaffe .. 230A
Bickington .. 230A
240A
Bicknoller .. 230A
Bidborough .. 220A
Biddenden .. 230A
Biddenham .. 210A
Biddestone .. 230A
Biddulph .. 230A
Biddulph Moor 230A
Biggar 240A
Biggin Hill .. 230A
Biggleswade .. 240A
Bigrig 230A
Bilbrooke .. 230A
Billericay .. 205A
230A
Billesdon .. 250A
Billingborough 230A
Billinge 230A
Billingford .. 230A
Billinghay ..
Billingley .. 230A
Billington .. 230A
Billockby .. 230A
Bilsby 230A
Bilston (Lothian) .. 230A
Bilston (Staffs.) 200A
Bilton (Hull) .. 230A
Bilton (Rugby) 250A
Binbrook .. 230A
Binegar .. 230A
Binfield .. 240A
Binley 230A
Binstead .. 240A
Binsted .. 230A
Bintry 230A
Birch 230A
Birchanger .. 240A
Birch Green .. 240A
Birchington .. 240A
Birchmoor .. 230A
Birchwood .. 230A
Birdbrook .. 230A
Birdham .. 230A
Birdingbury .. 250A
Birdwell .. 230A
Birkenshaw .. 230A
Birling 230A
Birling Gap .. 230A
Birstall (Leic.) .. 240A
Birstall (Yorks.) 230A
Birstwith .. 230A
Bisham .. 230A
Bishopbriggs .. 240A
Bishop Burton 230A
Bishop's Cleeve 210A
Bishop's Hull .. 230A
Bishop's Itchington .. 250A
Bishops Lydeard 230A
Bishop's Offley 230A
Bishop's Tachbrooke .. 250A
Bishop's Tawton .. 230A
Bishopsteignton 230A
Bishopstoke .. 240A
Bishopston .. 230A
Bishops Waltham .. 230A
Bishopsworth .. 210A
Bishop Thornton .. 230A
Bishopthorpe .. 230A
Bishopton .. 240A
Bishop Wilton 230A
Bishton .. 230A
Bisley 200A
Bispham .. 230A
Bittaford .. 240A
Bitteswell .. 250A
Bitton 230A
Bixley 230A
Blaby 250A
Blackcraig .. 230A
Blackdown .. 250A
Blackford .. 230A
Blackfordby .. 250A
Blackgang .. 240A
Blackheath (S.E.3) .. 200A
Blackheath (Surrey) .. 230A
Blackmill .. 220A
Blackmore .. 230A
Blackmore End 240A
Blackness .. 230A
Blackrod .. 230A
Blackshaw Head 230A
Blackstone .. 230A
Black Torrington 230A
Blackwater (Hants.) .. 250A
Blackwater (I.O.W.) .. 240A
Blackwell .. 230A
230A
Blackwood .. 230A
Blacon 230A
Bladnoch .. 230A
Blaengarw .. 230A
Blaengwrach .. 220A
Blaengwynfi .. 230A
Blagden .. 230A
Blagdon .. 230A
Blairlogie .. 250A
Blairmore .. 230A
Blakeney .. 230A
Blakesley .. 230A
Blake Street .. 230A
Blankney .. 230A
Blantyre .. 240A
Blatherwycke .. 230A
Blawith .. 230A
Bleadon .. 230A
Blean 220C
230A
Blencogo .. 230A
Bletchingley .. 240A
Bletchley .. 230A
Blickling .. 230A
Blindley Heath 230A
Blisworth .. 230A
Blofield .. 230A
Blue Anchor (Somerset) .. 230A
Blue Anchor (S. Wales) .. 230A
Blundeston .. 230A
Blunham .. 230A
Blymhill .. 230A
Blyth 230A
Blyth Bridge .. 230A
Boarhills .. 250A
Boarhunt .. 230A
Boarshill .. 230A
Bobbing .. 230A
Bobbington .. 200A
Boddington .. 210A
Bodiam .. 230A
Bodymoor Heath .. 250A
Boggs 230A
Bold 230A
Boldre 240A
Bolehall .. 250A
250A
Bollington .. 220A
Bollington (Macclesfield) 220A
Bolney 230A
Bolton 230A
105A
210A
230A
230C
Bolton-by-Bowland .. 230A
Bolton-le-Sands 230A
Bolton-on-Dearne .. 230A
Bonehill .. 250A
Bonningale .. 230A
Bonnybridge .. 250A
Bonnyrigg .. 230A
Bonchurch .. 240A
Bookhams (The) 230A
Borley Green .. 230A
Boosbeck .. 230A
Boothby Graffoe 230A
Bootle 230C
230A
Booton .. 230A
Borden .. 230A
Boreham Street 230A
Boreham Wood 240A
Boreland .. 250A
Borgue .. 230A
Borough Green 230A
Borwick .. 230A
Boscobel .. 230A
Boscombe .. 200A
Bosham .. 230A
Bostock .. 220A
Boston 240A
Boston Spa .. 230A
Bothenhampton 230A
Bothwell .. 240A
Botley 230A
Botolph Claydon 230A
Bottesford .. 230A
Bottisham .. 240A
Botton 230A
Bonghton (Kent) 230A
Boughton (Northants) .. 210A
Boughton Aluph 230A
Boughton Monchelsea .. 230A
Bourn 240A
Bourne .. 230A
Bourne End .. 100A
200A
230A
Boundstone .. 230A
Bourton .. 250A
Bousteads Hill 230A
Boverton .. 230A
Bovey Tracey .. 230A
Bovingdon .. 240A
Bow 230A
Bow Brickhill .. 230A
Bowden .. 250A
100A
200A
Bower Ashton .. 230A
Bower Hinton .. 230A
Bowers Gifford 230A
Bowershall .. 250A
Bowlee .. 230A
Bowlers Town .. 230A
Bowling .. 240A
Bowness .. 100A
200A
Bowthorpe .. 230A
Box 230A
Box 230A
Boxgrove .. 230A
Boxley 230A
Boxted .. 230A
Boyton .. 230A
Bozeat 230A
Bracebridge Heath .. 230A
Bracklesham .. 230A
Brackley .. 230A
Bracknell .. 240A
Braconash .. 230A
Bradda .. 230A
Bradden .. 230A
Bradfield (Essex) .. 230A
Bradfield (Yorks) .. 230A
Bradford .. 230C
230A
Bradford Abbas 230A
Bradford-on-Avon .. 230A
Bradford-on-Tone .. 230A
Brading .. 240A
Bradley .. 230A
Bradninch .. 230A
Bradpole .. 230A
Bradsham .. 230A
Bradwell .. 230A
Bradfield .. 230A
Braidwood .. 240A
Braintree .. 230A
Braithwell .. 230A
Bramber .. 230A
Bramcote .. 250A
Bramerton .. 230A
Bramfield .. 240A
Bramhall .. 240A
230A
Bramham .. 230A
Bramhope .. 230A
Bramingham .. 240A
Brandley (Surrey) .. 230A
Bramley (Yorks). .. 230A
Brampford Speke .. 230A
Brampton (Cumb.) .. 230A
Brampton (Derby) .. 240A
Brampton (Hunts.) .. 240A
Brampton Ash .. 230A
Brampton Bierlow .. 230A

Brampton-en-le-Morthen .. 230A
Brampton Junction .. 230A
Branderburgh .. 230C
Brandesburton 230A
Brandiston .. 230A
Brandon .. 250A
Bransford .. 200A
Branston (Lincs.) .. 230A
Branston (Staffs.) .. 230A
Branstone .. 230A
Brantham .. 230A
Branthwaite .. 230A
Brantingham .. 230A
Brasted .. 220A
Bratton .. 230A
Braughing .. 240A
Braughing Friars .. 240A
Braunston .. 230A
Braunston (Leics.) .. 230A
Braunstone .. 240A
Braunstone (Frith) .. 240A
Braunton .. 220C 230A
Bray 230C 230A
Braybrooke .. 230A
Breachwood Green .. 240A
Breadsall .. 200A
Bream 230A
Breamore .. 230A
Brean 230A
Brearton .. 230A
Brede 230A
Bredgar .. 230A
Breedon .. 250A
Brenchley .. 230A
Brent Knoll .. 230A
Brentor .. 230A
Brentwood .. 230A 240A
Brereton .. 230A
Bretby .. 230A
Bretford .. 250A
Bretton .. 230A
Brickenden .. 240A
Brickett Wood 240A
Bridekirk .. 230A
Bridestowe .. 230A
Bridge 230A
Bridge (Kent) .. 220C
Bridgefoot .. 230A
Bridge of Allan 250A
Bridge of Dee .. 230A
Bridge of Weir .. 240A
Bridgerule .. 230A
Bridgtown .. 230A
Briech 230A
Briercliffe .. 230A
Briercliffe Lower .. 230A
Brierley .. 230A
Brierley Hill .. 200A
Brigham .. 230A
Brightstone .. 240A
Brightwell .. 230A
Brigsley .. 230A
Brigstock .. 230A
Brinklow .. 250A
Brinsworth .. 230A
Brisco 230A
Brisley 230A
Brithdir .. 230A
Brixton (Devon) 230A
Brixworth .. 230A
Broadbottom .. 230A
Broadclyst .. 230A
Broadheath .. 200A
Broadhempton 240A
Broadlay .. 250A
Broadmayne .. 230A
Broadmore .. 230A
Broad Oak .. 230A
Broad Oak End 240A
Broadstairs .. 240C
Broadwater .. 240A
Broadwath .. 230A
Broadwell .. 230A
Broadwindsor .. 230A
Brock 230A
Brockenhurst .. 230A
Brockham .. 230A
Brockley (London) .. 200A
Brockley (Somerset) .. 230A
Brockmoor .. 200A
Brockworth .. 230A
Brocton .. 230A
Brodsworth .. 230A
Bromborough .. 230A
Bromeswell .. 230A
Bronham .. 210A
Bromley Cross .. 230A
Brompton (Kent) .. 230A
Brompton (Yorks.) .. 230A
Brook (I.O.W.) 240A
Brook (Surrey) 230A
Brooke 230A
Brookfield .. 240A
Brookmans Park 240A
Brookside .. 240A
Broom Barns .. 240A
Broome .. 230A
Broomfield .. 230A
Broomin Green 240A
Brotherton .. 230A
Brotton .. 250A
Brough 230A
Brough (Westmorland) .. 200C
Brough (Yorks.) 230A
Broughton (Flints.) .. 230A
Broughton (Lancs.) .. 230A
Broughton (Northants.) 230A
Broughton Astley .. 250A
Broughton Gifford .. 230A
Brown Edge .. 230A
Brownhills .. 250A
Brownsover .. 250A
Broxbourne .. 240A
Broxted .. 230A
Broxton .. 230A
Bruen Stapleford 230A
Brundall .. 230A
Brunstock .. 230A
Bruntingthorpe 250A
Bruton 230A
Bryncock .. 220A
Brynhir .. 230A
Brynmynach .. 230A
Brynna 230A
Brynsadler .. 230A
Bubbenhall .. 250A
Buckabank .. 230A
Buckden .. 240A
Buckfastleigh .. 240A
Buckhaven .. 250A
Buckhurst Hill 230A
Buckingham .. 230A
Buckland (Herts.) .. 240A
Buckland (Surrey) .. 240A
Buckland Monachorum 230A
Bucklesham .. 230A
Bucklow Hill .. 220A
Buckminster .. 230A
Bucksburn .. 230A
Bucks Horn Oak 230A
Budleigh Salterton .. 230A
Buerton .. 230A
Bugbrooke .. 210A
Bugle 230A
Bulkington .. 250A
Bulls Green .. 240A
Bullwood .. 230A
Bulmer 230A
Bumbles Green 240A
Bunkershill .. 230A
Buntingford .. 240A
Bunwell .. 230A
Burbage .. 250A
Burch Green .. 230A
Burchetts Green .. 240A
Burgh 230A
Burgh-by-Sands 230A
Burgh Castle .. 230A
Burgh Heath .. 230A
Burgh-le-Marsh 230A
Burgh St. Margaret 230A
Burgh St. Peter 230A
Burleigh .. 230A
Burlescombe .. 230A
Burley 230A
Burley (Hants.) 230A
Burley (Lincs.) 230A
Burley-in-Wharfedale .. 230A
Burlingham .. 230A
Burnett .. 230A
Burnham (Bucks.) .. 230A
Burnham (Somerset) .. 230A
Burnham Green 240A
Burnham-on-Crouch .. 230A
Burnmouth .. 230A
Burnopfield .. 250A
Burnriggs .. 230A
Burnside .. 240A
Burntisland .. 250A
Burntwood .. 250A
Burnt Yates .. 230A
Burrington .. 230A
Burrough .. 230A
Burrow Hill .. 200A
Burrow-with-Burrow .. 230A
Burry Port .. 250A
Burscough .. 230A
Bursledon .. 230A
Burslem .. 240A 220C
Burstow .. 230A
Burstwick .. 230A
Burton Ches.) .. 230A
Burton (Lancs.) 230A
Burton (Lincs.) 230A
Burton Agnes .. 230A
Burton Bradstock .. 230A
Burton-in-Lonsdale .. 230A
Burton Latimer 230A
Burton Lazars .. 230A
Burton Leonard 230A
Burton-on-the-Wolds .. 250A
Burton Overy .. 250A
Burton Pidsea .. 230A
Burton Salmon 230A
Burton-upon-Trent .. 200A
Burtonwood .. 230A 250A
Burwardsley .. 230A
Burwash .. 230A
Burwell .. 240A
Bury 230A
Bury Green .. 240A
Busby 240A
Bushbury .. 230A
Bush Hall .. 240A
Bushey 200A
Bushley .. 240A
Butetown .. 230A
Butleigh .. 230A
Butley 230A
Butlocks Heath 230A
Butterton .. 230A
Butterwick .. 230A
Butt Lane .. 230A
Buttsbury .. 230A
Buxton (Derby) 230C 230A
Buxton (Norfolk) 230A
Buxworth .. 230A
Byfield 230A
Byfleet 200A
Bygrave .. 240A
Bylaugh .. 230A
Bynea 250A
Byram-cum-Sutton .. 230A
Cadbury Camp 230A
Cadeby 250A
Caddington .. 240A
Cadishead .. 230A
Cadoxton .. 220A
Caerau 230A
Caergwrle .. 230A
Caerleon .. 230A
Cainscross .. 230A
Caister (East) .. 230A
Caister (West) .. 230A
Caister St. Edmunds .. 230A
Caldecote (Bedford) .. 230A
Caldecote (Leic.) 250A
Caldecott (Chester) .. 230A
Caldecott (Leic.) 230A
Calderbank .. 240A
Calderbridge .. 230A
Caldwell .. 230A
Calf Heath .. 230A
Callow 230A
Callow End .. 200A
Calstock .. 230A
Calthorpe (Norfolk) .. 230A
Calthorpe (Warwicks.) 250A
Calthwaite .. 230A
Calverley .. 230A
Calvert 230A
Calverton .. 230A
Cam 230A
Camber 230A
Camberley .. 250A
Camberwell .. 205A 205C 230A
Cambusbarron 250A
Cambuskneth .. 250A
Cambuslang .. 240A
Cameron .. 250A
Camerton .. 230A
Campsall .. 230A
Campsea Ash .. 230A
Campton .. 240A
Candlesby .. 230A
Candor 230A
Canendon .. 230A
Canning Town .. 200A
Cantley (Norfolk) .. 230A
Cantley (Yorks.) 230A
Cantsfield .. 230A
Canvey Island .. 230A
Canwell .. 250A
Canwick .. 230A
Capel (Surrey) .. 230A
Capenhurst .. 230A
Carclaze .. 230A
Carden 230A
Cardenden .. 250A
Cardington .. 230A
Cardonald .. 240A
Cardross .. 240A
Carfin 240A
Cargo 230A
Carhampton .. 230A
Carisbrooke .. 240A
Carleton (Pontefract) 230A
Carleton Forehoe .. 230A
Carleton Rode .. 230A
Carlin How .. 250A
Carlton (Barnsley) .. 230A
Carlton (Beds.) 230A
Carlton (Notts.) 230A
Carlton (Skipton) .. 230A
Carlton (Wetherby) .. 230A
Carlton-in-Lindrick .. 230A
Carluke 240A
Carlyon Bay .. 230A
Carmel 250A
Carmunnock .. 240A
Carmyle .. 240A
Carnaby .. 230A
Carnbee .. 250A
Carnforth .. 230A
Carnock .. 250A
Carnwath .. 240A
Carpalla .. 230A
Carreghofa .. 230A
Carrog 230A
Carrow HiW .. 230A
Carsethorn .. 230A
Carshalton .. 230A
Carstairs Junction .. 240A
CarstairsVillage 240A
Cartmel .. 230A
Carway 250A
Casterton .. 230A
Castle Ashby .. 230A
Castle Bromwich 230A
Castle Cary .. 230A
Castle Donington .. 250A
Castle Douglas 230A
Castleford .. 230A
Castle Gresley .. 230A
Castle Liberty .. 250A
Castlethorpe .. 230A
Castleton (Dorset) .. 230A
Castleton (Mon.) 230A
Castletown .. 230A
Castley 230A
Castoe 230A
Catcliffe .. 230A
Caterham .. 240A
Catfield 230A
Catford 200A 240A
Catforth .. 230A
Cathcart .. 240A
Catherington .. 230A
Catisfield .. 220A
Caton 230A
Catrine 240A
Catsfield .. 230A
Cattawade .. 230A
Cattistock .. 230A
Catton 230A
Catwick .. 230A
Caughall .. 230A
Causey 250A
Caverswall .. 230A
Cawood .. 230A
Cawston .. 230A
Cawthorne .. 230A
Caxton 240A
Cayton 230A
Cefn Bychan .. 230A
Cefy Coed .. 230C
Cefn Cribbwr .. 230A
Cefn Forest .. 230A
Cefn-y-Bedd .. 230A
Cellarhead .. 230A
Cemmaes .. 210C
Ceres 250A
Cerne Abbas .. 230A

Chackmore .. 230A
Chadderton .. 230A
Chaddesden .. 200A
Chadshunt .. 250A
Chadsmoor .. 230A
Chadwell Heath 230A
Chadwell St. Mary .. 230A
Chagford .. 230A
Chalgley .. 230A
Chailey 230A
Chaldon .. 230A
Chaldon Herring 230A
Chale 240A
Chalfont St. Giles .. 200A
Chalfont St. Peter .. 230A
Chalk 230A
Chalton .. 240A
Chalvington .. 230A
Chandlers Ford 230A
Chapel Brampton .. 210A
Chapel Chorlton 230A
Chapel-en-le-Frith.. .. 230A
Chapelhall .. 240A
Chapel-le-Ferne 230A
Chapel St. Leonards 230A
Chapelthorpe .. 230A
Chapeltown (Lancs.) .. 230A
Chapeltown (Yorks.) .. 230A
Cha'manslade .. 230A
Chappel 230A
Chard 230A
Chardstock .. 230A
Charfield .. 230A
Charing .. 230A
Charlcombe .. 230A
Charlecote .. 230A
Charlestown .. 250A
Charlestown (Cornwall) .. 230A
Charlestown (Yorks.) .. 230A
Charlesworth .. 230A
Charleton .. 240A
Charlton .. 230A
Charlton (S.E.7.) 200A
230A
Charlton Adam 230A
Charlton Horethorne .. 230A
Charlton Kings 210A
Charlton Mackrell .. 230A
Charltons .. 250A
Charlwood .. 230A
Charndon .. 230A
Charwelton .. 230A
Chase Terrace .. 250A
Chatburn .. 230A
Chatham .. 230A
Chattenden .. 230A
Chatteris .. 240A
Chavey Down .. 240A
Cheadle (Ches.) 230A
240A
Cheadle (Staffs.) 230A
Cheadle Hulme 240A
Cheam 230A
Chebsey .. 230A
Cheddar .. 230A
Cheddington .. 240A
Cheddleton .. 230A
Cheddon Fitzpaine.. .. 230A
Chelford .. 230A
Chellaston .. 200A
Chellington .. 230A
Chelmsford .. 230A
Chelsham .. 230A
Chelwood Gate 230A
Chenies.. .. 230A
Cheriton Fitzpaine .. 230A
Cherry Burton .. 230A
Cherry Hinton .. 240A
200A
Cherry Willingham 230A
Chertsey .. 200A
Cheshil 230A
Cheshunt .. 240A
Cheslyn Hay .. 230A
Chessington .. 230A
Chesterton Priory .. 240A
Cheswardine .. 230A
Chetnole .. 230A
Cheveley Park .. 240A
Chevening .. 220A
Chevet 200A
Chew Magna .. 230A
Chew Stoke .. 230A
Chewton Mendip 230A
Chickerell .. 230A
Chicksands Priory .. 230A
Chiddingstone .. 220A
Chideok .. 230A
Chigwell .. 230A
Chilcompton .. 230A
Chilcote .. 230A
Chilcote (Somerset)
Chilcote (Somerset) .. 250A
Chilfrome .. 230A
Chillington .. 240A
Chilworth .. 230A
200A
Chingford .. 240A
Chinley .. 230A
Chinnor .. 220A
Chippenham .. 230A
Chipping .. 240A
Chipping(Lancs.) 230A
Chipping Ongar 230A
Chipping Sodbury .. 230A
Chipping Warden .. 230A
Chipstead .. 230A
Chirton .. 240A
Chiselborough .. 230A
Chislehurst .. 210C
230A
200A
Chiswell Green 240A
Chisworth .. 230A
Chittering .. 240A
Chobham .. 200A
Chorley (Ches.) 230A
Chorley (Lancs.) 230A
Chorley Wood 240A
Chorlton .. 230A
Chowley .. 230A
Christchurch (Hants.) .. 230A
250C
Christian Malford .. 230A
Christleton .. 230A
Chryston .. 240A
Chudleigh .. 230A
Church .. 230A
Church Brampton .. 210A
Churchdown .. 230A
Churchgate Street .. 240A
Church Gresley 230A
Churchill .. 230A
Church Lawford 250A
Church Leigh .. 230A
Churchover .. 250A
Churchtown .. 230A
Churston Ferrers 220C
Churt 230A
Churton .. 230A
Churton-by-Farndon .. 230A
Churton Heath 230A
Cilfydd .. 230A
Cinderford .. 230A
City of London 200C
230A
210A
210C
Clackmannan .. 250A
Clandown .. 230A
Clansfield .. 230A
Clapham (Beds.) 210A
Clapham (S.W.4) .. 205A
230A
Clapham (Yorks.) .. 230A
Clapton (Somerset) .. 230A
Clarebrand .. 230A
Clarkston .. 240A
Claughton .. 230A
Claverdon .. 250A
Claverham .. 230A
Clavering .. 230A
Claverley .. 200A
Claverton(Ches.) 230A
Claverton (Somerset) .. 230A
Clacton .. 230A
Claybrooke Magna .. 250A
Claybrooke Parva .. 250A
Claygate .. 230A
Claypole .. 230A
Clayton (Yorks.) 230A
Clayton-le-Dale 230A
Clayton-le-Moors 230A
Clayton West .. 230A
Clayworth .. 230A
Clearbrook .. 230A
Cleator 230A
Cleator Moor .. 230A
Cleckheaton .. 230A
Cleeve 230A
Cleland 240A
Clenchwarton .. 230A
Clevedon .. 230A
Cleveley .. 240A
Cleveleys .. 230A
Cliburn .. 230A
Cliddesden .. 230A
Cliffe 230A
Clifford (Yorks.) 230A
Cliff 250A
Cliff Park .. 230A
Clifton 230A
Clifton (Beds.) .. 240A
Clifton (Lancs.) 230A
Clifton (Notts.) 230A
Clifton (Yorks.) 230A
Clifton Campville .. 250A
Clifton-on-Dunsmore .. 250A
Clifton Reynes 230A
Clint 200A
Clippesby .. 230A
Clipston .. 230A
Cliviger .. 230A
Clophill .. 230A
Clotton Hoofield 230A
Cloughton .. 230A
Cluny 250A
Clutton (Ches.) 230A
Clutton (Somerset) .. 230A
Clydach .. 230A
Clydebank .. 240A
Clymping .. 230A
Clyne 220A
Clyst Honiton .. 230A
Clyst St. George 230A
Coaley 230A
Coalfell .. 230A
Coaltown of Balgonie .. 250A
Coaltown of Wemyss .. 250A
Coalville .. 250A
Coat 230A
Coates 230A
Coberley .. 210A
Cobham (Kent) 230A
Cobham (Surrey) 230A
Cokaye Hatley 240A
Cockenzie .. 230A
Cockerham .. 230A
Cockermouth .. 230A
Cocklakes .. 230A
Cockwood .. 230A
Coddington .. 230A
Codinote .. 240A
Coed Talon .. 230A
Coffinswell .. 200A
Cogenhoe .. 230A
Coity 230A
Cokeham .. 230A
Colaton Raleigh 230A
Colby (I.O.M.) 230A
Colby (Norfolk) 230A
Cold Ashby .. 230A
Colden Common 230A
Coldharbour .. 230A
Coldingham .. 250A
Cold Norton .. 230A
Coldrey .. 230A
Coldstream .. 250A
Cole 230A
Coleby 230A
Coleford (Glos.) 230A
Coleford (Somerset) .. 230A
Cole Green .. 240A
Coleorton .. 250A
Coles Hill (Bucks.) .. 240A
Coleshill (Warwicks.) 230A
Coley 230A
Collinsburgh .. 250A
Collessie .. 250A
Collingham .. 230A
Collingtree .. 210A
Collyweston .. 230A
Colney 230A
Colney Heath .. 240A
Colney Street .. 240A
Coltishall .. 230A
Colton 230A
230A
Colvend .. 230A
Colwich .. 230A
Colwick .. 230A
Colyford .. 230A
230A
Combe-in-Teignhead .. 230A
Combe Martin .. 230A
Combe Raleigh 230A
Combe St. Nicolas .. 230A
Comberbach .. 220A
Comberford .. 250A
Combrook .. 250A
Combs 230A
Compstall .. 230A
Compton (Devon) .. 230A
Comptou (Hants.) .. 230A
Compton (Surrey) .. 230A
Compton Martin .. 230A
Compton Pauncefoot .. 230A
Compton Verney 250A
Coneythorpe .. 230A
Congresbury .. 230A
Coningsby .. 230A
Conisborough .. 230A
Coniston(Lancs.) 230A
Coniston (Yorks.) 230A
Conkwell .. 230A
Connel Park .. 240A
Cononley .. 230A
Cookham Dene 230A
Cookham Rise .. 230A
Cooksbridge .. 230A
Cookshill .. 230A
Coombe .. 220A
Copford .. 230A
Copgrove .. 230A
Copie 230A
Copmanthorpe 230A
Copplestone .. 230A
Copthorne .. 230A
Corby (Cumb.) .. 230A
Corby (Northants.) 230A
Corby Hill .. 230A
Corfe 230A
Corley 230A
Corpach .. 150C
Corpusty .. 230A
Corringham .. 230A
Corsham .. 230A
Corsto .. 210A
Corton 230A
Corton Denham 230A
Corvallie .. 230A
Cosby 250A
Coseley .. 200A
Cosgrove .. 230A
Cossington .. 250A
Costessey .. 230A
Cotebrook .. 220A
Cotesbach .. 250A
Cotes Heath .. 230A
Cothill 230A
Coton 200A
250A
Coton-in-the-Clay 230A
Coton-in-the Elms .. 230A
Cottenham .. 240A
Cottesbrooke .. 230A
Cottingham (Leic.) .. 230A
Cottingham (Yorks.) .. 230A
Cottingley .. 230A
Cotton Abbots 230A
Cotton Edmunds 230A
Cotton End .. 230A
Coulsdon .. 205A
230A
Coundon .. 230A
Countesthorpe .. 250A
Countisbury .. 100A
200A
Cove 230A
Cowbit 230A
Cowbridge Town 230A
Cowdenbeath .. 250A
Cowes (I.O.W.) 240A
Cowfold .. 230A
Cowley .. 230A
Cowley (Devon) 230A
Cowley (Glos.) 210A
Cowley (Middx.) 200A
Cowling .. 230A
Cowplean .. 230A
Cowslip Green 230A
Coxheath .. 230A
Coxley 230A
Coychurch .. 230A
Crackenthorpe 230A
Craddock .. 230A
Cradle End .. 240A
Craigcefnparc .. 230A
Craigendoran .. 240A
Crail 250A
Cranage .. 220A
Cranborne .. 240A
Cranbrook .. 230A
Cranfield .. 230A
Cranford .. 230A
Cranham .. 230A
Cranleigh .. 230A
Cransley .. 230A
Cranswich .. 230A
Crapstone .. 230A
Crawley .. 230A
Crawley Down 230A

Crayford .. 240A
Creaton .. 210A
Crediton .. 230A
Creebridge .. 230A
Creech St. Michael .. 230A
Creeksea .. 230A
Creetown .. 230A
Creigian .. 250A
Crewkerne .. 230A
Crick 230A
Cricklewood .. 240A
Crigglestone .. 230A
Cringleford .. 230A
Cripps Corner .. 230A
Crocketford .. 230A
Crockey Hill .. 230A
Crockham Hill 220A
Croesyceiliog .. 230A
Croft (Durham) 230A
Croft (Leic.) .. 250A
Croft (S. Wales) 230A
Crofton .. 230A
Crofty 230A
Cromer .. 240C
Crompton .. 230A
Cronton .. 230A
Crooklands .. 230A
Crookston .. 240A
Cropston .. 250A
Crosby (I.O.M.) 230A
Crosby (Yorks.) 230A
Crosby-on-Eden 230A
Cross 230A
Crosscanonby .. 230A
Crossford .. 250A
Crossgates .. 250A
Crosshills .. 230A
Crosshouse .. 240A
Cross Inn .. 230A
Crosskeys .. 230A
Crossmichael .. 230A
Croston .. 230A
Croughton (Ches.) .. 230A
Croughton (Northants.) 230A
Crow 230A
Crowborough .. 230A
Crowhurst .. 230A
Crowland .. 230A
Crowlink .. 230A
Crown Lane .. 230A
Crowthorne .. 250A
Crowton .. 220A
Croxall 250A
Croxley Green 240A
Croxton (Hunts.) 240A
(Staffs.) 230A
Kerrial 230A
Croy 250A
Croyde 230A
Crumlin (Mon.) 230A
250C
Crynant .. 220A
Cubbington .. 250A
Cuckfield .. 230A
Cuddington (Ches.) .. 220A
Cuddington (Surrey) .. 230A
Cudworth .. 230A
Cuerdale .. 230A
Cuerdley .. 250A
Cuffley 240A
Culcheth .. 230A
Culgaith .. 230A
Cullercoats .. 240A
Cullompton .. 230A
Cullingworth .. 230A
Culmstock .. 230A
Culpho 230A
Culros 250A
Culter 230A
Culton 230A
Cults 250A
230A
Culworth .. 230A
Cumbernauld .. 250A
Cumberworth .. 230A
Cummersdale .. 230A
Cumnor .. 230A
Cumwhinton .. 230A
Cupar 250A
Curdworth .. 230A
Currie 230A
Curry Rivel .. 230A
Custom House 200A
Cusworth .. 230A
Cwm 240C
Cwmavon .. 230A
Cwmbram .. 230A
Cwmfelin .. 230A
Cwmfelinfach 230A
Cwmffrwd .. 230A
Cwmgorse .. 230A
Cwmgwill .. 250A
Cwmgwrach .. 220A
Cwmllinau .. 220C
Cwmliynfell .. 230A
Cwmmau .. 230A
Cwmmer .. 230A
Cymmer South 230A
Cwm-Nant-Gwynt .. 230A
Cynmau .. 230A
Cynonafon .. 230A
Cynwyd .. 230A
Dacre 230A
Dadlington .. 250A
Dafen 250A
Dagenham .. 230A
Dairsie 250A
Dalbeattie .. 230A
Dalkeith .. 230A
Dalmelington .. 240A
Dalmuir .. 240A
Dalry (Ayr) .. 240A
Dalry (Kirkcudbright) 230A
Dalrymple .. 240A
Dalston (Cumb.) 230A
Dalton (Lancs.) 230A
(Yorks.) 230A
Dalton Holme-in-Furness 220A
Parva .. 230A
Danbury .. 230A
Dane End .. 240A
Danehill .. 230A
Danesbury .. 240A
Dareton .. 230A
Danzey Green 230A
Daresbury .. 250A
Dareton .. 230A
Darfield .. 230A
Darlaston .. 200A
Darley 230A
Darley Abbey .. 200A
Darley Head .. 230A
Darnhall .. 220A
Darrington .. 230A
Darton .. 230A
Darvel 240A
Datchworth .. 240A
Davenham .. 220A
Daventry .. 210A
Davington .. 230A
Davyhulme .. 230A
Dawlish 230A
Dawlish Warren 230A
Deal 230A
Dean 230A
Deane 230A
Deanhouse .. 230A
Deanshanger .. 230A
Dearham .. 230A
Dedham .. 230A
Deganwy .. 230A
Deighton .. 230A
Delamere .. 220A
Delph 230A
Denaby .. 230A
Denbeath .. 230A
Denbury .. 240A
Denby Dale .. 230A
Dendron .. 230A
Denford .. 210A
Denham .. 200A
Denholm .. 250A
Denholme .. 230A
Denmead .. 230A
Denshaw .. 230A
Denstone .. 230A
Denton (Kent) 230A
Denton (Lincs.) 230A
Denton Manchester .. 230A
Denton (Northants.) 230A
Denton (Yorks.) 230A
Deopham .. 230A
Deri 230A
Desborough .. 230A
Desford .. 250A
Detling .. 230A
Dewarton .. 230A
Devizes .. 230A
Dibden Purlieu 230A
Diddington .. 240A
Digby 230A
Diggle 230A
Digswell .. 240A
Dilham .. 230A
Dilhorne .. 230A
Dilton Marsh .. 230A
Dinas 230A
Dinas Powis .. 230A
Dinder 230A
Dingley .. 230A
Dinnington .. 230A
Dippenhall .. 230A
Dirleton .. 230A
Diseworth .. 250A
Disley 230A
Diss 230A
Distington .. 230A
Ditcheat .. 230A
Ditchingham .. 230A
Ditchling .. 230A
Dittisham .. 240A
Ditton .. 230A
Dittons, The .. 230A
Dobeross .. 230A
Dockenfield .. 230A
Doddington (Cambs.) .. 240A
Doddington (Kent) .. 230A
Dodington .. 230A
Dodleston .. 230A
Dodworth .. 230A
Donington .. 230A
Donisthorpe .. 250A
Donyatt .. 230A
Dordon 250A
Dormansland .. 230A
Dormans Park .. 230A
Dorney 230A
Dorridge .. 230A
Dorrington .. 230A
Dosthill .. 250A
Douglas Hall .. 230A
Dousland .. 230A
Dove Holes .. 230A
Dovenby .. 230A
Dovercourt Bay 240A
Dowlais .. 230C
Downham .. 230A
Downham Market .. 230A
Downholland .. 230A
Downley .. 230A
Drakelow .. 230A
Draughton .. 230A
Draycott (Somerset) .. 230A
Draycott (Staffs.) .. 230A
Drayton (Daventry) .. 230A
Drayton (Norfolk) .. 230A
Drayton (Somerset) .. 230A
Drayton Bassett .. 230A
DraytonParslow 230A
Dreghorn .. 240A
Drem 230A
Drewsteignton 230A
Driffield .. 230A
Drigg 230A
Drightlington .. 230A
Dringhouses .. 230A
Drivers End .. 240A
Drongan .. 240A
Dronfield .. 200A
Drovers, The .. 230A
Droxford .. 230A
Droylsden .. 230A
Drumchapel .. 240A
Drybridge .. 240A
Drybrook .. 230A
Duddington .. 230A
Duddon .. 230A
Duffield .. 200A
Dukenfield .. 230A
Dullatur .. 250A
Dulverton .. 230A
Dulwich .. 205A
230A
Dumbarton .. 240C
240A
Dunbar 230A
Dunbog .. 250A
Dunchurch .. 250A
Duncote .. 230A
Dundonald .. 240A
Dundrennan .. 230A
Dunfermline .. 220A
250A
Dunford Bridge 230A
Dunham .. 230A
Dunham Massey 250A
100A
200A
Dunino 250A
Dunipace .. 230A
Dunkeswick .. 230A
Dunlop 240A
Dunmow .. 230A
Dunnington .. 230A
Dunnockshaw .. 230A
Duns 250A
Dunsby .. 230A
Dunscroft .. 230A
Dunsden .. 230A
Dunsfold .. 230A
Dunshelt .. 250A
Dunstable .. 240A
Dunston .. 230A
Dunsville .. 230A
Dunswell .. 230A
Dunton 230A
Dunton Bassett 230A
Dunton Green .. 230A
Dunvant .. 230A
Duport 230A
Durdar 230A
Durrington (Sussex) .. 230A
Dursley .. 230A
Dutton 250A
Duxford .. 240A
Dwygyfylchi .. 230A
Dyce 230A
Dyffryn .. 230A
Dyke 230A
Dykes Head .. 230A
Dymchurch .. 230A
Dysart 250A
Eaglesfield .. 230A
Eaglesham .. 240A
Earlestown .. 230A
Earley 230A
Earls Barton .. 210A
Earl Shinton .. 250A
Earlston .. 250A
Earlswood (Surrey) .. 230A
Earlswood (Warwick) .. 230A
Earswick .. 230A
Easington .. 250A
East Ashling .. 230A
East Ayton .. 230A
East Barnet .. 240A
East Bergholt .. 230A
East Bierley .. 230A
East Bilney .. 230A
East Brent .. 230A
Eastburn .. 230A
Eastby 230A
East Calder .. 230A
East Carleton .. 230A
East Carlton .. 230A
East Chaldon .. 230A
East Challow .. 230A
East Chilcington 230A
East Chinnock .. 230A
East Clandon .. 230A
East Claydon .. 230A
East Coker .. 230A
Eastcote (Middx.) .. 240A
Eastcote (Northants.) 230A
East Coulston .. 230A
East Cowes .. 240A
East Dean .. 230A
East End Green 240A
Eastergate .. 230A
Easterton .. 230A
East Farleigh .. 230A
East Farndon .. 230A
East Guldford .. 230A
East Haddon .. 210A
Easthampstead 240A
East Hanningfield 230A
East Harptree .. 230A
East Hoathley .. 230A
East Horndon .. 230A
Easthorpe .. 230A
East Howdon .. 230A
East Hyde .. 240A
Eastington (Gloucs.) .. 210C
Eastington (Gloucs.) .. 230A
East Kerrier .. 240A
East Keswick .. 230A
East Kilbride .. 240A
East Langton .. 250A
Eastleigh .. 240A
East Linton .. 230A
East Malling .. 230A
East Markham 230A
Eastnor .. 230A
East Ogwell .. 200A
Easton (Dorset) 230A
Easton (Lincs.) 230A
Easton (Norfolk) 230A
Easton (Somerset) .. 230A
Easton-in-Gordano .. 230A
Easton Mandit 230A
Easton Peckham 230A
Easton Philipstoun .. 250A
Easton Preston 230A
Eastrea 230A
Eastry 230A
East Sheen .. 210C
East Tilbury .. 230A
East Tuddenham 230A
Eastwell .. 230A
East Wemyss .. 250A
East Wickham 200A
Easwood 230A
230C
Eaton (Ches.) .. 230A
Eaton (Lincs.) .. 230A
Eaton (Notts.) .. 230A
Eaton Bray .. 240A
Eaton Hastings 230A
Eaton Socon .. 240A
Ebford 230A
Ecclesfield .. 230A
Eccleshall .. 230A

Eccleston(Ches.) 230A
Eccleston (Chorley, Lancs.) .. 230A
Eccleston (St. Helens, Lancs.) .. 230A
Ecton 210A
Eddleston .. 230A
Edenbridge .. 230A
Edenhall .. 230A
Eden Lacy .. 230A
Edenthorpe .. 230A
Edgecote .. 230A
Edge Hay Green 230A
Edgehead .. 230A
Edgerley .. 230A
Edgware .. 240A
Edgworth .. 230A
Edingale .. 250A
Edington .. 230A
Edingworth .. 230A
Edlisborough .. 230A
Edmondstown .. 230A
Edmonton .. 240A
Edwalton .. 230A
Efail Isaf .. 230A
Effingham .. 230A
Egerton (Kent) 230A
Egerton (Lancs.) 230A
Eggborough .. 230A
Eggbrickland .. 230A
Eggington .. 230A
Eggliscliffe .. 250A
Egremont .. 230A
Eight Ash Green 230A
Elderslie .. 240A
Eldwick .. 230A
Elford 230A
Elgin 240C
Elie 250A
Ellan 220C
Ellattone .. 230A
Ellel 230A
Ellens Green .. 230A
Ellerby 230A
Ellerker .. 230A
Ellesmere Port 230A
250A
Ellingham .. 230A
Ellisfield .. 230A
Elloughton .. 230A
Elmdon 230A
Elmdon Heath .. 230A
Elmesthorpe .. 250A
Elmhurst .. 230A
Elmstead .. 230A
Elphinstone .. 230A
Elsecar .. 230A
Elsenham .. 240A
Elsfield .. 230A
Elsing 230A
Elston 210A
Elstree 240A
Elswick 230A
Eltham .. 220A
Eltisley 240A
Elton 240A
Elton (Ches.) .. 250A
Elton Bank .. 230A
Elvington .. 230A
Ely 240A
Emberton .. 210A
Emborough .. 230A
Embsay .. 230A
Emley 230A
Emsworth .. 230A
Enderby .. 230A
Endmore .. 230A
Endon 230A
Enfield 240A
240C
English Bicknor 230A
English Combe 230A
Epping .. 230A
240A
Epping Upland 230A
Erlestoke .. 230A
Erpingham .. 230A
Erringden .. 230A
Escrick .. 230A
Esher 230A
Esholt 230A
Essendine .. 230A
Essendon .. 240A
Essington .. 230A
Etching Hill .. 230A
Etchingham .. 230A
Eton 230A
Eton Wick .. 230A
Etton (Northts.) 230A
Etton (Yorks.) .. 230A
Evans' Farm Estate .. 240A
Evenley .. 230A
Evercreech .. 230A
Eversholt .. 240A
Evershot .. 230A
Everton .. 230A
Evington .. 200A
240A
Ewell 230A
Ewen 230A
Ewenny .. 230A
Ewhurst .. 230A
Ewood Bridge .. 230A
Exbourne .. 230A
Exminster .. 230A
Exmouth .. 230A
Exning .. 240A
Exton 230A
Eydon 230A
Eye (Northants) 230A
Eyemouth .. 230A
Eyke 230A
Eynesford .. 230A
Eythorne .. 230A
Facit 230A
Fairburn .. 230A
Fairlie 240A
Fairlight & Cove 230A
Fair Oak .. 230A
Fakenham .. 230A
Falfield .. 230A
Falkenham .. 230A
Falkland .. 250A
Farcet 230A
Farington .. 280A
Farleigh .. 230A
Farleigh Wallop 230A
Farleigh Wick .. 230A
Farleton .. 230A
Farley Green .. 230A
Farlington .. 230A
Farnborough .. 230A
Farnington .. 200C
Farnborough .. 240A
Farndon .. 230A
Farnham (Suffk.) 230A
Farnham (Srrey) 230A
Farnham (Yrks.) 230A
Farnham Royal 230A
Farnhill .. 230A
Farningham .. 230A
Farnley (Yorks.) 230A
Farnley Tyas .. 230A
Farnworth (Cornwall) .. 220C
230A
Farnworth (Lancs.) .. 230A
220C
Farrington Gurney .. 230A
Farsley .. 230A
Farthinghoe .. 230A
Fauldhouse .. 250A
Faversham .. 230C
Faversham Without .. 230A
Fawley .. 230A
Fazeley .. 250A
Featherstone .. 230A
Felbridge .. 230A
Felinfoel .. 250A
Felmersham .. 230A
Felmingham .. 230A
Felpham .. 230A
Felstead .. 230A
Feltham .. 200A
Felthorpe .. 230A
Fenny Bridge .. 230A
Fence 230A
Fen Ditton .. 200A
Fen End .. 230A
Fenham .. 240A
Fenny Compton 250A
Fenny Stratford 230A
Fenstanton .. 240A
Fenton (Cumb.) 230A
Fenton (Staffs.) 240A
Fenwick .. 240A
Ferndale .. 230A
Fernhill Heath 200A
Fermillie .. 230A
Ferrensby .. 230A
Ferring .. 230A
Ferrybridge .. 230A
Ferry Fryston .. 230A
Ferryside .. 250A
Festiniog .. 230C
Feston 230A
Fetcham .. 230A
Fforest Pontardulais 250A
Ffrith 230A
Field Burcote .. 230A
Filby 230A
Filey 230A
Fillougley .. 250A
Filton 210A
Finchampstead 250A
Findon 230A
Finedon .. 230A
Fingland .. 230A
Finglesham .. 230A
Fingringhoe .. 230A
Finsbury .. 104A
230A
Finsthwaite .. 230A
Firle 230A
Fishbourne (I.O.W.) .. 240A
Fishbourne (Sussex) .. 230A
Fishlake .. 230A
Fishtoft .. 240A
Fiskerton .. 230A
Fisland .. 230A
Fitzwilliam .. 230A
Five Ashes .. 230A
Five Oak Green 220A
Five Roads .. 250A
Fixby 230A
Flackwell Heath 230A
Flamborough .. 230A
Flamstead .. 240A
Flamshaw .. 230A
Flaunden .. 230A
Flax Bourton .. 230A
Flaxby 230A
Flaxton .. 230A
Fleckney .. 250A
Fleet (Lincs.) .. 230A
Fletching .. 230A
Fletton .. 230A
Fleur-de-Lis .. 230A
Flexbury .. 230A
Flimby .. 230A
Flimwell .. 230A
Flitton 240A
Flitwick .. 240A
Flixton .. 230A
Flockton .. 230A
Flockburgh .. 230A
Flordon 230A
Flore 210A
Fobbing .. 230A
Fochrin 230A
Foie 230A
Follejohn Park 240A
Folkington .. 230A
Follifoot .. 200A
Fontley .. 220A
Ford (Lancs.) .. 230A
Ford (Midlthan) 230A
Fordcombe .. 220A
Fordham .. 240A
230A
Fordingbridge 230A
Fordwich .. 230A
Forest Gate .. 200A
Forest Green .. 230A
Forest Hill .. 230A
Forest Hill (Oxford) 230A
Forest Row .. 230A
Forncett .. 230A
Forshaw Heath 230A
Fortimeswell .. 230A
Forton 230A
Forstyke .. 230A
Foston (Lincs.) 230A
Foston (Yorks.) 230A
Fotherby .. 230A
Fotheringhay .. 230A
Foulby 230A
Foulk Stapleford 230A
Four Crosses .. 230A
Foulridge .. 230A
Foulsham .. 230A
Fowey 230A
Foxdale .. 230A
Foxhall .. 230A
Foxhole .. 230A
Foxley .. 230A
Foxton (Herts.) 240A
Foxton (Leic.) .. 250A
Framilode .. 230A
Framfield .. 230A
Framingham Earl 230A
Framingham Pigot .. 230A
Framington .. 230C
Framlingham .. 220C
Frampton .. 230A
Frampton Cotterell .. 230A
Frankby .. 230A
Frankton .. 250A
Frant 230A
Frating 230A
Freasley .. 250A
Freathern-with-Saul 230A
Freckleton .. 240A
Freethorpe .. 230A
Freiston .. 230A
Fremington .. 230A
Frensham .. 230A
Freshfield .. 230A
Freshford .. 230A
Freshwater .. 240A
Frettenham .. 230A
Freuchie .. 250A
Friar Waddon .. 230A
Friar's Bay .. 230A
Friar's Wash .. 240A
Friern Barnet .. 240A
Frilford Heath 230A
Frilford Village 230A
Frindsbury .. 230A
Frinton-on-Sea 230C
Frinton Park Estate .. 230A
Frisby-on-the-Wreake .. 230A
Friston (Suffolk) 230A
Friston(Sussex) 230A
Frithelstock .. 230A
Frittenden .. 230A
Fritton 230A
230A
Frocester .. 230A
Frodingham .. 230A
Frodsham .. 250A
Frogmore .. 240A
Frolesworth .. 250A
Froome 240C
230A
Froyle 230A
Fulbourne .. 240A
Fulbrook .. 110A
230A
Fulford 230A
Fullers End .. 240A
Fulmer 200A
Fulneck .. 230A
Fulstow .. 230A
Fulwood .. 230A
Fundenhall .. 230A
Funtington .. 230A
Furnace .. 250A
Furness Vale .. 230A
Furneaux Pelham .. 240A
Gaddesby .. 250A
Gaddesden Row 230A
Gailey 230A
Galashiels .. 250A
Galby 250A
Galmpton .. 240A
Galston 240A
Gamblesby .. 230A
Gamels Hall .. 240A
Gamesley .. 230A
Gamlingay .. 240A
Gamston (E. Retford) .. 230A
Gamston (Notts) 230A
Gamswelt .. 230A
Ganstead .. 230A
Gardner Street .. 230A
Garforth .. 230A
Gargrave .. 230A
Garlieston .. 230A
Garnant .. 230A
Garstang .. 230A
Garvald .. 230A
Gastard .. 230A
Gatehead .. 240A
Gate Helmsley .. 230A
Gatehouse .. 230A
Gatley 230A
240A
Gattonside .. 250A
Gaunts End .. 240A
Gavinton .. 250A
Gawber 230A
Gawcott .. 230A
Gawsworth .. 230A
Gayle 230A
Gayton 230A
Gaywood .. 230A
Geddington .. 230A
Gedling 230A
Gedney 230A
Geldeston .. 230A
Gentleshaw .. 230A
Georgeham .. 230A
Gerrards Cross .. 200A
Gifford 230A
Giggleswick .. 230A
Gilcrux 230A
Gildersome .. 230A
Gilfach 230A
Gilfach Goth .. 230A
Gillingham (Kent) .. 230A
Gillingham All Saints .. 230A
Gillingham St. Mary .. 230A
Gilmorton .. 250A
Gilroes 240A
Gilsland .. 230A
Gilstead .. 230A
Girdle Toll .. 240A
Girton 200A
Girvan 240A
Gisburn .. 230A
Gittisham .. 230A
Gladsmuir .. 230A
Glais 230A
Glanamman .. 230A
Glan Conway .. 230A
Glan-y-Llyn .. 230A
Glapton .. 230A
Glascote (Staffs.) .. 250A
Glascote (Warwicks.) .. 250A
Glasshoughton 230A
Glassonby .. 230A

Glaston.. .. 230A
Glastonbury .. 230A
Glazebrook .. 230A
Glazebury .. 230A
Gleaston .. 230A
Glencorse .. 230A
Glencraig .. 250A
Glendon .. 230A
Glenfield .. 240A
Glenfield Frith 240A
Glengarnock .. 240A
Glenluce .. 230A
Glen Parva .. 250A
Glinton.. .. 230A
Glasburn .. 230A
Glascote .. 250A
Glyncorrwg .. 230A
Glynde 230A
Glynneath .. 220A
Gnosall.. .. 230A
Gobowen .. 230A
Godmanchester 240A
Godrergraig .. 230A
Godstone .. 240A
Goffs Oak .. 240A
Gofmwdy .. 230A
Golborne .. 230A
Golborne Bellow .. 230A
Golborne David .. 230A
Golant 230A
Golcar 100A 200A
Golders Green.. 240A
Goldhanger .. 230A
Goldington .. 210A
Goldsborough .. 230A
Goldthorpe .. 230A
Gomersal .. 230A
Gomshall .. 230A
Goole 230A
Goosnargh .. 230A
Gordon.. .. 250A
Gorebridge. .. 230A
Gorhambury .. 240A
Goring 230A
Gorleston .. 230A
Gornelly .. 230A
Gorran 230A
Gorran Haven.. 230A
Gosberton .. 230A
Gosforth .. 230A
Gosmore .. 240A
Gotherington .. 210A
Goudhurst .. 230A
Gourock .. 250A 250C
Gowerton .. 230A
Gowkshill .. 230A
Grafton (Ches.) 230A
Grafton(Yorks.) 230A
Grafton Underwood .. 230A
Grampound .. 230A
Grandborough.. 230A
Grange (Ches.).. 230A
Grange (Lancs.) 230A
Grange(Yorks.) 230A
Grangetown .. 250A
Grantchester .. 200A
Grantham .. 230A
Grappenhall .. 250A
Grasmere .. 100A 200A
Grassington .. 250C
Grasslot .. 230A
Graveley .. 240A
Gravenhunger.. 230A
Gravenhurst .. 240A
Greasborough .. 230A
Greasby .. 230A
Great Amwell .. 240A
Great Baddow.. 230A
Great Bangley.. 250A
Great Barford.. 230A
Great Bealings 230A
Great Bentley.. 230A
Great Berkhampstead .. 200A
Great Billing .. 210A
Great Blencow 230A
Great Boughton 230A
Great Brickhill 230A
Great Bridgeford 230A
Great Brington 230A
Great Bromley 230A
Great Broughton 230A
Great Broxted.. 230A
Great Budworth 220A
Great Burden .. 230A
Great Burstead 230A
Great Chart .. 230A
Great Chesterfield 230A
Great Cheverell 240A
Great Clifton .. 230A
Great Coates .. 230A
Great Corby .. 230A
Great Crosby .. 230C 230A
Great Dunmow 230A
Great Eccleston 230A
GreatGaddesdon 230A
Great Glen .. 250A
Great Gonerby 230A
Great Gransden 240A
Great Greenstead 230A
Great Hallingbury 240A
Great Harwood 230A
Great Haywood 230A
Great Holland.. 230A
Great Horkesley 230A
Great Hormead 240A
Great Horwood 230A
Great Houghton (Northants.) 230A
Great Houghton (Yorks.) .. 230A
Great Leighs .. 230A
Great Linford.. 230A
Great Malvern.. 100A 230A
Great Molewood 240A
Great Mongeham 230A
Great Musgrave 230A
Great Oakley .. 230A
Great Offley .. 240A
Great Ormside 230A
Great Orton .. 230
Great Ouseburn 230A
Great Plumstead 230A
Great Ponton .. 230A
Great Selkerd .. 230A
Great Sankey .. 250A
Great Saughall 230A
Great Shelford.. 200A
Great Staughton 240A
Great Strickland 230A
Great Tey .. 230A
Great Torrington 230A
Great Totham.. 230A
Great Urswick.. 230A
Great Waltham 230A
Great Warford .. 230A
Great Wilbraham 240A
Great Witchingham 230A
Great Witcombe 210A
Greatworth .. 230A
Green Wymondley 240A
Green Wyrley .. 230A
Greeba 230A
Green, The (Cumberland) 230A
Greenfield .. 240A 230A
Greenford .. 200A
Greenham .. 230A
Green Hammerton.. 230A
Greenlaw .. 250A
Greenodd .. 230A
Greens Norton.. 230A
Greenside .. 230A
Green Street .. 240A
Green Street Green .. 230A
Greenwich .. 200A
Greetland .. 230A
Grendon (Northants).. 230A
Grendon (Staffs.) 250A
Grenoside .. 230A
Gressenhall .. 230A
Gressingham .. 230A
Gretton .. 230A
Greysouthen .. 230A
Griffinstown .. 230A
Grimsargh .. 230A
Grimston .. 230A
Grindleton .. 230A
Gringley-on-the-Hill .. 230A
Grinton .. 230A
Gristhorpe .. 230A
Groby 250A
Groes Vaen .. 230A
Groombridge .. 220A
Grove 230A
Grovesend .. 230A
Guardbridge .. 250A
Guestling .. 230A
Guestwick .. 230A
Guilden Morden 240A
Guilden Sutton 230A
Guilsborough .. 210A
Guiseley .. 230A
Guist 230A
Gullane .. 230A
Gumley .. 250A
Gunthorpe .. 230A
Gunthwaite .. 230A
Gurney Slade .. 230A
Gustard Wood.. 240A
Gwaun-caegurwen .. 220A
Habergham Eaves .. 230A
Habrough .. 230A
Haccombe .. 230A
Hacconby .. 230A
Hackinthorpe .. 200A
Hackington .. 230A
Hackleton .. 230A
Hackthorpe .. 230A
Haddenham (Bucks.) .. 220A
Haddenham (Cambs.) .. 240A
Haddington .. 230A
Haddiscoe .. 230A
Hadfield .. 230A
Hadham Ford .. 240A
Hadleigh .. 230A
Hadlow .. 220A
Hadlow Down.. 230A
Hafodyrynys .. 250C
Haigh 230A
Haileybury .. 240A
Hailsham .. 230A
Hail Weston .. 240A
Hainford .. 230A
Halbeath .. 250A
Halberton .. 230A
Hale (Cheshire) 100A 200A
Hale (Farnham) 230A
Hale (Lancs.) .. 230A
Hale (Liverpool) 230A
Hales 230A
Hales Place .. 230A
Halesworth .. 230A
Halewood .. 230A
Hallaton .. 250A
Hallatrow .. 230A
Hallbankgate .. 230A
Hallingbury Park .. 240A
Hallow 200A
Halls Green .. 240A
Halsall 230A
Halstead (Essex) 230A
Halstead (Kent) 220A
Haltemprice .. 230A
Halton (Ches.) 250A
Halton (Lancs.) 230A
Halton West .. 230A
Halvergate .. 230A
Jam (Glos.) .. 230A
Jam (Surrey) .. 230A
Hamble .. 240A
Hambledon .. 230A
Hambleton .. 230A
Hamfallow .. 230A
Hammerwich .. 250A
Hammonds End Farm .. 240A
Hampnett .. 210C
Hampstead Garden Suburb 240A
Hampsthwaite 200A
Hampton .. 240A
Hampton-in-Arden .. 230A
Hampton Lucy 250A
Hampton Wick 240A
Hanbury .. 230A
Handcross .. 230A
Handforth .. 230A
Handforth .. 240A
Handley .. 230A
Hansacre .. 230A
Hanham Abbotts .. 230A
Hankham .. 230A
Hanley .. 240A
Hanslope .. 230A
Hansworth .. 200A 230A
Happisburgh .. 230A
Hapsford .. 250A
Hapton 230A
Harbledown .. 230A
Harborough Magna .. 250A
Harbury 250A
Harby 230A
Harden .. 230A
Hardgate .. 230A
Hardhorn .. 200A
Hardingham .. 230A
Hardingstone .. 210A
Hardwick Village .. 230A
Harefield .. 200A
Hare Street .. 240A
Harewood .. 230A
Harker 230A
Harlaston .. 250A
Harleston .. 230A
Harlington (Beds.) .. 240A
Harlington (Middx.) .. 200A 230A
Harlow .. 240A 230A
Harlton .. 240A
Harmer Green 240A
Harmondsworth 200A 230A
Harmston .. 230A
Harold Wood .. 230A
Harpenden Golf Club .. 240A
Harpenden Road .. 240A
Harpham .. 230A
Harpole .. 210A
Harpsden .. 230A
Harrietsham .. 230A
Harrington (Cumb.) .. 230A
Harrington (Northants.) 230A
Harriseahead .. 230A
Harrold .. 230A
Harrowden Great .. 230A
Harrowden Little .. 230A
Harrow Weald 240A
Harston (Cambs.) .. 240A
Harston(Lincs.) 230A
Hartfield .. 230A
Hartford (Ches.) 220A
Hartford (Hants.) .. 240A
Harthill (Chester) .. 230A
Harthill (Lanark) .. 240A
Harthill (Yorks.) .. 230A
Hartley (Cranbrook, Kent) 230A
Hartley (Longfield, Kent) .. 230A
Hartshead .. 230A
Hartshill .. 230A
Hartshorne .. 230A
Hartwell .. 230A
Hartwood .. 240A
Harworth .. 230A
Hascombe .. 230A
Haselbury Plucknett .. 230A
Hasland .. 240A
Haslingfield .. 240A
Hassocks .. 230A
Hatch Beauchamp 230A
Hatch End .. 240A
Hatching Green 240A
Hatfield (Herts.) 240A
Hatfield (Yorks.) 230A
Hatfield Broad Oak 230A
Hatfield Hyde.. 240A
Hatfield St. George .. 240A
Hatherleigh .. 230A
Hathern .. 230A
Hatherton .. 230A
Hatton .. 250A
Hatton Heath.. 230A
Haugh of Urr. 230A
Hauksdale .. 230A
Haunton .. 250A
Havant .. 230A
Havercroft .. 230A
Haverhill .. 230A
Haverigg .. 230A
Havering-atte-Bower .. 230A
Haveringland .. 230A
Haverthwaite 230A
Hawkestown .. 230A
Hawkhurst .. 230A
Hawkshead .. 230A
Hawksworth .. 230A
Hawkwell .. 230A
Hawley.. .. 250A
Haxby 230A
Haydock .. 230A
Haydon .. 230A
Hayes 240A
Hayfield .. 230A
Hayle 240A
Hayling Island 230A
Haynes .. 230A
Hayton (Cumb.) 230A
Hayton (York.) 230A
Haytor Vale .. 240A
HaywardsHeath 230A
Hazel Grove .. 230A
Hazel Slade .. 230A
Headcorn .. 230A
Headington .. 230A
Headley .. 230A
Heads Nook .. 230A
Heald Green .. 230A 240A
Healey .. 230A
Healing .. 230A
Heath 240A
Heath End .. 230A

Heath Hayes .. 230A
Heather .. 250A
Heatherton Park 230A
Heathfield .. 240A
Heathfield (Sussex) .. 230A
Heatley .. 250A
Heaton with Oxcliffe .. 230A
Heckingham .. 230A
Hedenham .. 230A
Hedge End .. 230A
Hednesford .. 230A
Hedon 230A
Hedsor 230A
Heighington .. 230A
Hele 230A
Helensburgh .. 240A
Hellesdon .. 230A
Hellidon .. 230A
Hellifield .. 230A
Hellingly .. 230A
Helmdon .. 230A
Helmshore .. 230A
Helpston .. 230A
Helsby 250A
Helsington .. 230A
Helston 240A
Hemblington .. 230A
Hemel Hempstead .. 240A
Hemingford Abbot .. 240A
Hemingford Grey .. 240A
Hemington .. 250A
Hemley .. 230A
Hemmingfield 230A
Hempnall .. 230A
Hempstead (Essex) .. 230A
Hempstead (Kent) .. 230A
Hempsted .. 230A
Hemsby .. 230A
Hemsworth .. 230A
Hemyock .. 230A
Hendrescythan 230A
Hendy 250A
Henfield .. 230A
Hengoed .. 230A
Henham .. 230A
Henley-on-Thames .. 230A
Henllys 230A
Henlow 240A
Hennock .. 280A
Hensall .. 230A
Hensingham .. 230A
Hensington .. 230A
Henton .. 230A
Heolcyw .. 230A
Heptonstall .. 230A
Hepworth .. 230A
Hermiston .. 230A
Hernden .. 230A
Herons Farm .. 240A
Herringfleet .. 230A
Herringthorpe 230A
Hersham .. 240A
Herstmontceux 230A
Hertford .. 240A
Hertford Heath 240A
Hertingfordbury 240A
Hesketh .. 230A
Heslington .. 230A
Hessle 230A
Hest 230A
Hest Bank .. 230A
Heswall .. 230A
Heversham .. 230A
Hethersett .. 230A
Hevingham .. 230A
Hewish .. 230A
Heworth .. 230A
Hexham .. 250A
Hextable .. 230A
Hexton .. 240A
Heybridge .. 230A
Heydon .. 230A
Heysham .. 230A
Heywood (Lanc.) 200C
230A
Heywood (Wlts.) 230A
Heywood Park 240A
Hickling .. 230A
Higham (Kent) 230A
Higham (Warwicks.) 250A
Higham Ferrers 210A
Highampton .. 230A
Highams Park 230A
High Beech .. 240A
High Bowbank 230A
Highbridge .. 230A
Highburton .. 230A
Highbury (Somerset) 230A
High Crosby 230A
High Cross .. 230A
High Cross (Herts.) .. 240A
Higher Horton 230A
Higher Irlam .. 230A
Higher Walton 250A
Highfield .. 230A
Highfield Hall .. 240A
High Halden .. 230A
High Hurstwood 230A
High Laver .. 230A
High Legh .. 250A
220A
High Littleton .. 230A
High Ongar .. 230A
High Street (Cornwall) .. 230A
Hightown .. 230A
High Wall .. 240A
Highway .. 230A
High Wych .. 240A
High Wycombe 210C
210A
Hildenborough 220A
Hildersham .. 240A
Hillam .. 230A
Hill Chorlton .. 230A
Hill End .. 240A
Hillend .. 250A
Hillhead .. 230A
Hillingdon .. 200A
Hill Millom .. 230A
Hillmorton .. 250A
Hilperton .. 230A
Hilton 240A
Himley .. 200A
Hincaster .. 230A
Hinckley .. 250A
Hindlip 200A
Hindolveston .. 230A
Hingham .. 230A
Hinksley .. 230A
Hinstock .. 230A
Hinton .. 230A
Hinton Charterhouse .. 230A
Hinton St. George .. 230A
Hints 250A
Hinxhill .. 230A
Hinxton .. 240A
Hipperholme .. 230A
Histon .. 200A
Hixon 230A
Hobson 250A
Hoby 250A
Hockenhull .. 230A
Hockering .. 230A
Hockley .. 230A
Hockley Heath 230A
Hoddesdon .. 240A
Hoddlesden .. 230A
Hoe 230A
Hoggeston .. 230A
Hogsthorpe .. 230A
Holbeach .. 230A
Holborn .. 104A
230A
Holcombe .. 230A
Holcutt 230A
Holker 230A
Hollesley .. 230A
Hollingbourne 230A
Hollingworth .. 230A
Hollowell .. 230A
Hollybush .. 230A
Holme (Lancs.) 230A
Holme (Yorks.) 230A
Holmbush .. 230A
Holme Pierrepoint 230A
Holmrook .. 230A
Holmwood .. 230A
Holne 240A
Holt (Norfolk) 230A
Holt (Wilts.) .. 230A
Holtby .. 230A
Holton le Clay .. 230A
Holwell .. 240A
Holymoorside .. 240A
Holyton .. 240A
Holywell Green 230A
Honing .. 230A
Honingham .. 230A
Honiton .. 230A
Honor Oak Park 200A
230A
Hoo 230A
Hooe 230A
Hook (Surbiton, Surrey) .. 230A
Hook (Yorks.) .. 230A
Hookwood .. 230A
Hoole 230A
Hoole Village .. 230A
Hooton Pagnell 230A
Hope 230A
Hope Cove .. 240A
Hopton 230A
Hopwas .. 250A
Hopwas Hayes 250A
Horam .. 230A
Horbling .. 230A
Horbury .. 230A
Hormead .. 240A
Hornby .. 230A
Horncastle .. 230A
Hornchurch .. 230A
Horndean .. 230A
Horndon-on-the Hill 230A
Horning .. 230A
Hornsea .. 230A
Horrabridge .. 230A
Horsebridge .. 230A
Horsell 200A
Horseman Green 230A
Horsford .. 230A
Horsforth .. 230A
Horsham St. Faiths .. 230A
Horsley Cross .. 230A
Horsley's, The .. 230A
Horsmorden .. 230A
Horstead with Stanninghall 230A
Horton (Bucks.) 230A
Horton (Ches.) 230A
Horton (Yorks.) 230A
Horton cum Peel 230A
Horwich .. 230A
Horwich End .. 230A
Hose 230A
Hothfield .. 230A
Hoton 250A
Houghton (Cumberland) 230A
Houghton (Hunts.) .. 240A
Houghton (Lancs.) .. 250A
Houghton Conquest .. 230A
Houghton-on the-Hill .. 250A
Houghton Regis 240A
Houley .. 230A
Hound Corner 230A
Hounslow .. 240C
Houston .. 240A
Hove 220C
220A
230C
230A
Hoveton St. John .. 230A
Hoveton St. Peter .. 230A
How 230A
How Hill .. 230A
Howe Green .. 240A
Howick .. 230A
Howwood .. 240A
Hoyland .. 230A
Hoyland Nether 230A
Hoyland Swaine 230A
Huby 230A
Hucclecote .. 230A
Hucknall .. 230A
Huddleston .. 230A
Hugglescote .. 250A
Hughenden .. 230A
Huish Episcopi 230A
Hulcote .. 230A
Humberston .. 230A
Humberstone .. 200A
240A
Huncoat .. 230A
Huncote .. 250A
Hungersheath .. 230A
Hungerton .. 250A
Hunmanby .. 230A
Hunningham .. 250A
Hunsdon .. 240A
Hunsdon Mill .. 240A
Hunsonby .. 230A
Hunstanton .. 230A
Hunsworth .. 230A
Hunters Quay .. 230A
Huntingdon .. 240A
Huntington .. 230A
Huntington (Ches.) .. 230A
Huntington (York) .. 230A
Hunton .. 230A
Huntwick .. 230A
Hurlet 240A
Hurley (Berks.) 240A
Hurley (Warwicks.) 250A
Hurlford .. 240A
Hurst 230A
Hursley Hill .. 230A
Hurst Green (Lancs.) .. 230A
Hurst Green (Sussex) .. 230A
Hurstmontceux—*See* Herstmontceux.
Hurstpierpoint 230A
Hurworth .. 230A
Husbands Bosworth .. 250A
Husborne Crawley .. 230A
Hutton 230A
Hutton (Lancs.) 230A
Hutton (Somerset) .. 230A
Hutton Bushel 230A
Hutton Cranswick .. 230A
Hutton Roof .. 230A
Huyton-with-Roby .. 230A
Huxley (Ches.) 230A
Hyde 230A
Hyde Heath .. 230A
Hyde Lea .. 230A
Hythe (Hants.) 230A
Hythe (Kent) .. 210A
210C
Ibstock .. 250A
Ickenham .. 200A
Ickham .. 230A
Ickleford .. 240A
Icklesham .. 230A
Ickleton .. 240A
Ickwell .. 230A
Iddenshall .. 230A
Ide 230A
Ide Hill .. 220A
Iden 230A
Iffley 230A
Ifield (Kent) .. 230A
Ifield (Sussex) .. 230A
Ightam .. 230A
Ilchester .. 230A
Ilminster .. 230A
Ilsington .. 230A
240A
Ilton 230A
Immingham .. 230A
Impington .. 200A
Ince 230A
Ince Blundell .. 230A
Inchinnan .. 240A
Ingatestone .. 230A
Ingbirchworth 230A
Ingham .. 230A
Ingleton .. 230A
Ingoldmells .. 230A
Ingrave .. 230A
Ingworth .. 230A
Innellan .. 230A
Innerleithen .. 250A
Instow 230A
Inveresk .. 230C
Inverkeithing .. 250A
Inverkip .. 230A
Inworth .. 230A
Ipplepen .. 200A
Ippollitts .. 240A
Irchester .. 230A
Irlam 230A
Irmingland .. 230A
Irstead 230A
Irthington .. 230A
Irthlingborough 210A
Irton 230A
Irvine 240A
Irwell Vale .. 230A
Isham 230A
Isleham .. 240A
Isle of Mull .. 230C
Isle of Whithorn 230A
Isleworth .. 230A
240C
Islip 210A
Itchenor .. 230A
Itteringham .. 230A
Iver 200A
Iver Heath .. 200A
Ivinghoe .. 240A
Jaywick .. 230A
Jedburgh .. 230C
230A
Jersey Marine .. 220A
Jesson .. 230A
Jevington .. 230A
Jockey Pitch .. 230A
John O'Gaunt .. 230A
Johnstone .. 240A
Johnstown .. 230A
Jordanhill .. 240A
Jully 230A
Kearsley .. 220C
230A
Kedleston .. 200A
Keekle .. 230A
Keelby 230A
Keevil 230A
Kegworth .. 250A
Kelnton Mandeville .. 230A
Kellbrook .. 230A
Kellington .. 230A
Kelmarsh .. 230A
Kelsall 230A
Kelso 250A
Kelston .. 210A
Kelvy 250A
Kemble .. 230A
Kemback .. 250A

Kempsey .. 200A
Kempshott .. 230A
Kempston .. 210A
Kempston Box End .. 210A
Kempston Hardwick .. 210A
Kemsing .. 220A
Kenfig 230A
Kenfig Hill .. 230A
Kenley .. 205A
230A
Kennford .. 230A
Kennilworth .. 250A
Kennington .. 230A
Kennishead .. 240A
Kennoway .. 250A
Kensington .. 100A
230A
230C
Kensworth .. 240A
Kentisbeare .. 230A
Kenton (Devon) 230A
Kent Street .. 230A
Kenyon .. 230A
Keresley .. 230A
Kesgrave .. 230A
Keston .. 240A
Keswick (Cumb.) .. 100A
Keswick (Cumb.) .. 200A
Keswick (Norfolk) .. 230A
Kettlebridge .. 250A
Kettles Hulme 230A
Kettlesing .. 230A
Ketton 230A
Kew 220A
Kewstoke .. 230A
Keyingham .. 230A
Keymer .. 230A
Keynsham .. 210A
Keysers Estate 240A
Key Street .. 230A
Kibworth Beauchamp .. 250A
Kibworth Harcourt .. 250A
Kidmore End .. 230A
Kidsgrove .. 230A
Kidside .. 230A
Kidwelly .. 250A
Kilbarchan .. 240A
Kilbirnie .. 240A
Kilby 250A
Kilconquhar .. 260A
Kildwick .. 230A
Killamarsh .. 250A
Killan 230A
Killay 230A
Killinghall .. 200A
230A
Kilmacolm .. 240A
Kilmany .. 250A
Kilmarnock .. 240A
240C
Kilmaurs .. 240A
Kilmersdon .. 230A
Kilmington .. 230A
Kilmun .. 230A
Kilndown .. 230A
Kilrenny .. 250A
Kilsby 230A
Kilsyth .. 250A
Kilwinning .. 240A
Kimberley .. 230A
Kimbolton .. 240A
Kimcote .. 250A
Kimpton .. 240A
Kincardine .. 250A
Kineton .. 250A
Kinghorn .. 250A
Kingsbarns .. 250A
Kingsbridge .. 230A
Kings Bromley 230A
Kingsbury (Middx.) .. 240A
Kingsbury (Staffs.) .. 200A
Kingsbury Episcopi .. 230A
Kings Cliffe .. 230A
Kingsdon .. 230A
Kingsdown .. 230A
Kings Dyke .. 230A
Kingseat 250A
Kingsford .. 230A
Kingskerswell .. 200A
Kingskettle .. 250A
Kings Langley 240A
Kingsley .. 250A
230A
Kingsley Holt .. 230A
Kings Marsh .. 230A
Kings Meaburn 230A
Kingsnorth .. 230A
Kings Norton .. 250A
Kings Park .. 240A
Kingstanley .. 230A
Kingsteignton 230A
Kingston .. 230A
Kingston (Somerset) .. 230A
Kingston-upon-Thames .. 240A
Kingstown (Cumb.) .. 230A
Kings Sutton .. 230A
Kings Waldon.. 240A
Kingswear .. 240A
230A
Kingswinford .. 200A
Kingswood .. 230A
Kingswood (Bristol) .. 210A
Kingswood .. (Surrey) .. 230A
KingtonLangley 230A
Kington St. Michael .. 230A
Kinnerley .. 230A
Kinnerton .. 230A
Kinsbourne Green .. 240A
Kinsley .. 230A
Kinvaston .. 230A
Kippax .. 230A
Kippford .. 230A
Kirby Bedon .. 230A
Kirby Bellars .. 230A
Kirby Cane .. 230A
Kirby Cross .. 230A
Kirby-le-Soken 230A
Kirby Muxloe .. 230A
Kirkandrews .. 230A
Kirk Bampton 230A
Kirkbean .. 230A
Kirkbride .. 230A
Kirkburn .. 230A
Kirkburton .. 230A
Kirkby .. 230A
Kirkby (Whiston) .. 230A
Kirkby Lonsdale 230A
Kirkby Malham 230A
Kirkby Overblow .. 230A
Kirkby Thore .. 230A
Kirkby Stephen 230A
Kirkcolm .. 230A
Kirkcowan .. 230A
Kirk Deighton.. 230A
Kirk Ella .. 230A
Kirk Fenton .. 230A
Kirkfieldbank .. 240A
Kirkham .. 230A
Kirkhamgate .. 230A
Kirkhammerton 230A
Kirkhampton .. 230A
Kirkheaton .. 230A
Kirkhouse .. 230A
Kirkinner .. 230A
Kirkintilloch .. 240A
Kirk Langley .. 200A
Kirkliston .. 230A
250A
Kirkmichael (Ayrs.) .. 240C
Kirk Michael (I.O.M.) .. 230A
Kirknewton .. 230A
Kirkoswald .. 230A
240A
Kirkpatrick Durham .. 230A
Kirk Sandall .. 230A
Kirk Smeaton .. 230A
Kirkton .. 250A
Kirn 230A
Kirton (Lincs.) 240A
Kirton (Suffolk) 230A
Kislingbury .. 210
Kittle 230A
Kiveton Park .. 230A
Knapton .. 230A
Knaresborough 200A
Knaresborough Chain Lane .. 230A
Knaresborough York Road .. 230A
Knebworth .. 240A
Kneesworth .. 240A
Knighton .. 230A
Knightswood .. 240A
Knipton .. 230A
Knockin .. 230A
Knodishall .. 230A
Knottingley .. 230A
Knowle .. 230A
Knowle Hill .. 240A
Knowsley .. 230A
Knox 230A
Knutsford .. 220A
Kyng 230A
Laceby .. 230A
Lach Dennis .. 220A
Lacock.. .. 230A
Ladbroke .. 250A
Laddingford .. 230A
Ladybank .. 250A
Laindon .. 230A
Lakeside .. 230A
Laleham .. 200A
Laleston .. 230A
Lamberhurst .. 230A
Lambeth .. 220A
Lambhill .. 240A
Lambourne .. 230A
Lamerton .. 230A
Lamnas .. 230A
Lanark .. 240A
Lancing .. 230A
Landbeach .. 240A
Landkey .. 230A
230C
Landywood .. 230A
Lane End .. 230A
Laneham .. 230A
Langbank .. 240A
Langcliffe .. 230A
Langdon Hills .. 230A
Langenhoe .. 230A
Langford (Beds) 240A
Langford(Essex) 230A
Langford (Somerset) .. 230A
Langford Budville .. 230A
Langham .. 230A
Langley (Ches.) 230A
Langley (Essex) 230A
Langley (Kent) 230A
Langley (Norfolk) .. 230A
Langley Burrell 230A
Langley Marish 230A
Langley Priory 250A
Langney .. 230A
Langport .. 230A
Langstone .. 230A
Langtoft .. 230A
Langton .. 220A
Langwathby .. 230A
Lannock Manor 240A
Lapley .. 230A
Lapworth .. 230A
Larbert .. 250A
Largo's, The .. 250A
Largs 240A
Larkfield .. 230A
Larkhall .. 240A
Lassodie .. 250A
Lasswade .. 230A
Latcham .. 230A
Latchford .. 240A
Latchford Without .. 250A
Latchingdon .. 230A
Latchmore Common .. 240A
Lathom .. 230A
Latimer .. 230A
Laughton-in-the-Morthen 230A
Lauriston .. 230A
Lavant 230A
Lavendon .. 230A
Lavernock .. 230A
Law 240A
Lawford .. 230A
Lawkland .. 230A
Laxey 230A
Layer Breton .. 230A
Layer-de-la-Haye .. 230A
Layer Marney .. 230A
Lazonby .. 230A
Lea (Ches.) .. 230A
Lea (Lancs.) .. 230A
Leagram .. 230A
Lea Marston .. 230A
Leamington .. 250A
230C
Leamington Hastings .. 250A
Lea Newbold .. 230A
Leasybridge .. 240A
Leathley .. 230A
Leazes 250A
Lebberston .. 230A
Leckhampstead 230A
Leckhampton 210A
Leconfield .. 230A
Ledburn .. 240A
Ledston .. 230A
Lee (Devon) .. 230A
Lee (S.E.12) .. 200A
Leece 230A
Lee Chapel .. 230A
Leeds (Kent) .. 230A
Leeds (Yorks.).. 200A
230A
Leekbrook .. 230A
Leek Wootton.. 250A
Lee-on-Solent .. 230A
Lees 230A
Leeswood .. 230A
Leftwich .. 220A
220C
Leicester Forest East .. 250A
Leicester Forest West .. 250A
Leicester Frith 240A
Leigh (Dorset).. 230A
Leigh (Kent) .. 220A
Leigh (Lancs.) 220C
230A
Leigh (Lancs.) (Rural) .. 230A
Leigh (Staffs.) 230A
Leigh (Surrey).. 230A
Leigh on Mendip 230A
Leigh on Sea .. 230C
230A
Leighton Buzzard .. 240A
Leigh Woods .. 230A
Leire 250A
Leiston .. 230A
Lelant 240A
Lemsford .. 240A
Lenham .. 230A
Lennoxtown 240A
Lenonfield .. 230A
Lenzie 240A
Leonard Stanley 230A
Lepton .. 230A
Leslie 250A
Lesmahagow .. 240A
Lessingham .. 230A
Letcombe Regis 230A
Letham .. 250A
Leuchars .. 250A
Leven (Fife) .. 250A
Leven (Yorks.) 230A
Levens 230A
Leverton .. 230A
Levington .. 230A
Lewisham .. 200A
Leybourne .. 230A
Ley Green .. 240A
Loy Hill .. 230A
Leyland .. 230A
Leytonstone .. 150C
230A
Lichfield (Staffs.) .. 230A
Lichfield (Staffs.) .. 240A
Lidlington .. 230A
Lifton 230A
Light Oaks .. 230A
Lightwater .. 240A
Lilbourne .. 230A
Lilford-cum-Wigthorpe .. 230A
Lilley 240A
Lilling 230A
Limehurst .. 240C
240A
Limekilns .. 250A
Limington .. 230A
Limpenhoe .. 230A
Limpley Stoke.. 230A
Limpsfield .. 220A
Lindal 230A
Lindale-in-Cartmel .. 230A
Lindfield .. 230A
Lingdale .. 250A
Lingerfield .. 230A
Lingfield .. 230A
Lingwood .. 230A
Linlithgow .. 250A
Linstock .. 230A
Linthwaite .. 100A
200A
Linton (Cambs.) 240A
Linton (Kent) 230A
Linton (Staffs.) 230A
Linton (York.) 230A
250C
Lintz 250A
Linwood .. 240A
Liskeard .. 230A
Listerdale .. 230A
Litheriand .. 230C
230A.
Littlington .. 240A
230A
Little Amwell .. 240A
Little Aston .. 230A
Little Baddow 230A
Little Bampton 230A
Little Barningham.. 230A
Little Bealings.. 230A
Little Berkhamp-stead .. 240A
Little Billing Lane.. 230A
Littlebourne .. 230A
Little Braxted 230A
Little Brickhill 230A
Little Brington 230A
Little Broughton 230A
Little Budworth 230A
Little Burstead 230A
Littlebury .. 230A
Little Chart .. 230A
Little Chesterford 230A

Little Cheverell 230A
Little Clacton .. 230A
Little Clifton .. 230A
Little Crosby .. 230A
Littledean .. 230A
Little Dunmow 230A
Little Eaton .. 200A
230A
Little Eversden 240A
Little Fambridge 230A
Little
Gaddesden .. 230A
Little Hadham 230A
Little
Hallingbury .. 230A
Littlehampton .. 230A
Little Haywood 230A
Little Heath .. 240A
Little Hoole .. 230A
Little Horkesley 230A
Little Hormead 240A
Little Horwood 230A
Little Houghton
(Northants.) 230A
Little Houghton
(Yorks.) .. 230A
Little Hulton .. 230A
Little Ingstre .. 230A
Little Kingshill 230A
Little Leigh .. 220A
Little Lever .. 230A
Little Marlow .. 230A
Little Melton .. 230A
Little Mill .. 230A
Little Missenden 230A
Littlemore .. 230A
Littlemoss .. 240A
Little Oakley .. 230A
Little Offley .. 240A
Little Ouseburn 230A
Littleover .. 200A
Little Parnell .. 230A
Little Parndon 240A
Little Paxton .. 240A
Little Plumstead 230A
Littleport .. 240A
Little Salkeld .. 230A
Little Saughall 230A
Little Shelford .. 200A
Little Smeaton 230A
Little
Staplebridge 230A
Little Stanney .. 250A
Little Stretton .. 250A
Little Strickland 230A
Little Sutton .. 230A
Little Tey .. 230A
Little Thurrock 230A
Littleton
(Chester) .. 230A
Littleton
(Hants.) .. 230A
Littleton
(Somerset) .. 230A
Littleton
(Woking) .. 200A
Little Torrington 230A
Little Urswick .. 230A
Little Waltham 230A
Littlewick Green 240A
Little
Wilbraham .. 240A
Little
Witchingham 230A
Littleworth .. 230A
Littleworth
(Worcs.) .. 200A
Little
Wymondley .. 240A
Litton 230A
Liversedge .. 230A
Liverton .. 240A
Livesey .. 230A
Llanblethian .. 230A
Llanbradach .. 230A
Llandavenny .. 230A
Llandoble .. 240A
Llandefellog .. 250A
Llandegreth .. 280A
Llandillo .. 220C
230C
Llandough .. 230A
Llanfrechfa .. 230A
Llangattock .. 230A
Llangeinor .. 230A
Llangennech .. 230A
Llangwynydd .. 230A
Llangwystenin .. 230A
Llangynwyd .. 230A
Llanharan .. 230A
Llanharry .. 230A
Llanhilleth .. 250C
Llanmaes .. 230A
Llanmorials .. 230A
Llanrhidian .. 230A
Llanrhos .. 230A
Llansaint .. 250A
Llantrisant .. 230A
Llantwit Fardre 230A
Llantwit Major 230A
Llanwern .. 230A
Llanymynech .. 230A
Llwynbendy .. 250A
Llwynypia .. 230A
Llysfaen .. 230A
Loanhead .. 230A
Loans 240A
Lochans .. 230A
Lochfoot .. 230A
Lochgelly .. 250A
Lochore .. 250A
Lochwinnoch .. 240A
Locking .. 230A
Lockinge .. 230A
Lockington .. 250A
Locksheath .. 230A
Locks Bottom 240A
Loddington .. 230A
Loddiswell .. 240A
Loddon 230A
Lofthouse
(Harrogate) 230A
Lofthouse
(Wakefield) .. 230A
Loganlee .. 230A
London, City of 210C
210A
200C
230A
London Colney 240A
Long Ashton .. 230A
Long
Bennington .. 230A
Long Buckby .. 230A
Long Buckby
Wharf .. 230A
Long Clawson .. 230A
Longdon .. 230A
Longdon Green 230A
Longdown .. 230A
Longfield .. 230A
Longford .. 230A
Long Itchington 250A
Long Lawfords 250A
Long Load .. 230A
Long Marton .. —
Longniddry .. 230A
Long Preston .. 230A
Longridge .. 230A
Longscales .. 230A
Longsdon .. 230A
Long Sutton
(Lincs.) .. 230A
Long Sutton
(Somerset) .. 230A
Longton (Lancs.) 230A
Longton (Staffs.) 240A
240C
Longtown .. 230A
Longwell Green 230A
Long Whatton 250A
Loose 230A
Lorton 230A
Lostock Gralam 220A
Lostock Green 220A
Lostwithiel .. 230A
Lothersdale .. 230A
Lotherton .. 230A
Loughor .. 230A
Loughton .. 230A
Lound (Notts.) 230A
Loversall .. 230A
Low Bowbank .. 230A
Low Crosby .. 230A
Lowca 230A
Low Coniscliffe 230A
Lower Bangley 230A
Lower
Boddington .. 230A
Lower Bourne .. 230A
Lower Froyle .. 230A
Lower
Harlestone .. 210A
Lower Heyford 210A
Lower
Kinnerton .. 230A
Lower Penn .. 200A
Lower Walton .. 240A
Lower
Willingdon .. 230A
Lowfield Heath 230A
Lowick (Lancs.) 230A
Lowick
(Northants.) 230A
Low Laithe .. 230A
Lowton 230A
Loxton 230A
Lubbersthorpe 240A
Lubenham 230A
Ludborough .. 230A
Luddenden .. 230A
Luddendenfoot 230A
Ludgvan .. 240A
Ludham .. 230A
Ludworth .. 230A
Lugton 240A
Lullington .. 230A
Lund 230A
Lundin Links .. 250A
Lunnon .. 230A
Lupset 230A
Lupton 230A
Lustleigh .. 240A
Lutterworth .. 250A
Lwynarthan .. 230A
Lydbrook .. 230A
Lydd 230A
Lydden 230A
Lyddington .. 230A
Lydford 230A
Lydford-on-
Fosse .. 230A
Lydiate .. 230A
Lydney 230A
Lye 200A
Lyminge .. 230A
Lymm 250A
Lympsham .. 230A
Lympstone .. 230A
Lyndhurst .. 230A
Lyne Hill .. 230A
Lynmouth .. 100A
200A
Mablethorpe .. 230A
Macclesfield .. 230A
230C
Machen 230A
Machen Lower 230A
Mackeyre End .. 240A
Mackworth .. 200A
Macmerry .. 230A
Madeley .. 230A
Madron 240A
Maendy .. 230A
Maer 230A
Maesbury .. 230A
Maesbury Marsh 230A
Maesycoed .. 230A
Maesycwmmer 230A
Magham Down 230A
Maghull .. 230A
Magor 230A
Maiden Newton 230A
Maidens .. 230C
Maidford .. 230A
Maids Moreton 230A
Maidwell .. 230A
Mainsriddell .. 230A
Malsemore .. 230A
Malborough .. 230A
Malden 220A
Malmesbury .. 230A
Maltaske 230A
Maltby 230A
Mancetter .. 250A
Mangotsfield .. 210A
Manley 250A
Manmoel .. 230A
Mannington .. 230A
Manningtree .. 230A
Manthorpe .. 230A
Manton
(Rutland) .. 230A
Manton (Wilts.) 230C
Mapledurham .. 200A
Mappleton .. 230A
March 240A
Marcham .. 230A
Marchington .. 230A
Marchwood .. 230A
Mardley Hill .. 240A
Mareham-en-Fen 230A
Maresfield .. 230A
Margaretting .. 230A
Margate .. 240C
Margrove Park 250A
Marhamchurch .. 230A
Marholm .. 230A
Mark 230A
Mark Causeway 230A
Mark Cross .. 230A
Market
Bosworth .. 250A
Market Deeping 230A
Market
Harborough .. 230A
Market
Lavington .. 230A
Market Overton 230A
Market Leighton 230A
Markfield .. 250A
Markham (Mon.) 230A
Markham
(Somerset) .. 230A
Markham
Clinton .. 230A
Markinch .. 250A
Marks Tey .. 230A
Markyate .. 240A
Marldon .. 200A
Marlesford .. 230A
Marlow 230A
Marlpit Hill .. 230A
Marlston-cum-
Lache .. 230A
Marple 230A
Marple Bridge .. 230A
Marsden .. 230A
Marshalswick .. 240A
Marsham .. 230A
Marshchapel .. 230A
Marshfield .. 230A
Marsh Gibbon .. 230A
Marston .. 220A
Marston Green 220A
Marston Magna 230A
Marston
Moretaine .. 230A
Marston
St. Lawrence 230A
Marston Trussell 230A
Marsworth .. 230A
Martham .. 230A
Marthall .. 220A
Martin 230A
Martlesham .. 230A
Martock .. 230A
Marton
(Warwicks.) .. 250A
Marton (Yorks.) 230A
Marton-in-
Cleveland .. 230A
Maryport .. 230A
Marytavy .. 230A
Masbury .. 230A
Mastin Moor .. 250A
Matching .. 230A
Matfield .. 230A
Matson 230A
Mattersey .. 230A
Mattishall .. 230A
Mauchline .. 240A
Maudlam .. 230A
Maulden .. 230A
Mautby .. 230A
Maxstoke .. 230A
Maxwelltown .. 230C
230A
Maybole .. 240A
Mayfield .. 230A
Mears Ashby .. 230A
Measham .. 250A
Meaux 230A
Melbourn .. 240A
Melbourne .. 250A
Melcombe Regis 230A
230C
Meldreth .. 240A
Melincourt .. 220A
Melksham .. 230A
Melling 230A
Mellor (Derby) 230A
Mellor (Lancs.) 230A
Melrose 230C
230A
Meltham .. 230A
Melton (Suffolk) 230A
Melton (Yorks.) 230A
Melton Mowbray 230A
240C
Membury .. 230A
Menai Bridge .. 230A
Menston .. 230A
Mentmore .. 240A
Meonstoke .. 230A
Meopham .. 230A
Meppershall .. 240A
Mere 220A
Meriden .. 250A
Merriott .. 230A
Merstham .. 230A
Merstone .. 240A
Merthyr Mawr .. 200A
Merthyr Tydfil 230C
Merthyr Vale .. 250A
Merton 220A
Messing .. 230A
Metheringham .. 230A
Methil 250A
Methilhill .. 250A
Methley .. 230A
Micklefield .. 230A
Mickleham .. 230A
Mickleover .. 200A
Micklethwaite .. 230A
Mickletown .. 230A
Mickle Trafford 230A
Mid-Calder .. 230A
Middle Bourne .. 230A
Middle Claydon 230A
Middlesmoor .. 230A
Middlestown .. 230A
Middlethorpe .. 230A
Middleton
(Lancs.) .. 220C
230A
Middleton
(Leic.) .. 230A
Middleton
(Staffs.) .. 250A
Middleton
(Sussex) .. 230A
Middleton
(Yorks.) .. 230A
Middleton
Cheney .. 230A
Middleton-in-
Wharfedale .. 230A
Middleton
Junction .. 230A
Middlewich .. 220A
Middlewood .. 230A
Midford .. 230A
Midgeholme .. 230A
Midgley .. 230A

Midsomer Norton .. 230A
Midway .. 230A
Mikleston .. 240A
Milborne Port .. 230A
Mile Oak .. 250A
Milesmark .. 250A
Milford .. 230A
Milford Haven .. 220C
Milford-on-Sea 230C
Millbridge .. 230A
Millbrook .. 230A
200A
Mill Corner .. 230A
Mill End .. 240A
Millfield .. 230A
Mill Green .. 240A
Millhead .. 230A
Mill Hill .. 240A
Milliken Park .. 240A
Millington .. 220A
Millrigg .. 230A
Milngavie .. 240A
Milnthorpe .. 230A
Milton (Cambs.) 240A
Milton (Dumfries) .. 240A
Milton (Hants.) 230A
Milton (Northants.) 210A
Milton (Staffs.) 230A
Milton Abbot .. 230A
Milton Bryan .. 240A
Milton Combe .. 230A
Milton Ernest .. 210A
Milton Regis .. 230A
Milton Street .. 230A
Milverton .. 230A
Mimbridge .. 200A
Minchinhampton 230A
Minishant .. 240A
Minnigaff .. 230A
Minster 130A
Minworth .. 230A
Miskin 230A
Misterton (Warwicks.) .. 250A
Misterton (Somerset) .. 230A
Mistley 230A
Mistley Heath .. 230A
Mitcham .. 205A
230A
Mitcheldean .. 230A
Mobberley .. 220A
Mochdre .. 230A
Modbury .. 240A
Moggerhanger .. 230A
Molescroft .. 230A
Moleseys, The .. 230A
Molewood .. 240A
Mollington .. 230A
Monk Fryston .. 230A
Monkhill .. 230A
Monkhill Kirby 230A
Monkswood .. 230A
Monkton .. 240A
Monkton Combe 240A
Monktonhall .. 230A
Montacute .. 230A
Moonzie .. 250A
Moore 250A
Moorhouse .. 230A
Moor Monkton .. 230A
240A
Moor Park .. 240A
Moor Row .. 230A
Moorsholm .. 250A
Moorville .. 230A
Morcombelake .. 230A
Morcott .. 230A
Morda 230A
Morden 205A
230A
Moresby .. 230A
Moresby Parks 230A
Moreton .. 230A
Moreton Morrell 230A
Moreton Pinkney 230A
Morland .. 230A
Morley 100A
200A
Morley St. Peter 230A
Morningthorpe 230A
Mortehoe .. 230A
Mortlake .. 210C
Morton (Lincs.) 230A
Morton (Yorks.) 230A
Morton Palms .. 230A
Mossend .. 240A
Mossley .. 230A
Mosspit 230A
Moston 230A
Motherwell .. 250A
240C
Mottingham .. 200A
Mottistone .. 240A
Mottram .. 230A
Mottram St. Andrews .. 230A
Mouldsworth .. 230A
Moulton (Ches.) 220A
Moulton (Lincs.) 230A
Moulton (Northants.) 210A
Moulton Chapel 230A
Mountfield .. 230A
Mount Nessing 230A
Mountsorrel .. 250A
Mouton-hampstead .. 240A
Much Hadham 240A
Much Hoole .. 230A
Mucking .. 230A
Mucklestone .. 230A
Mudford .. 230A
Mudgley .. 230A
Muirhead .. 240A
Mulbarton .. 230A
Mundham .. 230A
Mursley .. 230A
Murton (S. Wales) .. 230A
Murton (Yorks.) 230A
Musbury .. 230A
Muston 230A
Mulford .. 230A
Mwyndy .. 230A
Myddleton .. 250A
Mynyddygarreg 250A
Mytholmroyd .. 230A
Mytton 230A
Nacton 230A
Nafferton .. 230A
Nailsea 230A
Nailstone .. 250A
Nailsworth .. 230A
Nanpanton .. 230A
Nanpean .. 230A
Nangarn .. 230A
Nantyderry .. 230A
Nantyffyllon .. 230A
Nantymoel .. 220A
Naphill 230A
Napton 250A
Narborough .. 250A
Naseby 230A
Nash 230A
Nateby 230A
Natland .. 230A
Navenby .. 230A
Nazeing .. 240A
Neathop .. 230A
Neatishead .. 230A
Neldwood .. 230A
Nellston .. 240A
Nelson (Glam.) 230A
Nelson (Lancs.) 230A
Nelson Park .. 230A
Neston (Ches.) .. 230A
Neston (Wilts.) 230A
Nether Alderley 230C
Netherbury .. 230A
Netherfield .. 230A
Nether Heyford 210A
Nether Kellet .. 230A
Nether Popple-ton 230A
Netherseal .. 230A
Netherthorpe .. 230A
Netherton (Lancs.) .. 230A
Netherton (Yorks.) .. 230A
Netley 240A
Netley Common 230A
Netteswell Cross 240A
Nettledon .. 230A
Nettleham .. 230A
Nettlesford .. 230A
Nevendon .. 230A
New Abbey .. 230A
Newarthill .. 240A
New Barn .. 230A
Newbiggin .. 230A
Newbold-on-Avon 250A
Newboldpacey .. 250A
NewboldVerdon 250A
Newbourn .. 230A
New Bradwell .. 210A
Newbridge .. 230A
Newburgh .. 250A
Newby 230A
Newby Bridge .. 230A
Newcastle Higher(Glam.) 230A
Newcastle-under-Lyme .. 230C
230A
Newcastle-upon-Tyne .. 240A
New Cumnock .. 240A
Newdigate .. 230A
Newduston .. 210A
New Earswick .. 230A
New Eltham .. 220A
Newenden .. 230A
New Finlake .. 210A
New Galloway .. 230A
Newgate Street 240A
Newhall .. 230A
New Harrowden 230A
Newhythe .. 230A
Newick 230A
Newington (Kent) .. 230A
New Inn .. 230A
Newland .. 230A
Newlands .. 240A
New Marston .. 230A
Newmill .. 230A
Newmillerdam .. 200A
New Mills .. 250A
Newmilns .. 240A
Newnham (Glos.) 230A
Newnham (Herts.) .. 240A
Newnham (Kent) 230A
New Parks .. 240A
Newport (Essex) 230A
Newport (Fife) 250A
Newport (I.O.W.) 240A
Newport (Mon.) 100C
230C
200A
230A
Newport Pagnell 210A
New Romney .. 230A
New Stevenston 240A
Newton (Cambs.) 240A
Newton (Ches.) 230A
Newton (Warwick) .. 250A
Newton (Yorks.) 240A
230A
Newton (York) 230A
Newton Abbot 240C
230A
Newton Blossomville 230A
Newton by Tattenhall .. 230A
Newton Ferrers 230A
Newton Flotman 230A
Newtongrange 230A
Newton Harcourt 250A
Newton in Makerfield 230A
Newton in Willows .. 230A
Newton Longville .. 230A
Newton Mearns 240A
Newton Poppleford .. 240A
Newton Regis .. 250A
Newton Reigny 230A
Newton St. Cyres 230A
Newton St. Faiths .. 230A
Newton St. Loe 210A
Newton Solney 230A
Newton Stewart 230A
Newtown (Ches.) 230A
Newton (Camb.) 230A
Newtown (Scotland) .. 250A
Newtown (S. Wales) .. 230A
New Tredegar 230A
New Waltham (Lincs.) .. 230A
New Whittington .. 240A
New Windsor .. 110C
220C
Ninfield .. 230A
Niton 240A
Nitshill .. 240A
Noak Hill .. 230A
Nocton .. 230A
No Man's Heath 250A
Nomansland .. 240A
Nook 230A
Norland .. 230A
Norley 220A
Normandy .. 250A
Norman Cross .. 230A
Normanton le Heath .. 250A
Northall .. 240A
Northam .. 230A
Northaw .. 240A
North Baddesley 230A
North Benfleet .. 230A
North Bersted 230A
North Berwick 230A
Northborough 230A
Northbourne .. 230A
North Bradley .. 230A
North Cadbury 230A
Northchurch .. 200A
North Cotes .. 230A
North Cove .. 230A
North Cray .. 230A
North Curry .. 230A
North Elmham 230A
North Ferriby 230A
Northfleet .. 230A
North Frodingham .. 230A
North Harrow 240A
North Hykeham 230A
Northiam .. 230A
Northill 230A
North Killingholme 230A
North Kilworth 250A
Northleach .. 230C
North Leverton 230A
North Marston 230A
North Meols .. 230A
North Mimms 240A
North Molton 230A
North Newbold 230A
Northolt .. 200A
Northope .. 230A
North Ormesby 230A
Northowram .. 230A
North Perrott .. 230A
North Preston 230A
North Queensberry 250A
North Shields 240A
North Skirlaugh 230A
North Stoke .. 210A
North Tawton 230A
North Thoresby 230A
Northumberland 200A
North Walsham 230A
North Weal Bassett 230A
North Weald .. 230A
North Wheatley 230A
Northwich .. 220C
220A
Northwick .. 210A
North Woolwich 220A
Norton (Ches.) .. 250A
Norton (Worcs.) 250A
Norton (Yorks.) 230A
Norton Bridge .. 230A
Norton Canes .. 250A
Norton Fitzwarren .. 230A
Norton Green .. 240A
Norton-in-Hales 230A
Norton Juxta .. 250A
Norton St. Philip .. 230A
Norton Subcourse .. 230A
Norton Sub-Mamdon 230A
Norwood Green 230A
Norwood Hill .. 230A
Nottington .. 230A
Nunhead .. 205A
230A
Nun Monkton 230A
Nunney .. 230A
Nunthorpe .. 230A
Nup End .. 240A
Nurstead .. 230A
Nutbourne .. 230A
Nutfield .. 230A
Nutley 230A
Nyetimber .. 230A
Oadley .. 240A
Oakamoor .. 230A
Oakdale .. 230A
Oakenshaw .. 230A
Oakhill .. 230A
Oakley .. 250A
Oakley (Beds.) .. 210A
Oakley (Hants.) 230A
Oakley (Northants.) 230A
Oakthorpe .. 250A
Oakwood Hill .. 230A
Oakworth .. 230A
Oatlands Park .. 240A
Oborne .. 230A
Ochiltree .. 240A
Ockham .. 200A
Ockley .. 230A
Odell 230A
Odsey .. 230A
Offchurch .. 250A
Offham .. 230A
Offord 240A
Ogmore 230A
Ogmore Vale .. 220A
Okehampton .. 230A
Old Bradwell .. 230A
Old Brampton .. 240A
Old Cleeve .. 230A
Old Colwyn .. 230A
Old Craighall .. 230A
Old Cumnock .. 240A
Old Fletton .. 230A
Oldhall .. 240A
Old Hall Green 240A
Old Kilpatrick .. 240A
Oldland .. 230A
Old Leake .. 230A
Old Lound Booth 230A
Old Marston .. 230A
Oldmixon .. 230A
Old Sodbury .. 230A
Old Stratford .. 210A
Old Trafford .. 230A
Old Warden .. 230A
Oldway .. 230A

Old Whittington 240A
Old Windsor .. 230A
Old Wolverton 230A
Old Ynysybwl 230A
Ollerton .. 220A
Olney 230A
Olton 230A
Olveston .. 210A
Ouchan .. 230A
Ongar 230A
Onllwyn .. 220A
Orchard Portman .. 230A
Orford 230A
Orlingbury .. 230A
Ormesby .. 230A
Ormesby St. Margaret with Scratby 230A
Ormesby St. Michael .. 230A
Ormiston .. 230A
Orpington .. 240A
Orrell 230A
Orsett 230A
Orton 230A
Orton Longueville .. 230A
Orton-on-the-Hill 250A
Orton Rigg .. 230A
Orton Waterville 240A
Osbaldwick .. 230A
Osbaston .. 250A
Osgathorpe .. 250A
Osmington .. 230A
Osmington Mills 230A
Osmotherly .. 230A
Ospring 230A
Ossett 230A
Osterley .. 230A
Oswaldtwistle 230A
Otford 220A
Otham 230A
Otley 230A
Otterbourne .. 230A
Otterburn .. 230A
Otterton .. 230A
Ottery St. Mary 230A
Ottringham .. 230A
Oughterside .. 230A
Oughtibridge .. 230A
Oulton (Norfolk) 230A
Oulton (Suffolk) 230A
Oulton (Yorks.) 230A
Oundle 230A
Outerby .. 230A
Outwood(Lincs.) 230A
Outwood (Surrey) .. 230A
Over Kellett .. 230A
Overmoigne .. 230A
Overseal .. 230A
Overstone .. 210A
Over Stratton.. 230A
Over Tabley .. 220A
Overthorpe .. 230A
Overton(Hants.) 230A
Overton(Lancs.) 230A
Overton (Yorks.) 230A
Overtown .. 240A
Oving 230A
Oxendon .. 230A
Oxenholme .. 230A
Oxenhope .. 230A
Oxshott .. 230A
Oxspring .. 230A
Oxted 220A
Pabo 230A
Packington .. 250A
Packwood .. 230A
Padbury .. 230A
Paddock Wood 230A
Padstow .. 240A
Pagham .. 230A
Pailton.. .. 250A
Painthorpe .. 230A
Pall Mall .. 220C 230A
Palnackie .. 230A
Palnure .. 230A
Panborough .. 230A
Pannard .. 230A
Pannel 200A
Pantaquesta .. 230A
Pantygog .. 230A
Paytypwddin .. 230A
Papcastle .. 230A
Papworth Everard .. 240A
Par 230A
Parbold 230A
Parkbroom .. 230A
Parkend 230A
Parkeston .. 240A
Parkgate .. 230A
Parkmill .. 230A
Parks 230A
Parkstone .. 200A
Park Street .. 240A
Parlington .. 230A
Partney .. 230A
Parton 230A
Partridge Green 230A
Paston 230A
Patching .. 230A
Pateley Bridge 230A
Pathead .. 230A
Patna 240A
Patrick.. .. 230A
Patrington .. 230A
Patshul.. .. 230A
Pattingham .. 230A
Pattishall .. 230A
Paul Churchtown.. 240A
Paulerspury .. 230A
Paull 230A
Paulton .. 230A
Pavenham .. 230A
Peaslake .. 230A
Peasmarsh (Surrey) .. 230A
Peasmarsh (Sussex) .. 230A
Peatling Magna 250A
Peatling Parva 250A
Peckham .. 205A 230A
Peebles.. .. 250A
Peel 230A
Peldon 230A
Pelley 230A
Pembrey .. 250A
Pembury .. 220A
Pencaitland .. 230A
Penclawdd .. 230A
Pencoed .. 230A
Penderyn .. 230A
Pendlebury .. 230A 250C
Pendleton .. 230A
Penegoes .. 230A
Pengam .. 230A
Penge 200A
Penhow .. 230A
Penicuik .. 230A
Penistone .. 230A
Penketh .. 230A
Penkridge .. 230A
Penllergaer .. 230A
Penmaen .. 230A
Penn 200A
Pennard .. 230A
Pennington (Hants.) .. 240A
Pennington (Lancs.) .. 230A
Pennybridge .. 230A
Penrhiwceiber.. 230A
Penrhiwfer .. 230A
Penrhyn Bay .. 230A
Penrhynside .. 230A
Penryn 240A
Pensford .. 230A
Penshurst .. 220A
Pensnett .. 220A
Pentewan .. 230A
Pentre 230A
Pentrebach .. 250A
Pentrepoeth .. 230A
Pentwynmawr 230A
Pentyrch .. 250A
Penwithick .. 230A
Penwortham .. 230A
Penydarren .. 230C
Penyffordd .. 230A
Pen-y-Graig .. 230A
Penygroes .. 250A
Penyrheol .. 230A
Penzance .. 240A
Peover 220A
Peover Heath .. 220A
Percy Main .. 240A
Perry Green .. 240A
Petersham .. 220A
Peterston-super-Ely .. 230A
Petertavy .. 230A
Petrockstowe .. 230A
Pett 230A
Pettistree .. 230A
Pett Level .. 230A
Petts Wood .. 240A
Pevensey .. 230A
Pevensey Bay.. 230A
Piccadilly (Staffs.) .. 250A
Pickmere .. 220A
Picton 230A
Piddington .. 230A
Piddlehinton .. 230A
Piddletrenthide 230A
Pilcombe .. 230A
Pill 230A
Piltdown .. 230A
Pilton 230A
Pimlico.. .. 200C 230A
Pinchbeck .. 230A
Pinchbeck West 230A
Pinhoe 230A
Pinner 230A
Pipe Gate .. 230A
Pipers Estate .. 240A
Pipewell .. 230A
Pirbright .. 200A
Pirton 240A
Pishiobury Park 240A
Pitlessie .. 250A
Pitminster .. 230A
Pitney 230A
Pitsea 230A
Pitsford .. 230A
Pitstone .. 240A
Pittenween .. 250A
Plaistow .. 200A
Plaxt 230A
Platt Bridge .. 230A
Playden .. 230A
Playford .. 230A
Pleasington .. 230A
Pleasley .. 250A
Pluckley .. 230A
Plumley .. 220A
Plumpton .. 230A
Plumstead .. 220C 220A
Plungar .. 230A
Plympton St. Maurice .. 230A
Plymstock .. 230A
Pocklington .. 230A
Pointon .. 230A
Polebrook .. 230A
Polegate .. 230A
Poles 240A
Polesworth .. 250A
Polgooth .. 230A
Polmont .. 250A
Polsham .. 230A
Poltimore .. 230A
Ponders End .. 240A
Ponlottyn .. 230A
Ponsbourne Park 240A
Pontardulais .. 230A
Pontefract .. 230A
Ponthir.. .. 230A
Pontllanfraith.. 230A
Pontlliw .. 230A
Pontnewydd .. 230A
Pontnewynydd 230A
Pontrhydycyff 230A
Pontrhydyrun.. 230A
Pontyclun .. 230A
Pontycymmer.. 230A
Pontygwaith .. 230A
Pontymister .. 230A
Pontymoile .. 230A
Pontyrhyl .. 230A
Pontywain .. 230A
Pool (Yorks.) .. 230A
Poole 200A
Poolford .. 230A
Porchester .. 230A
Poringland .. 230A
Porlock Weir .. 230A
Portbury .. 230A
Port Erin .. 230A
Port Glasgow .. 250A 250C
Porth (Glam.).. 230A
Porthpean .. 230A
Portincross .. 240A
Portinscale .. 100A 200A
Portishead .. 230A
Portlethen .. 230A
Portling .. 230A
Portpatrick .. 230A
Port St. Mary.. 230A
Port Seton .. 230A
Portslade .. 230C 230A
Portway .. 230A
Portwilliam .. 230A
Postwick .. 230A
Potter End .. 230A
Potterhanworth 230A
Potter Heigham 230A
Potterne .. 230A
Potter Row .. 230A
Potters Bar .. 240A
Potters Heath.. 240A
Potters Marston 250A
Potterspury .. 230A
Potter Street .. 240A
Potton 210A
Poughill .. 230A
Poulner .. 250A
Poulton .. 200A
Poulton-le-Fylde 230A
Poulton-with-Fearnhead 250A
Poundon .. 230A
Powick .. 200A
Poxwell .. 250A
Poynders End 240A
Poynings .. 230C 230A
Poynton .. 230A
Prescot (Lancs.) 230A
Prescott .. 210A
Presford Bridge 230A
Prestbury (Ches.) .. 230A
Prestbury (Glos.) .. 210A
Preston St. Maurice .. 230A
Preston (Dumfries) .. 230A
Preston (Durham) .. 250A
Preston (Herts.) 240A
Preston (Lancs.) 230A
Preston (Lincs.) 230A
Preston (Yorks.) 230A
Preston Bagot 250A
Preston Bissett 230A
Preston Brook 250A
Preston Deanery 210A
Prestonmill .. 230A
Prestonpans .. 230A
Preston Patrick 230A
Prestwich .. 200A 230A
Prestwick .. 240A
Prestwood .. 230A
Priest Hutton .. 230A
Primrose Hill .. 230A
Primrose Valley 230A
Princes Risborough .. 220A
Princetown .. 200C
Prinknash .. 230A
Priors Hayes .. 230A
Priors Marston 250A
Prittlewell .. 230C 230A
Publow .. 230A
Puckeridge .. 240A
Pucklechurch .. 210A
Puddletown .. 230A
Pulborough .. 230A
Pulford .. 230A
Pulloxhill .. 240A
Pulrose .. 230A
Purbrook .. 230A
Purdis Farm .. 230A
Purfleet .. 230A
Purleigh .. 230A
Purley 205A 230A
Pury End .. 230A
Putney .. 205A 230A
Putnoe 210A
Puxton .. 230A
Pwll 250A
Pyle 230A
Pyrford.. .. 200A
Pytchley .. 230A
Quadring .. 230A
Quaker's Yard.. 250A
Quarndon .. 200A
Quarry Bank .. 200A
Quedgeley .. 230A
Queen Camel .. 230A
Queensbury .. 230A
Queensferry .. 230A
Queen's Head .. 230A
Quenilborough 250A
Quernmore .. 230A
Quinton .. 210A
Quinton Green.. 230A
Quorndon .. 250A
Rabley Gardens 240A
Rabley Heath .. 240A
Rabley Park .. 240A
Rackheath .. 230A
Radbourne .. 200A
Radcliffe .. 220C 230A
Radcliffe-on-Trent .. 230A
Radford .. 250A
Radstock .. 230A
Radwell .. 240A
Radyr 240A
Ragnall .. 230A
Rainford .. 230A
Rainham (Essex) 230A
Rainham (Kent) 230A
Rainhill .. 230A
Rainow.. .. 230A
Ralit 230A
Rampton .. 230A
Ramsbottom .. 230A
Ramsden Bellhouse .. 230A
Ramsey (Essex) 230A
Ramsey (Hunts.) 240A
Ramsey (I.O.M.) 230A
Ramsgill .. 230A
Ramsgreave .. 230A
Rangemore .. 230A
Rankinston .. 240A
Ranskill .. 230A
Ranworth-with-Panxworth .. 230A
Ratby 250A
Ratcliffe Culey 250A
Ratcliffe-on-the Wreak .. 250A
Ratho 230A

Raunds.. .. 210A
Ravendale .. 230A
Raveningham .. 230A
Ravenscar .. 230A
Ravensden .. 230A
Ravensthorpe .. 230A
Ravenstoft .. 230A
Ravenstone (Bucks.) .. 230A
Ravenstone (Leics.) .. 250A
Ravenstonedale 230A
Ravenstown .. 230A
Rawcliffe .. 230A
Rawdon .. 230A
Rawmarsh .. 230A
Rayleigh .. 230A
Rayner's Lane.. 240A
Reach 240A
Read 230A
Rearsby .. 250A
Reculver .. 230A
Redbourn .. 240A
Redbridge .. 230A
Redcliffe Bay .. 230A
Redhill .. 230A
Redlynch (Hants.) .. 230A
Redlynch (Wilts.) .. 230A
Redmile .. 230A
Reed 240A
Reedham .. 230A
Reedley .. 230A
Reepham (Lincs.) .. 230A
Reepham (Norfolk) .. 230A
Reeth 230A
Reighton .. 230A
Remenham .. 230A
Rendlesham .. 230A
Renfrew .. 240A
Renhold .. 230A
Renton .. 240A
Repps-with-Bastwick .. 230A
Repton .. 230A
Retford.. .. 230A
Rethenden .. 230A
Rewe 230A
Reynoldston .. 230A
Rhiwbina .. 230A
Rhiwderin .. 230A
Rhiwfawr .. 230A
Rhodesia .. 220A
Rhonehouse .. 230A
Rhoose .. 230A
Rhos 230A
Rhos-on-Sea .. 230A
Rhu 240A
Rhydyfelin .. 230A
Rhydyfro .. 230A
Ribchester .. 230A
Richmond (Surrey) .. 220A
Richmond (Yorks.) .. 230A
Rickerby .. 230A
Rickford .. 230A
Rickmansworth 240A
Riddrie .. 240A
Ridge 240A
Ridgmont .. 230A
Ridlington .. 230A
Rigton 230A
Rimington .. 230A
Rimpton .. 230A
Ringford .. 230A
Ringland .. 230A
Ringstead .. 210A
Ringway .. 220A
Ripe 230A
Ripley 200A
Rippingale .. 230A
Ripponden .. 230A
Rise 230A
Riseholm .. 230A
Rishton .. 230A
Rishworth .. 230A
Rising Bridge .. 230A
Risolven .. 220A
River 200A
Riverhead .. 220A
Rixton-with-Glazebrook .. 230A
Roade 210A
Roadwater .. 230A
Robertsbridge 230A
Robin Hood's Bay 230A
Rochester .. 230A
Roche 230A
Rochester .. 230A
Rochford .. 230A
Rockbeare .. 230A
Rockingham .. 230A
Rockland .. 230A
Rockley .. 230A
Rockliffe (Cumb.) .. 230A
Rockcliffe (Kircud.) .. 230A
Rodbaston .. 230A
Rodborough .. 230A
Rodney Stoke 230A
Roe End .. 240A
Rogerscale .. 230A
Rogerstone .. 230A
Rollesby .. 230A
Rolleston .. 230A
Rolvenden .. 230A
Romford .. 230A
Romiley .. 230A
Romsey .. 230A
Rookery 230A
Rooksbridge .. 230A
Roos 230A
Rosie 250A
Roslin 230A
Rosliston .. 230A
Rossington .. 230A
Rosyth .. 250A
Rothampstead Farm.. .. 230A
Rotherfield .. 230A
Rotherfield Greys .. 230A
Rotherfield Peppard .. 230A
Rotherhithe .. 240C
Rothley .. 250A
Rothwell (Northants.) 230A
Rothwell (Yorks.) .. 230A
Rottington .. 230A
Rough Close .. 230A
Rough Common 230A
Roughton .. 230A
Routh 230A
Rowberrow .. 230A
Rowde 230A
Rowfant .. 230A
Rowhedge .. 230A
Rowington .. 250A
Rowlands Castle 230A
Rowledge .. 230A
Rowley.. .. 230A
Rowley Regis.. 200A
Rowstock .. 230A
Rowston .. 230A
Rowton (Ches.) 230A
Rowton (Yorks.) 230A
Roxford .. 240A
Roxley Court .. 240A
Roxton.. .. 230A
Roydon .. 240A
Roydon Hamlet 240A
Royston (Herts.) 240A
Royston (Yorks.) 230A
Royton.. .. 230A
Ruardean .. 230A
Ruddington .. 230A
Rudge 230A
Rudheath .. 220A
Rudyard .. 230A
Rufford .. 230A
Rufforth .. 230A
Rugeley .. 230A
Ruislip 240A
Rumney .. 230A
Runcorn .. 250A
Runford .. 230A
Runham .. 230A
Runham Vauxhall .. 230A
Runnington .. 230A
Runwell .. 230A
Runwell (Essex) 230A
Ruscombe .. 230A
Rushmere .. 230A
Rushmere St. Andrew .. 230A
Rushton .. 230A
Rushwick .. 200A
Rustington .. 230A
Ruston.. .. 230A
Rutherglen .. 240A
Ruyton Eleven Towns .. 230A
Royall 230A
Ryarsh.. .. 230A
Ryde (I.O.W.).. 240A
Rye 230A
Rye Foreign .. 230A
Rye Harbour .. 230A
Ryehill.. .. 230A
Rye Park .. 240A
Ryhill 230A
Ryton on Dunsmore .. 250A

Sabden.. .. 230A
Sadbergh .. 230A
Saddington .. 250A
Saddleworth .. 230A
Saighton .. 230A
St. Abbs .. 250A
St. Albans .. 240A
240C
St. Annes .. 240C
240A
St. Athan .. 230A
St. Bees .. 230A
St. Blazey .. 230A
St. Blazey Gate 230A
St. Boswells .. 250A
St. Brides .. 230A
St. Budeaux .. 230A
St. Columb Major .. 240A
St. Ennis .. 230A
St. Donats .. 230A
St. Downham.. 240A
St. Germans .. 230A
St. Gorran .. 230A
St. Helens (I.O.W.) .. 240A
St. Helens (Lancs.) .. 230C
St. Helens (Lncs.) 230A
St. Hilary .. 230A
St. Ippolitts .. 240A
St. Ives (Cornwall) .. 240A
St. Ives (Hunts.) 240A
St. Johns (I.O.M.) .. 230A
St. Just.. .. 240A
St. Lawrence .. 240A
St. Leonards (Fife) .. 250A
St. Margarets .. 240C
240A
St. Margarets-at-Cliffe .. 200A
St. Martha .. 230A
St. Martins .. 230A
St. Mary Church 230A
St. Mary Cray.. 240A
St. Marys (Scilly Isles).. 230A
St. Mellons .. 230A
St. Michaels .. 230A
St. Monance .. 250A
St. Monans .. 250A
St. Neots .. 240A
St. Nicholas-at-Wade .. 230A
St. Nicholas Hurst .. 230A
St. Osyth .. 230A
St. Paul'sWalden 240A
St. Peters .. 240C
St. Stephens .. 240A
230A
St. Stephens Coombe .. 230A
Salehurst .. 230A
Salesbury .. 230A
Salford (Beds.) 230A
Salford (Lancs.) 230C
200A
230A
Salfords .. 230A
Salhouse .. 230A
Saline 250A
Sall 230A
Salsburgh .. 240A
Saltash.. .. 230A
Saltcoats .. 240A
Saltford .. 210A
Saltmarsh .. 230A
Saltney.. .. 230A
Saltwood .. 210C
210A
Salvington .. 230A
Salmesbury .. 230A
Sampford Arundel(Part) 230A
Sampford Brett 230A
Sampford Courtney .. 230A
Sampford Peverell .. 230A
Sancton .. 230A
Sand 230A
Sandal 200A
230A
Sandbank (Argyllshire) 230A
Sand Bay .. 230A
Sandford (Devon) .. 230A
Sandford (Somerset) .. 230A
Sandford-on-Thomas .. 230A
Sandford Orcas 230A
Sandgate .. 210C
210A
Sandhills .. 230A
Sandhoe .. 250A
Sandhurst (Glouc.) .. 230A
Sandhurst (Kent) .. 230A
Sandhurst (Surrey) .. 250A
Sand Hutton .. 230A
Sandiway .. 220A
Sandling .. 230A
Sandon.. .. 230A
Sandown .. 240A
Sandridge .. 240A
Sandsend .. 230A
Sandside .. 230A
Sandwich .. 230A
Sandwith .. 230A
Sandy 210A
Santon 230A
Sapcote .. 250A
Sarisbury.. .. 230A
Saron 250A
Sarre 230A
Saul 230A
Saunton .. 230A
Sawbridgeworth 240A
Sawley 230A
Sawrey.. .. 100A
200A
Sawston .. 240A
Saxilby.. .. 230A
Saxlingham .. 230A
Saxmundham .. 230A
Saxthorpe .. 230A
Saxton 230A
Scalby 230A
Scaleby.. .. 230A
Scales 230A
Scammonden .. 230A
Scar Close .. 230A
Scarcroft .. 230A
Scarisbrick .. 230A
Scarning .. 230A
Scarthoe .. 230A
Scaynes Hill .. 230A
Scholes.. .. 230A
Scissett.. .. 230A
Scopwick .. 230A
Scotby 230A
Scotstoun .. 240A
Scotton.. .. 230A
Scraptoft .. 240A
Scriven.. .. 230A
Seaborough .. 230A
Seacroft .. 230A
Seaforth .. 230A
230C
Seagry 230A
Seal 220A
Sealand .. 230A
Seamer.. .. 230A
Sea Palling .. 230A
Seasalter .. 230A
Seascale .. 230A
Seaton (Devon) 230A
Seaton(Cumb.) 230A
Seaton(Yorks.) 230A
Seaton Junction 230A
Seaview .. 240A
Seavington .. 230A
Sebastopol .. 230A
Seckington .. 250A
Sedgebrook .. 230A
Sedgley.. .. 200A
Sedgwick .. 230A
Sedlescombe .. 230A
Seend 230A
Seer Green .. 220C
220A
Seething .. 230A
Sefton 230A
Selghford .. 230A
Selby 230A
Selkirk 250A
Selmeston .. 230A
Selsdon.. .. 230A
Selsey 230A
Semington .. 230A
Send 200A
Senghenydd .. 230A
Sevenoaks (Kent) .. 110A
220A
Sevenoaks Weald .. 220A
Seven Sisters .. 220A
Sevington .. 230A
Sewardstonebury 240A
Sewardstone Road (Waltham Abbey).. 240A
Sewerby .. 230A
Shadoxhurst .. 230A
Shadwell .. 230A
Shafton .. 230A
Shaldon .. 230A
Shalfleet .. 240A
Shalford .. 230A
Shallowford .. 230A
Shalstone .. 230A
Shanklin .. 240A
Shap 230A
Sharcombe .. 230A
Sharlston .. 230A
Sharnbrook .. 210A
Sharnford .. 250A
Sharpenhoe .. 240A

Shawell.. .. 250A
Shawforth .. 230A
Shawhead .. 230A
Shaw Mills .. 230A
Shebbear .. 230A
Shedfield .. 230A
Sheepwash .. 230A
Sheepy Magna.. 250A
Sheepy Parva.. 250A
Sheering .. 240A
Shefford .. 240A
Sheldon .. 230A
Shelf 230A
Shelfield .. 250A
Shelley 230A
Shenley .. 240A
Shenley Brook End 230A
Shenley Church End (Bucks.) 230A
Shenstone .. 230A
Shenton .. 250A
Shepbourne .. 220A
Shephall .. 240A
Shepherds Bush 110A 230A
Shepherdswell.. 230A
Shepley .. 230A
Shepperton .. 200A
Shepreth .. 240A
Shepshed .. 250A
Shepton Beauchamp .. 230A
Shepton Mallet 230A
Sherborne .. 230A
Sherborne St. John .. 220A
Sherbourne .. 250A
Sherburn-in-Elmet .. 230A
Shere (Surrey).. 230A
Sheriff Hutton.. 230A
Sheringham .. 240A
Sherington .. 230A
Shermanbury .. 230A
Shevington .. 230A
Shillington .. 240A
Shilton 250A
Shinfield .. 230A
Shipdham .. 230A
Shipham .. 230A
Shiplake .. 230A
Shipley(Yorks.) 230A 230C
Shipley Bridge.. 230A
Shipton .. 230A
Shipton-by-Benningborough .. 230A
Shireoaks .. 220A
Shirley 230A
Shitlington .. 230A
Shocklach Church .. 230A
Shocklach Oviatt .. 230A
Sholden .. 230A
Shoreham(Kent) 230A 220A
Shoreham-by-Sea 230A
Shorne 230A
Shortfield Common .. 230A
Short Heath .. 200A
Shortstown .. 210A
Shorwell .. 240A
Shoteshan All Saints .. 230A
Shotover .. 230A
Shotton .. 230A
Shotts 240A
Shotwick .. 230A
Shotwick Park.. 230A
Shrewley .. 250A
Shrimpney .. 230A
Shurdington .. 210A
Shurlock Row .. 240A
Shustoke .. 230A
Shuttington .. 250A
Sibbertoft .. 230A
Sicklinghall .. 230A
Sidbury .. 220C
Sidcup 200A
Sidford.. .. 230A
Sidlisham .. 230A
Sidmouth .. 230A
Sidway.. .. 230A
Sigglesthorpe .. 230A
Sileby 250A
Silkstone .. 230A
Silloth 230A
Silsoe 240A
Silverdale .. 230A
Silverhill .. 230A
Silverstone .. 230A
Silverton .. 230A
Silvertown .. 200A
Simonstone .. 230A
Simonswood .. 230A
Simpson .. 230A
Sinclairston .. 240A
Sinfin Moor .. 200A 230A
Singleton .. 200A
Singlewell .. 230A
Sishes End .. 240A
Sisland 230A
Sissinghurst .. 230A
Siston 230A
Sittingbourne .. 230A
Six Mile Bottom 240A
Skegness .. 230A
Skelmanthorpe 230A
Skelmersdale .. 230A
Skelton.. .. 250A
Skelton-in-Cleveland .. 230A
Skendleby .. 230A
Skerne 230A
Skidby 230A
Skillington .. 230A
Skinburness .. 230A
Skipsea.. .. 230A
Skirlaugh .. 230A
Slamannan .. 250A
Slapton.. .. 230A
Slapton (Beds.) 240A
Slapton (Devon) 240A
Slattocks .. 230A
Slawston .. 250A
Sleights .. 230A
Slindon.. .. 230A
Slip End .. 240A
Slitting Mill .. 230A
Slyne 230A
Smallburgh .. 230A
Smallfield .. 230A
Smallford .. 240A
Smarden .. 230A
Smeeth.. .. 230A
Smeeton Westerby .. 250A
Smelthouses .. 230A
Smithy Bridge.. 230A
Snailwell .. 240A
Snainton .. 230A
Snape 230A
Snarestone .. 250A
Snitterfield .. 250A
Snodland .. 230A
Snydale .. 230A
Soberton .. 230A
Soham 240A
Solihull .. 230A
Somerby .. 230A
Somerleyton .. 230A
Somerton .. 230A
Somerton East 230A
Somerton West 230A
Sonning .. 230A
Sorbie 230A
Sorn 240A
Souldrop .. 210A
Sourton Cross.. 230A
Southam (Glouc.) .. 210A
Southam (Warwicks.) 250A
South Ascot .. 220C
South Bank .. 250A
South Benfleet 230A
Southborough .. 220A
Southbourne (Bournemouth) 230A
Southbourne (Emsworth) 230A
South Brent .. 240A
South Cadbury 230A
South Cave .. 230A
South Crosland 100A 200A
South Croxton.. 250A
South Dalton .. 230A
South Elmsall.. 230A
South Fambridge .. 230A
Southfleet .. 230A
Southgate(N.14) 240A
Southgate (Glam.) .. 230A
South Hanningfield 230A
South Harrow.. 240A
South Heath .. 230A
South Hiendley 230A
Southhill .. 230A
South Killingholme 230A
South Kilworth 250A
South Kirby (Yorks.) .. 230A
South Leverton 230A
South Milford.. 230A
South Milton .. 240A
South Mimms.. 240A
Southminster .. 230A
South Molton .. 230A
South Newbold 230A
South Nutfield 230A
South Ockendon 230A
Southouram .. 230A
South Petherton 230A
South Preston.. 230A
South Queensferry.. 250A
Southsea .. 200A 230A
South Skirlaugh 230A
South Stainley 200A
Southstoke .. 230A
South Walsham 230A
Southwark (Part) .. 215C
Southwark .. 205A 205C 230A 220C
Southwell .. 230A
South Wheatley 230A
Southwick (Sussex) .. 230A 230C
Southwick (Wilts.) .. 230A
Southwold .. 280A
Southworth with Croft .. 250A
South Zeal .. 230A
Sowerby .. 230A
Sowerby Bridge 230A
Soyland .. 230A
Spalding .. 230A
Sparham .. 230A
Sparkbridge .. 230A
Speech House .. 230A
Speldhurst .. 220A
Spellbrook .. 240A
Spetchley .. 200A
Spilsby .. 230A
Spinkhill .. 220A
Spixworth .. 230A
Spofforth .. 230A
Spondon .. 200A
Spratton .. 210A
Springbolg .. 240A
Springfield .. 230A 250A
Springhead .. 230A
Springholm .. 230A
Springside .. 240A
Sprotborough 230A
Sproughton .. 230A
Sabling .. 230A
Stableford .. 230A
Stagsden .. 230A
Stainborough .. 230A
Staincross .. 230A
Staines .. 230A 200A
Stainforth (Settle) .. 230A
Stainforth (Yorks.) .. 230A
Stainland .. 230A
Stainton .. 230A
Staintondale .. 230A
Stalham .. 230A
Stallingborough 230A
Stalmine .. 230A
Stamford (Lincs.) .. 240C
Stamford Bridge
Stamford Rivers 230A
Staminglev .. 230A (York) .. 230A
Stanalees .. 230A
Stanborough .. 240A
Stanbridge .. 240A
Standish .. 230A
Standon (Herts.) 240A
Stanton (Staffs.) 230A
Stane Street .. 240A
Stanford le Hope 230A
Stanground .. 230A
Stanion.. .. 230A
Stank 230A
Stanmore .. 240A
StansteadAbbotts 240A
Stansteadbury 240A
Stanstead Mountfitchet 240A
Stanstead St. Margarets 240A
Stanthorne .. 220A
Stanton .. 230A
Stanton Drew .. 230A
Stanton St. Quintin 230A
Stanton-under-Bardon .. 250A
Stanway .. 230A
Stanwell .. 230A 200A
Stanwick .. 230A
Staple 230A
Staplecross .. 230A
Staple Fitzpaine 200A
Stapleford .. 230A 240A 200A
Stapleford Tawney .. 230A
Staplegrove .. 230A
Staplehurst .. 230A
Stapleton .. 250A
Starcross .. 230A
Stathern .. 230A
Statford .. 250A
Staveley (Derby) 230A 250A
Staverton (Glos.) 210A 230A
Staverton (Northants.) 230A
Steatley .. 240A
Steelworks .. 240A
Steeple Ashton 230A
Steeple Claydon 230A
Steeple Morden 240A
Steeton .. 230A
Stembridge .. 230A
Stenton.. .. 230A
Steppingley .. 240A
Stepps 240A
Sternfield .. 230A
Stevenage .. 240A
Stevenston .. 240A
Steventon .. 230A
Stevington .. 230A
Stewartby .. 210A
Stewarton .. 240A
Stewkley .. 230A
Sticker 230A
Sticklepath .. 230A
Stickney .. 230A
Stifford .. 205A 230A
Stillington .. 230A
Stilton 240A
Stwichall .. 230A
Stock 230A
Stockham .. 250A
Stocksbridge .. 230A
Stockton (Warwicks.) 250A
Stockton (Yarmouth) 230A
Stockton Brook 230A
Stockton Heath 250A
Stockton-on-Forest .. 230A
Stockton-on-Tees 250A 230C
Stodford .. 230A
Stoke (Chester) 250A
Stoke (Kent) .. 230A
Stoke Albany .. 230A
Stoke Bardolph 230A
Stoke Cannon .. 230A
Stoke D'Abernon 230A
Stoke Doyle .. 230A
Stoke Fleming.. 240A
Stoke Gabriel .. 240A
Stoke Gifford .. 210A
Stoke Golding 250A
Stoke Goldington 230A
Stoke Hammond 240A
Stoke Holy Cross 230A
Stokeinteignhead 230A
Stoke Lane .. 230A
Stokenham .. 240A
Stoke-on-Trent 230C 240C 240A
Stoke Poges .. 230A
Stoke Rochford 230A
Stoke St. Mary 230A
Stoke St. Michael 230A
Stokesby with Herringby .. 230A
Stoke under Ham 230A
Stoke (Staffs.) 230A
Stoke Allerton 230A
Ston Easton .. 230A
Stone (Bucks.) 230A
Stone (Kent) .. 230A
Stone Cross .. 230A
Stonehall .. 230A
Stonehouse (Glos.) .. 230A
Stonehouse (Lanark) .. 230A
Stoneleigh .. 250A 230A
Stonely .. 240A
Stoneykirk .. 230A
Stoney Stanton 250A
Stoneyhurst .. 230A
Stonidelph .. 250A
Stony Stratford 210A
Stopsley .. 240A
Storkhill .. 230A
Storrington .. 230A
Storth 230A
Stortsfold .. 240A
Stoughton .. 240A
Stourbridge .. 200A
Stourton .. 230A
Stow 250A
Stowe 230A

Stowmarket .. 230A
Stow St. Mary's 230A
Stranshall .. 230A
Stranraer .. 230A
Stratford .. 200A
Stratford-on-Avon.. .. 230A
230C
Stratford St. Mary .. 230A
Strathaven .. 240A
Strathkinness .. 250A
Strathmiglo .. 250A
Stratton .. 230A
Stratton Hall .. 230A
Stratton on Fosse.. .. 230A
Stratton St. Margaret's 220A
Stratton St. Mary .. 230A
Stratton St. Michael .. 230A
Streat 230A
Streatham .. 230A
205A
Streatley .. 240A
Street 230A
Streethouse .. 230A
Streetly .. 230A
230C
Strensall .. 230A
Strete 240A
Stretham .. 240A
Stretton (Burton-on-Trent, Staffs.) 230A
Stretton (Ches.) 230A
Stretton (Lancs.) 250A
Stretton (Staffs.) 230A
Stretton Baskerville .. 250A
Stretton-en-le-Field .. 250A
Stretton-on-Dunsmore .. 250A
Strone 230A
Strood .. 230A
Strumpshaw .. 230A
Stubbington .. 230A
Stubton .. 230A
Studdale .. 230A
Studham .. 230A
Stuntney .. 240A
Sturminster Newton .. 230A
Sturnall .. 230A
Sturry 230A
Sturton-le-Steeple .. 230A
Stutton .. 230A
Styal 230A
Sudborough .. 230A
Sudbourne .. 230A
Sudbury .. 230A
Sulby 230A
Sulgrave .. 230A
Sullington .. 230A
Summerbridge 230A
Sunbury .. 200A
230A
Sundon.. .. 240A
Sundridge .. 220A
Sunningdale .. 220C
Sunninghill .. 220C
Sunningwell .. 230A
Sunnybank .. 230A
Sunnyside .. 230A
Surfleet.. .. 230A
Surlingham .. 230A
Sutterton .. 230A
Sutton (Beds.) 230A
Sutton (Ches.).. 250A
Sutton (Norfolk) 230A
Sutton (Notts.) 230A
Sutton (Suffolk) 230A
Sutton (Surrey) 230A
200A
Sutton (Yorks.) 230A
Sutton Bassett 230A
Sutton Benger 230A
Sutton Bridge.. 230A
Sutton Cheney 250A
Sutton Coldfield 230A
230C
Sutton Courtenay .. 230A
Sutton Montis.. 230A
Sutton-on-Forest .. 230A
Sutton-on-Hull 230A
Sutton-on-Sea.. 230A
Sutton Valence 230A
Swadlincote .. 230A
Swaffham Bulbeck .. 240A
Swaffham Prior 240A
Swainsthorpe .. 230A
Swainswick .. 230A
Swalecliffe .. 230A
Swallownest .. 230A
Swanbourne .. 230A
Swanland .. 230A
Swanley Junction .. 230A
Swanmore .. 230A
Swannington (Leic.) .. 250A
Swannington (Norfolk) .. 230A
Swanscombe .. 230A
Swanton Morley 230A
Swanwick .. 230A
Swarcliffe Top 230A
Swardeston .. 230A
Swarthmoor .. 230A
Sway 230A
Swepstone .. 250A
Swillington .. 230A
Swimbridge Newland .. 230A
Swindon (Glos.) 210A
Swindon (Wilts.) 220A
220C
Swindon (Worc.) 200A
Swine 230A
Swineford .. 230A
Swineshead .. 280A
Swinesherd .. 200A
Swinford .. 250A
Swinton (Manchester) 230A
250C
Swinton (Yorks.) .. 230A
Swithland .. 250A
Sydenham .. 200A
230A
Sydling St. Nicholas .. 230A
Symington (Ayr) 240A
Symington (Lanark) 240A
Symonds Green 240A
Syresham .. 230A
Syston 250A
230A
Sywell 210A
230A
Tacolneston .. 230A
Tadworth .. 230A
Taffs Well .. 230A
Talke 230A
Tallentire .. 230A
Tamerton .. 230A
Tamworth .. 250A
Tamworth-in-Arden .. 230A
Tandridge .. 230A
Tang 230A
Tangmere .. 230A
Tantobie .. 250A
Taplow.. .. 230A
230C
Tarbock .. 230A
Tarbolton .. 240A
Tarleton .. 230A
Tarnock .. 230A
Tarporley 230A
Tarraby .. 230A
Tarvin 230A
Tasburgh .. 230A
Tatenhill .. 230A
Tatham .. 230A
Tatsfield .. 230A
Tattenhall .. 230A
Tattershall .. 230A
Tatworth .. 230A
Taverham .. 230A
Tavistock .. 230A
Tayport .. 250A
Tean 230A
Tebay 230A
TedburnSt.Mary 230A
Teddington .. 240C
Teesville .. 250A
Teignngrace .. 230A
Telscombe .. 230A
230C
Temple Cloud.. 230A
Temple Ewell.. 200A
Temple Sowerby 230A
Tempsford .. 230A
Tendring .. 230A
Tenterden .. 230A
Terlings .. 240A
Terrance .. 240A
Terrington .. 230A
Terrington St. Clement.. 230A
Tetbury .. 230A
Tetney 230A
Tettenhall .. 230A
Tewin 240A
Tewin Hill .. 240A
Tewin Water .. 240A
Thame 220A
Thanington .. 230A
Thankerton .. 240A
Thaxted .. 230A
Theale (Berks.) 200A
Theale (Somerset) .. 230A
Thearne .. 230A
Theddingworth 250A
The Lee .. 230A
Thelwall .. 250A
Themelthorpe .. 230A
Thetford .. 230A
Theydon .. 230A
Theydon Bois.. 230A
Theydon Garnon 230A
Thirtleby .. 230A
Thorley (Herts.) 240A
Thorley (I.O.W.) .. 240A
Thorley Street.. 240A
Thornborough.. 230A
Thornby .. 230A
Thorne 230A
Thorner .. 230A
Thorney .. 240A
Thorney (Somerset) .. 230A
Thornford .. 230A
Thorngumbald 230A
Thornham .. 230A
Thornhill .. 230A
Thornhill (Hants.) .. 230A
Thoruliebank .. 240A
Thornton .. 230A
200A
Thornton (Fife) 250A
Thornton (Lancs.) .. 230A
Thornton(Leic.) 250A
Thorntonhall .. 240A
Thornton-in-Craven .. 230A
Thornton-le-Clay 230A
Thorp Arch .. 280A
Thorpe (Surrey) 200A
230A
Thorpe (Yorks.) 230A
Thorpe Achurch 230A
Thorpe Acre-cum-Dishley 230A
Thorpe Arnold 240C
Thorpe Audlin 230A
Thorpe Bay .. 230A
230C
Thorpe Constantine.. 240A
Thorpe Hesley.. 230A
Thorpe Langton 250A
Thorpe-le-Soken .. 230A
Thorpe Lubenham .. 230A
Thorpe Malsor.. 230A
Thorpeness .. 230A
Thorpe-next-Haddiscoe .. 230A
Thorpe St. Andrew .. 230A
Thorpe Satchville .. 250A
Thorpe Waterville .. 230A
Thorrington .. 230A
Thorverton .. 230A
Thrapston .. 210A
Three Bridges.. 230A
Three Crosses .. 230A
Three Oaks .. 230A
Threshfield .. 250C
Thrigby .. 230A
Thringstone .. 250A
Throwleigh .. 230A
Thrupp.. .. 230A
Thrussington .. 250A
Thrybergh .. 230A
Thundersley .. 230A
Thurcaston .. 250A
Thurcroft .. 230A
Thurgarton .. 230A
Thurgoland .. 230A
Thurlaston .. 250A
Thurlby .. 230A
Thurlestone .. 240A
Thurlstone .. 230A
Thurlton .. 230A
Thurmaston .. 240A
Thurne.. .. 230A
Thurnham .. 230A
Thurning .. 230A
Thurnley .. 240A
Thurnscoe .. 230A
Thursby .. 230A
Thurstonfield .. 230A
Thurstonland .. 230A
Thuxton .. 230A
Thwaite .. 230A
Ticehurst .. 230A
Tickenham .. 230A
Tickhill.. .. 230A
Tickton .. 230A
Tidal Basin .. 200A
Tidenham .. 230A
Tiffield 230A
Tilbury.. .. 230A
Tilehurst .. 200A
Tilford .. 230A
Tillicoultry .. 250A
Tilmanstone .. 230A
Tilston 230A
Tilstone Fearnall .. 230A
Tilsworth .. 240A
Timberland .. 230A
Timberscombe.. 230A
Timperley .. 100A
200A
Timsbury .. 230A
Tindale.. .. 230A
Tingewick .. 230A
Tingley.. .. 230A
Tingrith .. 240A
Tinhead .. 230A
Tinkers Hill .. 240A
Tinsley.. .. 230A
Tintinhull .. 230A
Tinwell.. .. 230A
Tipton 200A
Tipton St. John 230A
Tiptree.. .. 230A
Tirphill.. .. 230A
Tiryberth .. 230A
Tisbury .. 230A
210C
Titchfield .. 230A
Titchmarsh .. 230A
Titmore Green.. 240A
Titsey 220A
Tittenson .. 230A
Tiverton (Ches.) 230A
Tiverton (Devon) .. 230A
230C
Tivington .. 230A
Tixall 230A
Tixover .. 230A
Tockholes .. 230A
Toddington .. 240A
Todds Green .. 240A
Todwick .. 230A
Toft Grange .. 230A
Toft Monks .. 230A
Tollerton .. 230A
Tollesbury .. 230A
Tolleshunt D'Arcy .. 230A
Tolleshunt Knights .. 230A
Tolpuddle .. 230A
Tolworth .. 230A
Tong 230A
Tongland .. 230A
Tongwynlais .. 230A
Tonna 220A
Tonteg 230A
Tonypandy .. 230A
Tonyrefail .. 230A
Tooting .. 230A
Topcroft .. 230A
Topsham .. 230A
Torbryan .. 200A
Tormarton .. 230A
Torcross .. 240A
Torpoint .. 230A
Torryburn .. 250A
Tortington .. 230A
Tortworth .. 230A
Torworth .. 230A
Totland Bay .. 240A
Totton 220A
Tottenham .. 240A
Totteridge .. 240A
Totternhoe .. 240A
Tottington .. 230A
Totton 230A
Towchester .. 230A
Townhill .. 220A
Toynton, All Saints .. 230A
Toys Hill .. 220A
Trafford Park.. 230A
230C
Tranent .. 230A
Trawden .. 230A
Trebanog .. 230A
Trebanos .. 230A
Trefonen .. 230A
Treforest .. 230A
230C
Trefriw.. .. 230A
Tregrehan .. 230A
Trehafod .. 230A
Treharris .. 250A
Treherbert .. 230A
Trelewis .. 230A
Trentham .. 230A
Treorchy .. 230A
Treswell .. 230A
Trethomas .. 230A
Treviscoe .. 230A
Trewoon .. 230A

Triangle .. 230A
Trimley St. Martin .. 240A
Trimley St. Mary.. .. 240A
Trimsaren .. 250A
Trinant.. .. 230A
Tring 220A
Troedrhiwfuwch 230A
Troedyrhiw .. 250A
Troon 240A
Troutbeck .. 100A
200A
Trowbridge .. 230A
Trowse-with-Newton .. 230A
Truddox Hill .. 230A
Trull 230A
Trumpington .. 200A
Tryddyn .. 230A
Trysull 200A
Tubney.. .. 230A
Tuckenhay .. 240A
Tuddenham .. 230A
Tufthorn .. 230A
Tumby Point .. 230A
Tunstall(Lancs.) 230A
Tunstall(Staffs.) 240A
220C
Tunstall(Yorks.) 230A
Tunstead .. 230A
Tur Langton .. 250A
Turleigh .. 230A
Turnberry .. 240A
Turners Hill .. 230A
Turnford .. 240A
Turvey.. .. 230A
Turweston .. 230A
Tutbury .. 230A
Tuttington .. 230A
Tuxford .. 220A
Two Gates .. 250A
Twycross .. 250A
Twyford (Berks.) .. 230A
Twyford (Hants.) .. 230A
Twyford (Leic.) 250A
Twyford (Norfolk) .. 230A
Twyford (Northants.) 230A
Twynholm .. 230A
Tycroes .. 250A
Tyersal.. .. 230A
Tyldesley .. 230A
Tyler Hill .. 230A
Tylers Green .. 210A
Tyn-y-Coedcae 230A
Tytherington .. 230A
Tyttenhanger Green .. 240A
Tywardreath .. 230A

Ubley 230A
Uckington .. 210A
Uddingston .. 240A
Udimore .. 230A
Uffculme .. 230A
Ufford 230A
Ufton 250A
Ugborough .. 240A
Ullesthorpe .. 250A
Ulley 230A
Ulting 230A
Underriver .. 220A
Union Mills .. 230A
Unsworth .. 230A
Upham.. .. 230A
Uphill 230A
230C
Upholland .. 250A
Uplawmoor .. 240A
Uplyme .. 230A
Upminster .. 230A
Upper Boat .. 230A
Upper Boddington 230A
Upper Bourne.. 230A
Upper Cwmbran 230A
Upper Greetland 230A
Upper Hale .. 230A
Upper Harlestone.. .. 230A
Upper Hatherley 210A
Upper Heyford 210A
Upper Leigh .. 230A
Upper Longdon 230A
Uppermill .. 230A
Upper Nazing .. 240A
Upper Noble .. 230A
Upper Norwood 200A
230A
Upper Poppleton 230A
Uppingham .. 230A
Upshire .. 240A
Upton (Ches.) .. 230A
Upton (Cornwall) 230A
Upton (Northants) .. 210A
Upton (Yorks.) 230A
Upton Cheyney 230A
Upton Park .. 200A
Upton Pyne .. 230A
Upton St. Leonards 230A
Upton-with-Fishley .. 230A
Urchfont .. 230A
Urmston .. 230C
Usk 230A

Vange 230A
Vaynor.. .. 230A
Velmore .. 240A
Ventnor .. 240A
Victoria (Mon.) 240C
Victoria(S.W.1.) 200C
230A
Vinehall .. 230A
Vines Cross .. 230A

Wacton .. 230A
Waddesdon .. 220A
Waddington (Lancs.) .. 230A
Waddington (Lincs.) .. 230A
Wadebridge .. 240A
Wadeford .. 230A
Wadenhoe .. 230A
Wadesmill .. 240A
Wadhurst .. 230A
Wadsworth .. 230A
Wadworth .. 230A
Wainfleet .. 230A
Wainscott .. 230A
Wakes Colne .. 230A
Walberton .. 230A
Walcot.. .. 230A
Walcott .. 230A
Walditch .. 230A
Waldringfield .. 230A
Waldron .. 230A
Wales 230A
Walker Fold .. 230A
Walkern .. 240A
Walkhampton.. 230A
Walkington .. 230A
Wall 230A
Wallington .. 240A
Wallington (Surrey) .. 230A
Wallyford .. 230A
Walmer .. 230A
Walmer Bridge 230A
Walsall .. 230A
Walsall Wood 250A
Walsgrave-on-Stowe .. 230A
Waltham (Grantham).. 230A
Waltham (Lincs.) 230A
Waltham Abbey 240A
Waltham St. Lawrence 240A
Walton .. 230A
Walton (Cumb.) 230A
Walton (Derbyshire) 240A
Walton (Essex) 230A
Walton (Somerset) .. 230A
Walton (Wakefield) .. 230A
Walton (Wetherby) .. 230A
Walton-in-Gordano .. 230A
Walton-le-Dale 230A
Walton-on-Thames .. 240A
Walton-on-the-Hill 230A
Walton-on-the-Wolds .. 250A
Walton Park 230A
Walton-upon-Trent .. 230A
Wandsworth .. 205A
230A
Wannock .. 230A
Wanstead .. 230A
Wanstrow .. 230A
Wappenham .. 230A
Warboys .. 240A
Warburton .. 250A
Warcop .. 230A
Warden .. 250A
Wardle .. 230A
Ware 240A
Wareham .. 230A
Waresley .. 240A
Warfield .. 240A
Wargrave .. 230A
Warkton .. 230A
Warlingham .. 230A
Warminster .. 230A
Warmsworth .. 230A
Warmwell .. 230A
Warren Bank .. 230A
Warsash .. 230A
Warthill .. 230A
Warton (Carnforth) .. 230A
Warton (Lancs.) 230A
Warton (Staffs.) 240A
Warwick .. 250A
230C
Warwick Bridge 230A
Washford .. 230A
Washingborough 230A
Washington .. 230A
Wasperton .. 250A
Watchet .. 230A
Watchfield .. 230A
Waterbeach .. 240A
Water Eaton .. 230A
Waterford .. 240A
Waterhall Farm 240A
Wateringby .. 230A
Waterlip .. 230A
Waterloo (Lanark) .. 240A
Waterloo (Lancs.) .. 240A
Waterloo (Liverpool) .. 230A
230C
Waterlooville .. 230A
Water Orton .. 230A
Waterside Farm 240A
Water Stratford 230A
Wath (Yorks.).. 230A
Wath-on-Dearne .. 230A
Watledge .. 230A
Watling Street 250A
Watton.. .. 240A
Wattsville .. 230A
Wauldby .. 230A
Wauullwyd .. 240C
Wavendon .. 230A
Waverley .. 230A
Waverton (Ches.) 230A
Waverton (Yorks.) .. 230A
Wawne .. 230A
Wayford .. 230A
Wealdstone .. 240A
230C
Weare 230A
Weare Gifford .. 230A
Wearen Wyche 230A
Weaverham .. 220A
Webbington .. 230A
Webbs Heath .. 230A
Wedges Mills .. 230A
Wedmore .. 230A
Wednesbury .. 200A
Wednesfield .. 200A
Weedon (Northants.) 210A
Weekley .. 230A
Week St. Mary.. 230A
Weel 230A
Weeley .. 230A
Weeley Heath 230A
Weeton.. .. 230A
Welburn .. 230A
Welby 240C
Weldon.. .. 230A
Welford .. 230A
Welham .. 230A
Welham Green 240A
Well End .. 240A
Wellesbourne .. 250A
Welling.. .. 200A
Wellingore .. 230A
Wellow .. 240A
230A
Wells (Norfolk) 230A
Wells (Somerset) 230A
Well Vale .. 230A
Welton (Northants.).. 230A
Welwyn .. 240A
Welwyn Garden City.. 230A
Wembley .. 240A
Wembury .. 230A
Wemyss Bay .. 230A
Wendon Lofts 230A
Wendover .. 220A
Wennington .. 230A
Wentbridge .. 230A
Wentworth (Surrey) .. 230A
Wentworth (Yorks.) .. 230A
Wenvoe .. 230A
Wernffrwd .. 230A
Werrington .. 230A
Wervin .. 230A
Wesham .. 230A
West Aberthaw 230A
West Ashling .. 230A
West Ashton .. 230A
West Ayton .. 230A
West Bergholt.. 230A
Westbourne .. 230A
West Bradford 230A
West Bretton .. 230A
West Bridgford 230A
West Buckland 230A
Westbury (Northants.) 230A
Westbury (Somerset) 230A
Westbury (Wilts.) .. 230A
Westbury-Leigh 230A
Westbury-on-Severn .. 230A
Westby-with-Plumptons .. 230A
West Calder .. 230A
West Camel .. 230A
West Chillington Common .. 230A
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Westcliff-on-Sea 230C
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West Coker .. 230A
West Compton 230A
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West Dean .. 230A
West Deeping .. 230A
West Ella .. 230A
West End (Hants.) .. 240A
Westerfield .. 230A
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Westerham Hill 230A
Westerleigh .. 230A
Westerton .. 240A
West Farleigh 230A
West Felton .. 230A
Westfield .. 230A
Westgate .. 240A
West Grinstead 230A
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West Hill .. 230A
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West Horndon.. 230A
West Hougham 230A
Westhoughton.. 230A
West Kilbride 240A
West Kirby .. 230A
Westland Green 240A
West Langton 250A
West Lavington 280A
Westleigh (Devon) .. 230A
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West Linton .. 230A
Westlinton .. 230A
West Lulworth 230A
West Lynn .. 230A
West Malling .. 230A
West Malvern .. 200A
West Melton .. 230A
West Mersea .. 230A
Westmeston .. 230A
Westmill .. 240A
West Milton .. 230A
Westminster .. 100C
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West Monkton 230A
Weston .. 230A
Weston (Herts.) 240A
Weston Bampfylde .. 230A
Weston-by-Weedon .. 230A
Weston-by-Welland .. 230A
Weston Coyney 230A
Westoning .. 230A
Weston-in-Gordano .. 230A
Weston Longville 230A
Weston Turville 220A
Weston-under-Lizard .. 230A
Weston-under Wetherby .. 250A
Weston Underwood .. 230A
Weston Peverell 230A
Weston-with-Preese .. 200A
West Penwith 240A
West Porlock .. 230A
West Quantoxhead 230A
West Thurrock 200A
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West Town .. 230A
Westward Ho .. 230A
Westwell .. 230A
Westwick .. 230A
West Wickham 240A
Westwood .. 230A

West Wycombe 210A
Wetheral .. 230A
Wetherby .. 230A
Wetley Rocks .. 230A
Wetwood .. 230A
Weybourne .. 230A
Weybridge .. 230A
Whaddon .. 230A
Whaley Bridge 230A
Whalley .. 230A
Whaplode .. 230A
Whateley .. 250A
Whatlington .. 230A
Whauphill .. 230A
Wheatacre-all-Saints .. 230A
Wheat-hampstead .. 240A
Wheatley Carrbooth .. 230A
Wheaton Aston 230A
Wheldrake .. 230A
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Whesson .. 230A
Whetstone .. 250A
Whiddon Down 230A
Whimple .. 230A
Whippingham .. 240A
Whipsnade .. 240A
Whiston .. 230A
Whiston (Northamts.) 230A
Whiston(Yorks.) 230A
Whitacre .. 230A
Whitburn .. 250A
Whitchurch (Devon) .. 230A
Whitchurch (Glam.) .. 230A
Whitchurch (Hants.) .. 240A
Whitchurch (Somerset) .. 230A
Whitchurch Canonicorum 230A
Whitechapel .. 240C
Whitecraigs .. 240A 230A
Whitefield .. 230A
Whitegate .. 220A
White-le-Head 250A
White Lund .. 230A
White Waltham 240A
Whitfield (Kent) 230A
Whitfield (Northants.) 230A
Whitford .. 230A
Whithorn .. 230A
Whitlebury .. 230A
Whitley .. 230A 250A
Whitley Bridge 230A
Whitley Upper 230A
Whitlingham .. 230A
Whitmore .. 230A
Whitnash .. 250A
Whittingham .. 230A
Whittington (Lancs.) .. 230A
Whittington (Shrop.) .. 230A
Whittington (Staffs.) .. 230A
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Whittlesey .. 230A
Whittlesford .. 240A
Whitwell .. 230A
Whitwell(Herts.) 240A
Whitwell (I.O.W.) .. 240A
Whitwell (Norfolk) .. 230A
Whitwick .. 250A
Whixley .. 230A
Whytcleafe .. 230A
Wibtoft .. 250A
Wick (Caithness) 230C
Wick (Sussex) .. 230A
Wicken 230A
Wickersley .. 230A
Wickford .. 230A
Wickham (Hants.) .. 230A
Wickham Bishops .. 230A
Whickham-breaux .. 230A
Wickham Market .. 230A
Wickhampton .. 230A
Wicklewood .. 230A
Wickmere .. 230A
Wickwar .. 230A
Widford (Essex) 230A
Widford(Herts.) 240A
Widnes 250A
Wigan 230A
Wigan (Rural) .. 230A
Wigganthorpe .. 230A
Wiggenhall St. Germans .. 230A
Wigginton (Staffs.) .. 250A
Wigginton (Yorks.) .. 230A
Wigmore .. 230A
Wigston .. 250A
Wigtoft .. 230A
Wigton(Cumbs.) 230A
Wigton(Yorks.) 230A
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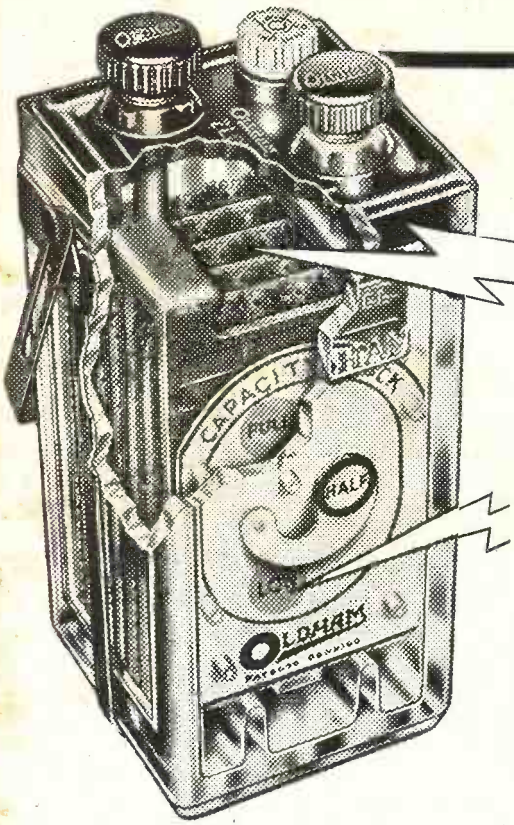
Wilberfoss .. 230A
Wilburton .. 240A
Wilby 230A
Wilden 230A
Wildhill .. 240A
Wilford 230A
Wilkieston .. 230A
Wilkins Green .. 240A
Willand .. 230A
Willenhall .. 200A 230A
Willensborough 230A
Willerby .. 230A
Willingdon .. 200A
Willington (Beds.) .. 210A
Willington (Chcs.) .. 230A
Williton .. 230A
Willoughbridge Wells .. 230A
Willoughby .. 230A
Willoughby Waterless .. 250A
Willsbridge .. 230A
Wilmington (Kent) .. 230A
Wilmington (Sussex) .. 230A
Wilmslow .. 230A
Wilnecote (Staffs.) .. 250A
Wilnecote (Warwicks.) 250A
Wilpshire .. 230A
Wilsden .. 230A
Wilstead .. 230A
Wimblington .. 240A
Wimbolds Trafford .. 250A
Wimborne .. 230A
Wincham .. 220A
Winchburgh .. 250A
Winchelsea .. 230A
Winchelsea Beach .. 230A
Windle 230A
Windlesham .. 220C
Windlesham Village .. 240A
Windygates .. 250A
Winford .. 230A
Winfrith Newburgh .. 230A
Wing (Beds.) .. 240A
Wing (Lincs.) .. 230A
Wingfield .. 230A
Wingham .. 230A
Winkfield .. 240A
Winkfield Row 240A
Winnersh .. 230A
Winnington .. 220A 220C
Winscombe .. 230A
Winsford .. 220A
Winsham .. 230A
Winskill .. 230A
Winsley .. 230A
Winslow .. 230A
Winstanley .. 230A
Winterbourne .. 210A
Winterton .. 230A
Winwich-with-Hulme .. 250A
Wirral 230A
Wiseton .. 230A
Wishanger .. 230A
Wishaw .. 230A
Wishaw (Lanark) .. 250A 240C
Wishaw (Warwicks.) .. 230A
Wisley 200A
Wissendene .. 230A
Wiswell .. 230A
Witham .. 230A
Witheridge .. 230C
Witherley .. 250A
Withernick .. 230A
Withernsea .. 230A
Withington .. 230A
Withnell .. 230A
Withybrook .. 250A
Withyham .. 230A
Wittering .. 230A
Wittersham .. 230A
Wittlestone .. 230A
Witton 230A
Wiveliscombe .. 230A
Wivelsfield .. 230A
Wivenhoe .. 230A
Wix 230A
Woburn .. 240A
Woburn Sands .. 230A
Woking .. 200A
Woking (West End) .. 240A
Wokingham .. 250A
Woldingham .. 230A
Wollaston .. 230A
Wollescote .. 200A
Wolstanton .. 240A
Wolston .. 250A
Wolterton .. 230A
Wolvercote .. 230A
Wolverton .. 250A
Wolvey .. 250A
Wombourn .. 200A
Wombwell .. 230A
Wonersh .. 230A
Wooburn .. 230A
Wooburn Green 230A
Woodall .. 230A
Woodbank (Chcs.) .. 230A
Woodbastwich 230A
Woodbury .. 230A
Woodchester .. 230A
Woodchurch .. 230A
Wood Dalling .. 230A
Wood End .. 250A
Woodford (Chcs.) .. 230A
Woodford (Essex) .. 230A
Woodford (Northants.) 210A
Woodford Halse 230A
Woodford Side 230A
Wood Green .. 240A 240C
Woodhall Spa .. 230A
Woodham Ferrers .. 230A
Woodham Mortimer .. 230A
Woodham Walter 230A
Woodhouse .. 250A
Woodhouses .. 240A
Woodkirk .. 230A
Woodlands Park 240A
Woodlands Terrace .. 230A
Woodlesford .. 230A
Woodley (Berks.) 230A
Woodley (Ches.) 230A
Woodmancote (Glos.) .. 210A
Woodmancote (Sussex) .. 230A
Woodmansey .. 230A
Woodmansterne 230A
Wood Newton 230A
Wood Norton .. 230A
Wood Plumpton 230A
Wood Rising .. 230A
Woodseaves .. 230A
Woodside .. 240A 250A
Woodston .. 230A
Wood Street (Surrey) .. 230A
Woodthorpe (Derby) .. 250A
Woodthorpe (Leic.) .. 230A
Woodton .. 230A
Woodville .. 230A
Wookey .. 230A
Woolacombe .. 230A
Woolley .. 230A
Woolmer Green 230A
Woolsthorpe .. 230A
Woolston .. 230A
Woolston with Martinscroft .. 250A
Woore 230A
Wootton .. 230A
Wootton (Beds.) 230A
Wootton (I.O.W.) .. 240A
Wootton Courtney .. 230A
Wootton St. Mary Without 230A
Wootton under Edge .. 230A
Wootton Underwood .. 230A
Wootton Mill .. 230A
Wootton Wawen 250A
Wordsley .. 200A
Worle 230A
Worlingham .. 230A
Worlington .. 220C
Wormingford .. 230A
Wormit .. 250A
Wormley .. 240A
Worplesdon .. 230A
Worsborough .. 230A
Worsley .. 230A
Worstead .. 230A
Worston .. 230A
Worth 230A
Worthing (Sussex) .. 230C 230A
Worthing (Norfolk) .. 230A
Worthington .. 250A
Worting .. 230A
Wortley (Yorks.) 230A
Worton 230A
Wothorpe .. 230A
Wotton 230A
Wouldham .. 230A
Wrabness .. 230A
Wrafton .. 220A 220C
Wrangle .. 230A
Wraxall .. 230A
Wray 230A
Wraysbury .. 230A 200A
Wrayton .. 230A
Wrea Green .. 230A
Wrecclesham .. 230A
Wrenthorpe .. 230A
Wrexham .. 230A 230C
Wrightington .. 230A
Wrington .. 230A
Writhlington .. 230A
Writtle .. 230A
Wrotham .. 230A
Wrotham Heath 230A
Wrottesley .. 230A
Wroxall .. 240A
Wroxham .. 230A
Wyberton .. 240A
Wychnor .. 230A
Wye 230A
Wykeham .. 230A
Wyllie 230A
Wymeswold .. 250A
Wymondham .. 230A
Wytham .. 230A
Wyton 240A 230A
Yalding .. 230A
Yapton .. 230A
Yardley Gobion 230A
Yardley Hastings 230A
Yarmouth (I.O.W.) .. 240A
Yarnfield .. 230A
Yate 230A
Yateley 250A
Yatton 230A
Yaverland .. 240A
Yaxham .. 230A
Yaxley .. 230A
Yeadon 230A
Yealand Conyers 230A
Yealand Redmayne .. 230A
Yealmpton .. 230A
Yelvertoft .. 230A
Yelverton .. 230A
Yeovil Without 230A
Yetminster .. 230A
Yiewsley .. 200A
Ynishir .. 230A
Ynismeudw .. 230A
Ynysawdre .. 230A
Ynyslas .. 230C
Ynysybwl .. 230A
Yoker 240A
Youlton .. 230A
Yoxall 230A
Ystalyfera .. 230A
Ystradgynlais .. 220C
Ystrad Mynach 230A
Ystradowen .. 230A



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