THE BROADCASTER TRADE ANNUAL 1936

The Broadcaster
RADIO & GRAMOPHONE
TRADE ANNUAL
1936

Right in Front!

EKCO

CLEAR-CUT REALITY RADIO

Exide AND Drydex BATTERIES

5/- NET.

Model 704.—AUTO RADIO GRAMOPHONE

There is both satisfaction and profit in selling an R.G.D. Radio Gramophone. In the first place you sell an instrument of the highest repute, acknowledged to be the finest of its type, and, in the second place—important from your point of view—you reap a very generous profit on the transaction.

The R.G.D. range is very comprehensive, embracing as it does a radio console and Five radio gramophones. In each model will be found refinements not usually associated with commercial receivers, and a standard of performance definitely in advance of all other types.

Make 1936 an R.G.D. year. Display and demonstrate R.G.D., and by so doing increase your prestige—and profits.

R·G·D

PERFORMANCE SETS A NEW STANDARD

RADIO GRAMOPHONE DEVELOPMENT Co., Ltd.
18-20, Frederick Street, Birmingham 1.

London: 40, Doughty St., W.C.1
Manchester: 17, Bridge Street.

"The

c2

THE ROLLS ROYCE OF RADIO

Model 1203.—ALL-WAVE AUTO RADIO GRAMOPHONE

Model 1202. 12 Valve Auto Radio Gramophone - - **107 Gns.**

Model 1202. Non Auto - **100 Gns.**

Model 1203. 13 Valve All-Wave Auto Radio Gramophone **120 Gns.**

Model 1204. 12 Valve Auto Radio Gramophone - - **83 Gns.**

Model 1204. Non Auto - **76 Gns.**

Model 704c. 7 Valve Radio Console **38 Gns.**

Model 704. Auto Radio Gramophone - - - **55 Gns.**

Model 704. Non Auto - **48 Gns.**

Model 705. 8 Valve All-Wave Auto Radio Gramophone - **83 Gns.**

Model 705. Non Auto - **76 Gns.**

Model 704C

Aristocrats of the Radio World"

Licensed under Br. Pat. 325833 (Paraphase).

Holdens

RADIOMETERS

"ALLVALVE" TESTER

With this instrument it is possible to check for emission and slope practically every well-known make and type of valve, including the side-pin variety favoured by certain valve makers, and those of American pattern. Mains and battery-operated valves ranging from four to nine pin types can be tested with equal facility. Provision is also made for class B and Q.P.P. valves, and single and duo diodes, full and half-wave rectifiers falling within the latter category.

Thirty-six valve holders are accommodated on the sloping front panel, this arrangement reducing the necessity for switching to an absolute minimum.

IMPORTANT TO SERVICE MEN

The above instrument was designed in a Service Department to meet the definite requirements of Service Men.

TYPE U.V.T.

8 GNS.
NETT TRADE

or supplied on Deferred Terms.

Obtainable through your Factors, or direct from Radiometers, Ltd.

We Specialise in Service Work for Trade only.
All enquiries regarding servicing should be sent to ROBSON'S TRADE RADIO SERVICE. Address as below.

RADIOMETERS LIMITED

DUNBAR WORKS, DUNBAR STREET, LONDON, S.E.27

Telephone: STReatham 2241.

Are you using the BEST for

BRASS & N.P. TURNED SCREWS, NUTS, WASHERS, TERMINALS, PLUGS, SOCKETS, SCREWED BRASS STUDDINGS.

WANDER PLUGS, INSULATED PLUGS & SOCKETS, INSULATED TERMINALS, INSULATED SPADE & PIN TERMINALS, MIDGET WANDER PLUGS & SOCKETS.

CROCODILE CLIPS, CONE WASHERS & EXTENSIONS, STANDARD STAMPED PARTS (Spades, Pins, Soldering Tags, etc.), LEAD-IN TUBES, PUSH-PULL SWITCHES.

Entirely British made *at our London works.* Large stocks, competitive prices, prompt delivery. Guaranteed accuracy and finish.

Turned special parts to sample or sketch

Get a quotation from **E. J. FRANCOIS**

89 CLERKENWELL ROAD, LONDON, E.C.1

Telephone: HOLBORN 6055 *Telegrams:* "NOSAMFRAN, SMITH, LONDON"

DRY BATTERIES
of outstanding Merit

Batteries made up with round and square cells at a popular price.

STERLING BATTERIES LTD.

WHY YOU GET MORE ELECTRICAL ENERGY WITH A STERLING "SQUARE-CEL" H.T. BATTERY.

1. Because you get more active material.
2. Because no space is wasted between the cells.
3. Because "Square-Cel" Batteries have large zinc cans and a larger amount of depolariser than any other battery of the same size.

They are the only super-capacity batteries having standard dimensions.

STERLING WORKS, DAGENHAM, ESSEX
Telephone : Seven Kings 3466/9.

SOMETHING TO SELL?

A small advertisement under Trade Bargains For Sale in the Classified Advertisement Section of "The Broadcaster and Wireless Retailer" will dispose of it quickly and cheaply.

Rates and full particulars of other headings on application to:
The Advertisement Manager, 29, Bedford St., Strand, London, W.C.2

TANNOY "Sound Equipment"

TANNOY PRODUCTS (Guy R. Fountain, Ltd.), Canterbury Grove, West Norwood, London, S.E.27

Quick Servicing! QUICK SALES!

Get these instruments on your counter . . . show them "in action" . . . let your customers see the sclentifically accurate testing facilities they afford . . . THEN leave them to sell themselves. Where they are seen they are sold . . . quickly and easily. In addition to the profit from sales, *you* get–in your servicing–the invaluable advantage of *truthful* meter readings. No dealer can afford to be without at least one AvoMinor in stock.

The D.C. AVOMINOR

REGD. TRADE MARK

13 PRECISION METERS IN ONE

Radio's triumphant little helpmate. It provides *accurate testing* for everyone. The thousands sold prove its tremendous success. The D.C. AvoMinor makes testing easy and accurate. It tracks every defect—traces the most baffling fault. Thirteen precision meters are combined in one. Circuits, valves, components, batteries and power units can all be tested quickly with ease. Every dealer needs at least one D.C. AvoMinor in stock for use and for sales. Display material free. *Send for descriptive folder.*

RETAIL **40/-**

MILLIAMPS
- 0-6 milliamps
- 0-30 ,,
- 0-120 ,,

VOLTS
- 0-6 volts 0-12 volts
- 0-120,, 0-240 ,,
- 0-300 ,, 0-600 ,,

OHMS
- 0-10,000 ohms
- 0-60,000 ,,
- 0-1,200,000 ohms
- 0-3 megohms

BRITISH MADE

The UNIVERSAL AVOMINOR

REGD. TRADE MARK

A.C. AND D.C. TESTS

22 METERS IN ONE

This ingenious instrument has met with a reception that testifies to its usefulness and to its fulfilment of a long-felt need. It gives 22 different ranges of readings (A.C. and D.C.). Has 3-in. scale. Total resistance 200,000 ohms. Complete with instruction book, leads, and interchangeable testing prods and crocodile clips.

(*Deferred Terms if desired.*)

RETAIL **£5**

Leather Case 10/-

THE AUTOMATIC COIL WINDER AND ELECTRIC EQUIPMENT CO. LTD.,
Winder House, Douglas Street, London, S.W.1. *Phone: Victoria 3404-7.*

CELESTION

The Very Soul of Music

LOUDSPEAKERS

Celestion Chassis models are specially designed to meet the individual requirements of set manufacturers. Specifications are rigidly adhered to and no effort is spared to obtain absolute uniformity and reliability.

•

The Foremost Name in Sound Reproduction.

•

Head Office & Works:

CELESTION LIMITED, KINGSTON-ON-THAMES.

The Trade Paper that makes Trade

CAN a newspaper actually increase your business? Yes, as thousands of "Broadcaster" subscribers already know to their profit. "The Broadcaster" is more than a newspaper. It is an unfailing source not only of essential and timely trade reports, but of ideas that are full of business possibilities. It tells you what the rest of the radio world is doing and gives you, through its interesting pages, the results of the latest research in construction and marketing.

It does even more than that. "The Broadcaster" maintains for the sole benefit of its readers a comprehensive Service Bureau of acknowledged experts, who will gladly advise you, without fee, in all your advertising, technical, sales and servicing problems. Such a service is unique in the industry; it provides endless scope for individual business improvements.

The annual subscription to "The Broadcaster" is 10/6. This small sum procures you 52 weekly issues of the leading radio trade newspaper, and the full free use of its magnificent Service Bureau. An additional 2/6 brings you the "Service Engineer," a valuable monthly supplement to "The Broadcaster" which gives an analysis of the latest sets in the most minute detail.

SUBSCRIPTION 10/6 PER ANNUM

The Broadcaster
& WIRELESS RETAILER
29, Bedford Street, Strand, London, W.C.2.
Telephone: Temple Bar 2468.

POLAR and N.S.F. for the SET MANUFACTURER

RELIABILITY begets confidence—and confidence is the keystone upon which leadership is built. Polar and N.S.F. rightly enjoy leadership in their respective spheres. Because of their unquestioned reliability—the result of many years of experience and intensive research—Polar Condensers and Drives, N.S.F. Resistors, Volume Controls, Tubular Condensers, etc., are the invariable choice of the leading commercial set manufacturers. Polar and N.S.F. reliability have won their confidence.

•

Whatever your particular requirements—use Polar and N.S.F. with confidence.

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WINGROVE & ROGERS LTD.
188 & 189, Strand, London, W.C.2
Phone: TEMple Bar 2244. Works: Old Swan, Liverpool

CA 2786

A COMPLETE RANGE FROM WHICH TO CHOOSE

There's a Westinghouse Battery Charger to meet YOUR needs. One that will do its job without worry and with the minimum of expense. No rectifier renewals or replacements. Efficient service day *and* night without attention. Batteries charged at the correct rate specified by the makers, which means a satisfied clientele and a steady profit.

Write to Dept. "BA" for booklet "AT THE CORRECT RATE."

WESTINGHOUSE

BATTERY CHARGERS

WESTINGHOUSE BRAKE & SIGNAL CO. LTD.,
82, York Road, King's Cross, London, N.1.

The Broadcaster

RADIO AND GRAMOPHONE TRADE ANNUAL

1936

FIFTH EDITION

PRICE Post Free **5s.**

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

CALENDAR for 1935

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

	JULY.	AUGUST.	SEPTEMBER.	OCTOBER.	NOVEMBER.	DECEMBER.
Sun.	. 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
Mon.	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
Tues.	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
Wed.	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 . .
Thurs.	4 11 18 25 . .	1 8 15 22 29	5 12 19 26 . .	3 10 17 24 31	. 7 14 21 28	5 12 19 26 . .
Fri.	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 . .
Sat.	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 . .

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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 . .

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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
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Sat.	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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THE BRITISH BROADCASTING CORPORATION YEAR

The most important event in British broadcasting recently was the introduction of the Droitwich National transmitter.

At about the same time, a new London studio centre came into operation at Maida Vale, where a large orchestral studio, capable of accommodating the full B.B.C. Symphony Orchestra, has been built inside premises which were originally used as a roller skating rink. The building also houses the whole of the sound-recording section, a complete control room, and a number of listening rooms and other auxiliary rooms, and four further studios.

The broadcasting of topical events which occur at times unsuitable for broadcasting or in places where land-lines are not available, has been facilitated by the introduction of Mobile Sound Recording Vans which enable sound pictures to be recorded at practically any site.

The next important change was the introduction of the new Midland Regional transmitter at Droitwich, which was accompanied by a re-arrangement of wavelengths among the Midland and other transmitters and the synchronisation on one wavelength of the three medium-wave National-programme transmitters in England.

These changes were made in order to make the general scheme of distribution more equitable, and have been fully justified by the results obtained in practice. The full advantages of the changes will not, however, be obtained until the new high-power stations in Northern Ireland and the North-East of England are in operation. The construction of the former at Lisburn, near Belfast, is well advanced. The Newcastle studio premises have been re-equipped and the studios modernised.

In Glasgow the premises of Queen Margaret College have been purchased for conversion into a studio centre, while in the North of Scotland work is proceeding on the new high-power station at Burghead. In North Wales a studio centre has been equipped at Bangor.

The development of the Empire Service has continued, and a number of new short-wave aerials, giving improved service in distant parts of the Empire, have been erected as a result of experiments conducted at Daventry. A decision to build two new high-power short-wave transmitters at Daventry, in order to extend the present service, has been announced.

Following the recommendation of the Television Committee, appointed by the Postmaster-General, it has been decided to use a part of the Alexandra Palace for a High-Definition Television Station to serve London, and work on the station is well in hand.

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 at intervals throughout the whole 24 hours, the times varying according to the time of year.

B.B.C. ADDRESSES.

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

Headquarters.

Head Office and National and London Regional Studios	Broadcasting House, London, W.1. Telegrams : Broadcasts, London. Phone : Welbeck 4468

Regional Centres.

Midland Region	282–5 Broad Street, Birmingham.
Welsh Region ...	38 to 40, Park Place, Cardiff.
North Region ...	Broadcasting House, Piccadilly, Manchester.
Scottish Region	5 and 6, Queen Street, Edinburgh.
N. Ireland Regn.	31, Linenhall Street, Belfast.
W. Eng. Region	21–23, Whiteladies Road.

Other B.B.C. Offices.

Aberdeen ...	15, Belmont Street.
Bournemouth ...	72, Holdenhurst Road.
Glasgow ...	268, West George Street.
Leeds	Broadcasting House, Albrecht's Buildings, Woodhouse Lane.
Newcastle ...	54, New Bridge Street.
Plymouth ...	Athenæum Chambers, Athenæum Lane.
Swansea ...	Oxford Buildings, Oxford Street.
Bangor ...	Broadcasting House, Meirion Road.

THE RADIO MANUFACTURERS' ASSOCIATION

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Belling Lee, Ltd., A. F. Bulgin & Co., Ltd., Climax Radio Electric, 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., Kolster-Brandes, Ltd., McMichael Radio, Ltd., Marconiphone Co., Ltd., Mullard Radio Valve Co., Ltd., Pye Radio, Ltd., Radio Gramophone Development Co., Ltd., Radio Instruments, Ltd., Ultra Electric Ltd., Westinghouse Brake & Signal Co., Ltd., Wingrove & Rogers, Ltd.

Director and Secretary :

D. Grant Strachan, Astor House, Aldwych, London, W.C.2 (Holborn 3346–7).

The membership of the Radio Manufacturers' Association at the end of December, 1935, was 108.

During the year the Association continued its policy in regard to Exhibitions as in the previous two years. Shows arranged by the Association were as follows :—

(*a*) The National Radio Exhibition, Olympia, August 14 to 24, 1935.

(*b*) The Scottish Radio Exhibition, Kelvin Hall, Glasgow, August 30 to September 7.

(*c*) The Northern National Radio Exhibition, City Hall, Manchester, September 20 to 28 (in co-operation with Provincial Exhibitions, Ltd.).

The period of the National Radio Exhibition, this year, was extended from nine days to 10, the total paid attendance amounting to 192,202.

The Broadcasting Theatre was continued on the same lines as at the 1934 Exhibition, and, with the co-operation of the B.B.C., three variety performances were given each day, a number of the shows being broadcast by the B.B.C. from one or other of their transmitting stations.

A new feature at Radiolympia was the inclusion of a Radio Interference Bureau in the organisation of which the Post Office, the British Electrical and Allied Industries Research Association and the B.B.C. co-operated with the R.M.A. This Bureau was used for the purpose of explaining to visitors the causes of electrical interference with broadcasting and the means which should be adopted to overcome it.

At the Scottish Exhibition, the Broadcasting Theatre was replaced by a free dance hall with music by Chalmers Wood and his band, and Marius B. Winter's band. The Post Office and the B.B.C. co-operated in the Scottish Exhibition in the same way as they had done at Radiolympia.

The Association has had under consideration during the year the development of the television broadcast service, and, in this connection, in the spring of the year, conferences were arranged throughout the country between representatives of the Association and the editors of the London daily and provincial newspapers.

At these Conferences, the R.M.A. gave the editors authoritative information in regard to the proposed television service, and so was instrumental in allaying, to a very considerable extent, rumours which had been current concerning the speedy initiation of a television service to the detriment of the Radio Industry as a whole.

Copies of the statement were mailed to editors of all newspapers throughout the country with whom it was not possible to get into touch at the said conferences.

The dissemination of authoritative information on the television situation was carried a stage further by the preparation and issue to dealers of a pamphlet, entitled, "Television : Answers to your Customers' Queries."

The aim of this pamphlet, as indicated by its title, was to inform the dealer of the position in such a manner as to permit him to answer, readily, queries which might be put to him by his clients and so prevent the growth of the impression, at one time current, that television would, in the comparatively near future, supersede the present broadcasting service.

The Association has, throughout the year, been in touch with the proposed Television Broadcasting Authorities with a view to obtaining technical information for the assistance of members in the development and production of television receivers.

The experiment made by the Association in 1934 in the training of radio engineers was followed, after consultation with representatives of the Board of Education, by a wider scheme embracing the country as a whole. It provided for the institution of a three-year course of training in radio technology of such a character as to permit the award of a National Certificate to successful students.

This theoretical course was supplemented by an offer by the Association to place in manufacturers' works for a period of six months' practical training selected students who had successfully completed the theoretical course—an adequate maintenance allowance being guaranteed during the six months training period.

The problem of electrical interference with broadcasting has continued to receive the attention of the Association. A good deal of work which has been done on this subject by the British Electrical and Allied Industries Research Association has been rendered possible through the co-operation of the R.M.A., B.B.C., and the Post Office.

In connection with the King's Silver Jubilee, the Association organised a Window Dressing Competition for dealers in an endeavour to utilise the special Jubilee Broadcasts as a means of increasing radio sales at a normally quiet period of the year.

When the Government appointed a Commission to enquire into the matter of the termination of the B.B.C. Charter in 1936, the Association accepted an invitation to give evidence as to the views of the industry concerning the system of broadcasting to be followed thereafter.

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

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.

Associates—

Cryselco, Ltd.
Siemens Electric Lamps and Supplies, Ltd.

Chairman :—J. H. Thomas.

Director :—H. Howitt.

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, and state that agreement holders may have no dealings of any kind with any make of valves unless authorised in writing by the Association. *This regulation applies to valves whether sold in sets or separately.*

These also cover 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. The terms to retailers are 25 per cent. off English list prices.

Terms to Retail Agreement-holders.—A special bonus of 10 per cent. on the nett invoice value of valves purchased is paid direct by the Association in cash to retail agreement-holders subject to observance of the agreement.

Wholesale Distribution.—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, who enter into specific obligations with 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.

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 seven "Original Subscribers" who are the manufacturers who launched the original scheme.

The Original Subscribers include :—

E. K. Cole, Ltd.
A. C. Cossor, Ltd.
Ferranti, Ltd.
General Electric Co., Ltd.
Marconiphone Co., Ltd.
Philips Lamps, Ltd.
Ultra Electric, Ltd.

The Manufacturer Subscribers include :—

Aerodyne Radio, Ltd.
A. J. Balcombe, Ltd.
Beethoven Radio, Ltd.
British Blue Spot Company, Limited.
City Accumulator Co., Ltd.
Ever Ready Radio, Ltd.
Halcyon Radio, Ltd.
Mullard Wireless Service Co., Ltd.
Ormond Engineering Co., Ltd.
Radio Gramophone Development Co., Ltd.
Radio Instruments, Ltd.
United Radio Manufacturers, Ltd. (as kit makers only).

Approximately 165 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.

BRITISH "WIRELESS FOR THE BLIND" FUND

The British "Wireless for the Blind" Fund was started on Christmas Day, 1929, 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 27,000 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.

The Fund has therefore completed its original task of supplying wireless sets to blind persons who in 1930 had not experienced the pleasure to be gained from listening-in, but the sad thing about blindness is that a large number of new cases occur every year. Moreover, the time has come when a considerable number of worn-out sets has to be replaced.

The President of the Fund is H.R.H. The Prince of Wales ; its Chairman, 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 (Museum 9701).

CO-OPERATIVE ADVERTISING CAMPAIGN

Twenty-five of the leading manufacturers of the Radio Industry supported in December, 1935, a Co-operative Advertising Scheme designed to increase Christmas trade.

A number of wholesalers also contributed.

The manufacturers who backed the scheme included :—

Beethoven Radio, Ltd.
Belling & Lee, Ltd.
A. F. Bulgin & Co., Ltd.
E. K. Cole, Ltd.
A. C. Cossor, Ltd.
Chloride Electrical Storage Co., Ltd. (Exide & Drydex Batteries).
Dubilier Condenser Co. (1925), Ltd.
Ever Ready Co. (Great Britain), Ltd.
Ferranti, Ltd.
General Electric Co., Ltd.
His Master's Voice (The Gramophone Co., Ltd.)
Kolster-Brandes, Ltd.
Marconiphone Co., Ltd.
McMichael Radio, Ltd.
Mullard Wireless Service Co., Ltd.
Philips Lamps, Ltd.
Portadyne Radio.
Pye Radio, Ltd.
Quadrant Carbon & Metal Products, Ltd.
Tannoy Products (Guy R. Fountain, Ltd.).
Telegraph Condenser Co., Ltd.
Ultra Electric, Ltd.
Varley (Oliver Pell Control, Ltd.).
Whiteley Electrical Radio Co., Ltd.
Wingrove & Rogers, Ltd., and British N.S.F. Co., Ltd.

A Working Committee was appointed to co-operate with the London Press Exchange, who handled the campaign. The following were the committee members :—

Capt. S. R. Mullard (Mullard Wireless Service Co., Ltd.), chairman ; Messrs. G. J. Freshwater (Marconiphone Co.,) H. Boon (Exide), H. J. Otten (Philips Lamps), E. A. Lever (Pye) and C. Pinkham (G.E.C.)

The campaign was launched on Wednesday, December 4, when the first advertisement appeared in the *Daily Mail*, *Daily Express*, *News Chronicle* and *Daily Herald*.

The same day 15,500 dealers in Great Britain and the Irish Free State received a statement from the Committee outlining the campaign and giving the names of the firms behind it.

Dealers were given every opportunity to tie-up with the campaign. A window bill was distributed, and four stereos of dealer advertisements, which required only the insertion of the dealer's name and address, were available, free of charge.

The window bill featured a photograph of H.M. the King at the microphone, and tied up with his Christmas Day broadcast.

Following the first advertisements in the national dailies, the next announcement was on Wednesday, December 11, and was followed by a number of small announcements the next week before the Christmas drive came to an end.

The first two weeks' advertisements added interest to the programmes by competitions in which a prize of £100 was offered for the best postcard answering the question : " What do you consider the best radio turn during the week, and why ? "

Diana Wynyard and C. B. Cochran were the judges for the competitions.

A lunch was held at which numerous well-known radio stars were present, and members of the public were invited to submit a post-card saying what favourite radio star they would like to sit next to, and give their reasons for the choice.

From the people submitting postcards a number were selected as winners to take part.

Among the stars who were present at the lunch were Henry Hall, Stanelli, Norman Long, Leslie Holmes, Anona Wynn, Elsie and Doris Waters and Mabel Constanduros.

Considerable Press publicity resulted both from the competitions and the lunch.

Support was given by the B.B.C., but the Radio Manufacturers' Association was not connected with the campaign.

A full report of the work done and the way the funds were expended was given to sub-scribers early in the New Year.

At the same time the Committee submitted a suggestion to the Radio Manufacturers' Association which proposed that future Co-operative Advertising should be carried on under R.M.A. auspices.

The lines on which future publicity should be carried out were suggested, and it was proposed that a similar Committee to that employed on the Christmas campaign should be called together to carry on the work.

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.
Chairman : Mr. A. F. Bulgin, M.I.R.E.
Vice-Chairman : Mr. E. M. Lee, B.Sc.
Treasurer : Mr. F. H. McCrea (Dubilier Condenser Co. (1925), Ltd.).
Executive Council : Bulgin & Co., Ltd. ; Belling & Lee, Ltd. ; British Blue Spot Co., Ltd. ; Dubilier Condenser Co. (1925), Ltd. ; Edison Swan Electric Co., Ltd. ; Ferranti, Ltd. ; Radio Instruments, Ltd. ; Telegraph Condenser Co., Ltd. ; Wright & Weaire, 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 conduct of 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 on matters affecting the well-being of the industry.

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 five 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.

The Federation has on several occasions been invited to appoint representatives to various committees of the British Standards Institution dealing with radio components.

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 ; C.A.C. Cabinets, Ltd. ; Carrington Manufacturing Co., Ltd. ; R. Cruickshank (Cellulose), Ltd. ; Edward Doherty & Sons ; John J. Dunster & Sons, Ltd. ; Durex Abrasives, Ltd. ; Eburite Corrugated Containers, Ltd. ; A. Ercolani & Sons, Ltd. ; Freestone Endura Co ; S. Greeman, Ltd. ; Holmes Bros. (London), Ltd. ; J.B. Manufacturing Co. (Cabinets), Ltd. ; W. & T. Lock Ltd. ; John Lovegrove & Co. ; Macfarlane, Burchell & Co. ; Nobel Chemical Finishes, 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.

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 1935–36 are as follows:—

President: A. G. Beaver (Sun Electrical Co., Ltd.).
Vice-President: C. H. G. Hobday (Hobday Brothers, Ltd.).
Hon. Treasurer: A. J. Dew (A. J. Dew & Co., Ltd.).
Secretary: J. Macfarlane.

Council:

B. R. Banks ...	Brown Brothers, Ltd.
T. Beadle	T. Beadle & Co., Ltd.
E. H. Burris ...	Fred. Burris & Sons, Ltd.
E. J. Collier ...	East London Rubber Co., Ltd.
E. W. Houghton ...	Ensign, Ltd.
J. W. Riddiough ...	Frank Riddiough & Son.
J. Robertson ...	James Robertson.
E. Smith	Midland Auto Components.
W. E. Collins ...	The Albion Electric Stores.
G. G. Kent ...	The Johnson Talking Machine Co., Ltd.
R. G. Willis ...	Dulcetto - Polyphon, Ltd.

Section Officials:

North Midland Section—
Chairman: H. C. Needham (C. E. Needham & Brother, Ltd.).
Vice-Chairman: G. P. Fearnside (Ellis & Mort, Ltd.).
Hon. Secretary: W. J. Smith (Sloan Electrical Co., Ltd.).

Midlands Section—
Chairman: J. H. Hale (Hobday Brothers, Ltd.).
Vice-Chairman: G. A. Litchfield (Nottingham Radio Supplies, Ltd.).
Hon. Secretary: W. Balmford (Walter Balmford, Ltd.).

Scottish Section—
Chairman: J. Whiteford (James Whiteford & Co.).
Vice-Chairman: R. Marriott (Dulcetto-Polyphon, Ltd.).
Hon. Secretary: W. M. Howitt (Cuthbertson & Co., Ltd.).

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

London and South Eastern Section—
Chairman: A. A. Byne (L. E. S. Distributors, Ltd.).
Vice-Chairman: J. Diamond (Thompson, Diamond & Butcher).
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 seven 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.

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 :—

Acting Chairman : Mr. N. J. Gibson.

Hon. Secretary : Mr. H. W. King, Leysian Buildings, 114, City Road, London, E.C.1 (Clerkenwell 9800).

Council : Messrs. N. J. Gibson, W. Merrington, T. D. Baker, H. W. King, L. Ridgway, Howard Morgan, G. Palmer, W. L. Cornish, J. W. Ralph, K. H. Spanner, A. R. Twiss, and M. Levitt.

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

Employment Bureau and Examinations.—Harold W. King, 34, Bush Elms Road, Romford, Essex.

Publicity.—H. W. King and N. J. Gibson.

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.

Lectures and Meetings.—Howard Morgan, 172, Garrett Lane, S.W.18 ; and

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

General Correspondence will be handled by the central office at 114, City Road, E.C.1.

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

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 the English Clock and Watch Manufacturers, Ltd., 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, when necessary.

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, 56, Howland Street, London, W.1.

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

WIRELESS RETAILERS' ASSOCIATION

OF GREAT BRITAIN AND NORTHERN IRELAND

Vice-Presidents : A. E. Betambeau (London) ; and H. A. J. Shearman Dyer (London).
Chairman : J. Fielding (Brighton).
Vice-Chairman : Walter Upton (Middlesbrough).
Hon. Treasurer : J. Lightfoot (London).
General Secretary : Capt. H. A. Bain, 316/318, First Avenue House, High Holborn, London, W.C.1 (Holborn 1391).

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 one and a half guineas per annum.

The Association has now 107 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.—P. L. Harrison (Lincoln). 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.—D. Howorth (Rochdale). W. Bannister, 27b, Milnrow Road, Rochdale.

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

SOUTH MIDLANDS.—R. J. Stearn (Luton). A. W. Chattell, The Bridge, Bedford.

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

WESTERN.—C. H. Phillips (Cardiff). H. J. Fletcher, 218, Whitchurch Road, Cathays, Cardiff.

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, Great Yarmouth.

EAST MIDLANDS AREA.—Dearne Valley, Lincoln, Nottingham, Retford, Chesterfield, Grimsby, Doncaster, Sheffield, Rotherham, Barnsley, Peterborough.

LONDON AND HOME COUNTIES.—Beckenham, Croydon, South London, East London, North London, North West London, Harrow, Watford, West Middlesex, Southend-on-Sea.

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

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

SOUTHERN AREA.—Aldershot, Brighton, Southampton, Canterbury, Chatham, Tunbridge Wells, Eastbourne.

SOUTH MIDLANDS AREA.—North Bucks, South Bucks, Mid. Bucks, Oxford, Reading, Bedford, Luton, Swindon.

SOUTH WESTERN AREA.—Bath, Bristol, Chippenham, Exeter, Exmouth, Plymouth, Taunton, Torbay, Weston-Super-Mare.

WESTERN AREA.—Cardiff, Newport, Pontypridd, Swansea, Gloucester, Llanelly.

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

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. D. S. Bilantz (Itonia, Ltd.) ; *Vice-President*, Mr. E. R. Lewis (Decca Record 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 RADIO RETAILERS' ASSOCIATION

President : Mr. F. R. Forbes.

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).

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

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.

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.

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.

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 at least one year's standing in the Association.

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. William Fleming, and the *hon. secretary* is Mr. Ralph S. Neilson, 53, Chichester Street, Belfast (Phone : 27196).

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 25, and is to include Nelson dealers. 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.

It has a system for the inter-exchange each week between members of information regarding bad or doubtful H.P. customers which has proved of great value.

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*, Mr. H. H. Spicer; *Hon. Secretary*, Mr. G. H. Parsons, 201, Broad Lane, Coventry (office, 7, Warwick Row); *Hon. Treasurer*, Mr. H. J. Cleaver; *Committee*, Mrs. Mackereth, Messrs. M. G. Dent, C. Payne, H. Payne, J. Fennell, H. Crane, F. W. Nicholls, L. Parker, and W. Johnson.

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: Mr. A. E. Woods, Chairman; Mr. L. Apsey, Vice-Chairman; Mr. Clifford Lister, Treasurer; and Mr. L. C. Latch, Secretary.

A. E. Woods is the National Chairman of the Music Trade Association; L. Apsey is National Chairman of the Cycle Association.

A strong committee, representative of districts, was formed, and general meetings have since been held in the New Southampton Town Hall.

The area covered by the Association includes Salisbury, Andover, Amesbury, Portsmouth, Bournemouth, Isle of Wight, Totton, Lyndhurst, Lymington, Bishops 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 six meetings annually are usually held, and various social functions, including lectures by manufacturers' representatives, have taken place. At the meetings members discuss technical and other matters of interest to radio retailers generally and obtain information from one another which is of value in the technical sides of their businesses.

Membership comprises 33 firms. The entrance fee is 10s. 6d. and the annual subscription also 10s. 6d.

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.

The Association developed from the old North London branch of the Wireless Retailers' Association.

REIGATE

The Borough of Reigate Radio Association is an organisation to further and protect the interests of local dealers who have, in the opinion of the Committee, suitable premises and showrooms.

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 114–5).

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.

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 750.

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.

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

Ordinary members of Committee are. Sir Noel Ashbridge; Mr. H. Bishop, B.Sc: (Eng.); Mr. S. Brydon, D.Sc.; Mr. W. T. Ditcham; Mr. N. F. S. Hecht; Mr. J. Joseph; Mr. A. H. Mumford, B.Sc. (Eng.); Dr. W. F. Rawlinson; Mr. R. L. Smith-Rose, Ph.D., D.Sc; Mr. Frederick 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. J. M. Kennedy (President); the Chairman, I.E.E. Papers Committee; and a representative of I.E.E. Council.

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.2. (Euston 1629.)

MUSIC 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 six guineas for the largest.

Applications should be addressed to Frank Ayliffe, Secretary, 17, Wigmore Street, London, W.1.

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.

Chairman:	J. J. Denton, A.M.I.E.E.
Vice-Chairman:	A. T. K. Moir, A.M.I.E.E.
Secretary:	A. R. Twiss, M.I.R.E., 85, Gloucester Place, Portman Square, London, W.1. (Welbeck 8402).
Council:	J. J. Denton, A.M.I.E.E.
	A. T. K. Moir, A.M.I.E.E.
	A. R. Twiss, M.I.R.E.
	D. A. Bell.
	C. W. H. Ashwin.
	Caradoc Williams.
	T. W. E. Towers.
	H. Moyse Bartlett.
	M. W. G. Russell, M.I.R.E.
	H. V. Fowler-Wallis.
Solicitors:	D. Edgar Rodwell & Co., 4, Half Moon Street, London, W.1.

I.E.E. INTERFERENCE COMMITTEE

The I.E.E. Radio Interference Committee was set up for the purpose of considering and making recommendations on the question of interference with broadcasting arising from the operation of other electrical plant.

A number of Sub-Committees, dealing with the various classes of disturbing plant, are in existence. One of these has been engaged, with the co-operation of the British Standards Institution, in preparing a Specification for Components for Radio-Interference Suppression Devices. This has now been published as B.S.S. No. 613, 1935.

Further Specifications, dealing with other aspects of the subject, will be prepared in due course when international agreement has been reached in regard to the degree of suppression required, methods of measurement to be employed, etc.

The International Electrotechnical Commission recently set up a Special Committee to deal with the question of international action in regard to electrical equipment embodying suppression devices, and the I.E.E. Committee were invited, and agreed, to act for the British National Committee of the I.E.C. in this matter.

The Committee.

The membership of the Committee is now as follows :—

Mr. J. M. Kennedy, O.B.E., President, I.E.E. (ex-officio).

Mr. Clifford C. Paterson, O.B.E. (Chairman) ; Lieut.-Col. A. G. Lee, O.B.E., M.C. (Vice-Chairman) ; and Messrs. F. W. Purse and L. B. Turner, M.A., representing the I.E.E. Council.

Col. A. S. Angwin, D.S.O., M.C., B.Sc. (Eng.) (General Post Office).

Mr. E. A. Barker, M.C. (Incorporated Municipal Electrical Association).

Mr. A. H. Bennett (British Electrical and Allied Industries Research Association).

Mr. A. T. Priddle (Society of Motor Manufacturers and Traders).

Mr. A. F. Bound (Railway Companies' Association).

Sir Noel Ashbridge (British Broadcasting Corporation).

Mr. J. M. Donaldson, M.C. (Incorporated Association of Electric Power Companies).

Mr. H. W. Ellis (Electrical Contractors' Association).

Mr. A. E. Betambeau (Wireless Retailers' Association of Great Britain and Northern Ireland).

Mr. P. Good (International Electrotechnical Commission, British National Committee).

Mr. R. S. Downe (London Electricity Supply Association).

Mr. H. Jones (Railway Companies' Association).

Mr. J. Joseph (Radio Manufacturers' Association).

Mr. A. K. Toulmin-Smith, B.A. (Air Ministry).

Mr. J. Munro (Association of Supervising Electrical Engineers).

Mr. T. A. Pond (Provincial Electric Supply Association).

Sir Arthur Preece (Association of Consulting Engineers).

Mr. C. Rodgers, O.B.E., B.Sc., B.Eng. (British Electrical and Allied Manufacturers' Association).

Mr. P. M. Hunt (Tramways, Light Railways and Transport Association).

Mr. F. M. Colebrook, B.Sc. (National Physical Laboratory).

Mr. E. B. Wedmore (British Electrical and Allied Industries Research Association).

Mr. Johnstone Wright (Central Electricity Board).

Mr. C. O. Silvers (Municipal Tramways and Transport Association).

Mr. J. Clarricoats (Radio Society of Great Britain).

Institute of Radio Engineers

The American Institute of Radio Engineers 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 seventeen 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.

THE WIRELESS LEAGUE TRADERS' SCHEME

The Wireless League is making great progress with its scheme for the Registration of Approved Traders, of whom there are now some 400 throughout the country. Membership of the League's Register of Approved Traders is confined to those dealers who can prove they have the ability and the equipment to service receivers and who can satisfy the Committee they are otherwise suitable.

The League's lay members are recommended to patronise Approved Traders for purchases, repairs and accumulator charging, and are given a list of these dealers in their locality.

Apart, however, from the support of members, the League claims that the dealer gains the confidence of the general public, since the very fact that he is approved provides him with documentary evidence of his ability.

To assist our dealers to capitalise their appointment, the League provides :

(1) An enamelled sign to hang outside their premises.

(2) Window transparencies — miniatures of the above.

(3) Letter-heading blocks.

(4) Badges to be worn by the approved trader's technical staff only.

(5) Propaganda leaflets for distribution by approved traders.

(6) A script vellum diploma, signed by Prof. A. M. Low and other scientists and technicians.

(7) Special notepaper with the dealer's name and address printed on it.

(8) Rubber stamps of sign.

(9) Showcards.

(10) Co-operative advertising.

In addition, the retailer can profit by pointing out to customers that by patronising an approved trader the purchaser has a definite right of appeal to an unbiased body.

The annual subscription is 21s.

Committee Chairman : Prof. A. M. Low, A.C.G.I.

General Secretary : Miss I. Joss, 12, Grosvenor Crescent, London, S.W.1.

INCORPORATED 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 and has been under the patronage of H.R.H. the Prince of Wales since 1922.

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 500 such members are at present co-operating in 6 sections, each of which is studying a specific problem.

Standard frequencies are transmitted at regular intervals and these are guaranteed to be correct to within a few parts in a million.

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 third edition.

The membership of the Society as at December, 1935, was 2,590, representing an increase of over 1,300 members since 1930. Over 500 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 1936 are : *President*, Mr. Arthur E. Watts ; *Executive Vice-president*, Mr. E. Dawson Ostermeyer ; *Honorary Editor*, 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, and special papers are set for them.

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.

President: James Nelson, M.I.W.T., M.I.E.E.

Immediate Past President: William Beresford Medlam, B.Sc., M.I.W.T., A.M.I.E.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 C. Garrard, Ph.D., M.I.W.T., M.I.E.E.; Y. W. P. Evans, M.I.W.T.; and E. H. Turle, M.I.W.T., M.I.E.E., A.M.I.Mech.E.

Honorary Treasurer: B. Tunbridge Hogben, A.M.I.W.T., A.C.C.S.

Council: 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.; Sydney Hurren, M.C., A.M.I.W.T.; H. A. G. Howse, M.I.W.T., A.M.I.E.E.; George Lea, M.I.W.T.; Leslie H. Paddle, M.I.W.T., A.M.I.E.E.; 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.

Students.

Membership of the Institute of Wireless Technology Students' Society is confined solely to Student Members of the Institute. A number of special concessions are available to members, including reduced examination fees.

Student Members are not required to pay any additional subscription.

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.

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. G. Young (Radio Central Exchanges, Ltd.) as its Chairman: H. Noble (Selective Radio Relay Co., Ltd., Bradford), Deputy Chairman; and C. Sharp (Nottingham Rediffusion Services, Ltd.), Hon. Treasurer.

The Council includes Messrs. D. G. Ball; R. Blood; H. Boocock; H. J. Boon; W. A. Brown; W. Darwen; A. J. Davis; L. J. Donovan; R. R. Goding; B. H. Lyon; 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. W. C. Robinson, E. Wyatt 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.

The Association replaces one which was formed three years ago to protect relay operators. It was felt desirable to reform the old Association on broader lines that could be fully representative of the Industry.

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.)

THE TELEVISION SOCIETY

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

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

The Society organised in 1933 its fourth exhibition of television and other photo-electric apparatus, at the Imperial College of Science, London, and 3,000 people attended.

The Socicty 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.; G. P. Barnard, Esq., B.Sc., Grad.I.E.E.; R. W. Corkling, Esq., F.P.S.; J. J. Denton, Esq.; H. M. Dowsett, Esq., M.I.E.E., M.I.R.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.; L. McMichael, Esq., M.I.E.E.; W. G. W. Mitchell, Esq., B.Sc.; G. Parr, Esq.; R. R. Poole, Esq., B.Sc.; J. C. Rennie, Esq., B.Sc., M.I.E.E.; E. Phillips, Esq.; 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. Business and Membership Secretary: J. J. Denton, Esq., 25, Lisburne Road, Hampstead, London, N.W.3.

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

THE TRADE'S LUNCHEON CLUBS

LEEDS

The headquarters of the Leeds Radio Trades Luncheon Club are the Hotel Metropole, King Street, Leeds, 1. The Club meets the first Thursday of the month.

The officers are as follows: *Chairman:* H. W. Sellers; *Vice-Chairmen:* L. J. Smith and Robson Elliff; *Hon. Treasurer:* A. P. Pearson; *Secretary,* R. Broadbent.

The Club organised in December, 1935, what is expected to be the annual Leeds Radio Ball.

It was held at the large Victoria Hall of the Leeds Town Hall and was attended by a thousand people. The proceeds were devoted to the Leeds General Infirmary Appeal.

Bertini's dance band from the Tower Ballroom, Blackpool, and Roland Powell's dance band were engaged for the occasion.

Cabaret items were given and an "In Town To-night" programme by various well-known local personalities and pantomime artists rehearsing in Leeds was presented.

A popular novelty of the evening was a race game, for which the following firms and people presented prizes: Mr. H. Wadsworth Sellers, Itonia, Ltd., Mr. Hetherington (of Ediswan), Sun Electric, Brown Bros. (at Leeds), Smith's Electric Clocks, Mr. Rowland Winn (of Leeds), Albion Electric, Mr. R. F. Winder (of Leeds), G.E.C., Siemens Lamps and Supplies, Ltd., and Every Ready Radio Ltd.

In May, 1935, a golfing section was formed and proved extremely popular. Six meetings were 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. J. W. Needham; *Vice-chairmen:* Messrs. J. H. Farthing, V. Z. de Ferranti, H. Nightingale; *Hon. Treasurer:* Mr. S. J. Wrigglesworth; *Hon. Secretary:* Mr. R. H. Ellis, Northern House, 7, Gartside Street, Manchester 3.

The committee includes Messrs. Y. W. P. Evans, C. S. Warde, J. R. Carter, M. H. Quarmby, C. E. Leak and W. F. Litherland.

MIDLANDS

The Midlands' Radio Luncheon Club holds luncheon meetings every third Thursday

in the month at the White Horse Hotel, Birmingham. Its membership is about 100.

The club's officers are as follows :—

Chairman : Mr. Gordon Baynton.

Vice-Chairman : Mr. John Priestly.

Hon. Secretary : Mr. C. C. Shipway, 31, Holloway Head, Birmingham. (Midland 2227.)

Hon. Treasurer : Mr. W. J. Dyer, Alcester Street, Redditch.

NEWCASTLE

The Newcastle and District Radio Trade Social Club had a most successful year. In addition to arranging outings and dances for its members, it sent along a cheque for over £30 to the Gresford Colliery Distress Fund.

During the summer months the "A. E. Dees" Silver Challenge Cup for golf was played for. This was presented to the Club for annual competition by Mr. A. E. Dees, the Newcastle manager for Dulcetto-Polyphon.

The Silver Challenge Cup for annual Tennis Competition, presented by the Chairman (Mr. John Watson), was played off amid much enthusiasm.

Motor rallies were among the most happy events of the year.

The Club officers are as follows :—

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

Chairman : Mr. J. Watson, of Watson's Wholesale Wireless, Ltd.

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

Hon. Secretary : Mr. J. Roddy.

Asst. Hon. Secretary : Mr. G. Parker.

Hon. Treasurer : Mr. A. Guitard.

Committee : Messrs. R. E. Fabian, J. C. Blanks, J. Mitchelhill, J. W. Skurr, W. Swan, J. S. Wood, E. C. Ridsdale, and E. C. Robinson.

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 six committee members are two 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 : Col. T. W. Vigers (British Blue Spot Co., Ltd.).

Vice-Chairman : Mr. G. G. Kent (Johnson Talking Machine Co.).

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. E. S. Brown (Brown Brothers, Ltd.) ; S. Wilding Cole (Kolster-Brandes, Ltd.) ; H. de A. Donisthorpe (General Electric Co., Ltd.) ; J. C. N. Eastick (J. J. Eastick & Sons) ; H. R. Harris (Edison Swan Electric Co., Ltd.) ; C. H. G. Hobday (Hobday Brothers, Ltd.) ; W. A. Hunt (National Radio Service Co.) ; and Col. G. D. Ozanne (Wingrove & Rogers, Ltd.).

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.

The annual subscription is 10s. 6d., and there is an entrance fee for new members of 10s. 6d. Only 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. B. Gott, and the *Hon. Secretary*, Mr. S. M. Smith, of 8, Charles Street, Sheffield.

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 July 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:* J. D. Morrison; *Vice-Captain:* C. P. Beardsall.

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, L. E. Birchall, J. E. Kemp, J. Hall, C. Gadd, J. McCrea, C. S. Warde, H. Nightingale, F. Paulson.

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*, Gordon Baynton; *Vice-Captain*, H. E. Cox; *Hon. Treasurer*, H. E. Pope; *Hon. Secretary*, F. H. Barlow, 27, Hazel Oak Road, Shirley, Birmingham.

RIGS

President: Lt.-Col. J. T. C. Moore-Brabazon, M.C., M.P.

Vice-Presidents: J. H. Williams and H. Howitt.

Captain: J. G. G. Noble, M.C.

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

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

Asst. Hon. Secretary: Gray Sinclair.

Committee: Gordon Baynton, H. Boon, Ernest Brown, H. Bryan, S. Grey, H. Howitt, E. M. Lee, F. H. McCrea, S. R. Mullard, M.B.E., J. G. G. Noble, M.C., Lt.-Col. G. D. Ozanne, M.C., F. H. Robinson, E. E. Rosen, Gray Sinclair, J. H. Williams.

The Society has 150 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.

The meetings during the 1935 season, which ended on October 31, were as follow: Tuesday, March 26, Pinner Hill; Wednesday, May 1, Coombe Hill; Wednesday, May 29, Gerrards Cross; Wednesday, June 19, Old Fold Manor; Thursday, July 25, Berkshire; Tuesday, August 20, R.A.C. Country Club, Woodcote Park; Tuesday, October 1, West Herts.

SCOTTISH

The number of friendly radio trade golf matches in Scotland gradually grew until the first Tuesday of each summer month became a regular meeting day.

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 without having a separate Society. 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.

It was decided, then, that the Scottish Radio Golf Society be formed. Mr. R. Adam was appointed President; Mr. P. Mackenzie, Captain; and Mr. J. R. Paterson, Secretary.

At the first annual meeting after the formation of the society Mr. R. Adam was appointed Hon. Vice-President; Mr. P. Mackenzie, President; and Mr. A. E. Amour, Captain.

Mr. A. E. Amour is now President; Mr. E. Machell, Vice-President; and Mr. J. B. H. Warden, 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 70. 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.

WHO'S WHO IN RADIO

ALLEN, Charles Gilbert, Fellow R.E.S.—Sales Manager, McMichael Radio, Ltd., Danes Inn House, 265, Strand, London, W.C.2. A.M.I.R.E. 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, 1929–30–31–32–33–34–35. Born 1895. Recreation: motoring. Address: 9, New Cavendish Street, W.1. (Langham 1085.)

ALLSTON, Reginald Oscar.—Sales Manager, Hellesens Ltd., S. Wimbledon, S.W.19. Six years 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.—Acting 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.

BAGGS, John.—Radio Sales Manager's Chief Publicity Assistant, Ferranti, Ltd., Radio Works, Moston, Manchester: 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 30, 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, G. G. Graves, Ltd., Radio Factory, Crookes, 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," Baslaw Road, Totley, nr. Sheffield.

BAIN, Herbert Alexander, J.P.—General Secretary, W.R.A., 316, First Avenue House, High Holborn, London, W.C.1. 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. Recreations: golf, music. Private address: Deepdene, Snaresbrook, London, E.11.

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.—Ariel, 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

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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-BEALL, Alfred.—Managing Director The Lithanode Co., Ltd., 190, Queen's Road, Battersea, London, S.W.8; 30 years' connection with mechanical and electrical engineering, with the manufacture of accumulators and primary batteries. Born 1875.

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. Recreations: music, gardening. Private address: 36, Lloyd Park Avenue, Croydon, Surrey.

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. 25 years in electrical trade. Born: October 5th, 1894. Recreations: deep sea fishing. Private address: "Avoca," Middleton Avenue, Hove.

BAYNTON, Gordon.—Joint General and Sales Manager, Radio Gramophone Development Co., Ltd., 18–20, Frederick Street, Birmingham. R.M.A. Council. Chairman, Midland Radio Lunch Club; Captain, Midland Radio Golf Society. Born October 1, 1895. Recreation: golf, fishing. Private address: 197, Russell Road, Moseley, Birmingham.

BEADLE, Thomas.—Managing Director T. Beadle & Co., Ltd., 3, 4, 5, Castle Street, Hull, and at Grimsby, Leicester, Liverpool, Nottingham, Birkenhead, Blackburn, Derby, Leeds, Manchester. In wholesale electrical business 31 years, and wholesale radio since 1924. Councillor of N.A.R.M.A.T. from inauguration until dissolution; chairman, Northern Section, 1924. R.W.F. Councillor from inauguration to date; chairman, North Midland Section, 1930. Member of wholesalers' R.W.T.A. Liaison Committee. E.W.F. Councillor; chairman Lancs and Yorks Section, 1925. Born November 6th, 1879. Recreations: golf, billiards, snooker, bowls. Private address: 262, Anlaby Road, Hull.

BEAVER, Eric, A.C.G.I.—Radio and Sales Promotion Manager, 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.

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 Commercial Committee B.V.A. since 1933; 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: golf, gardening. Private address: Alton, Sheepfoot Lane, Heaton Park, Manchester. (Cheetham Hill 1019.)

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, 1932–35; 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.

BILANTZ, David Sidney.—Chairman and Managing Director, Itonia Ltd., 58, City Road, London, E.C.1. President, A.G.M.I.M. Born 1894. Recreations: golf, motoring. Private address: 72, Brondesbury Park, N.W.2.

BLACK, Michael.—Managing Director, Michael Black, Ltd., 80, Blytheswood Street, Glasgow, C.2, 57-59, Elder Street, Edinburgh, and 30-32, Chapel Street, Aberdeen. Born August 11, 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 1926–29; 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, Anson & Hopwood, Ltd., 11, Berkeley Square, London, W.1.; Bowyer-Lowe & A.E.D., Ltd., Brighton. 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.

BRITTAIN, Sir Harry, K.B.E., C.M.G., LL.D., M.A. (Oxon).—Director of D. Napier & Son, Ltd.; Provincial Newspapers, Ltd.; Illustrated London News and Sketch Co., Ltd.; Neue Freie Presse of Vienna; Chairman, Home and Overseas Press Services; trained for business, after Oxford, in Sheffield; represented London at Washington International Chambers of Commerce, also represented Great Britain on Air Transport, 1930, and again in Vienna, 1933; has taken interest in wireless, from national viewpoint since he founded the first Imperial Press Conference in 1909, at which conference Marconi took part, and also the second Conference in 1920. Author of the "A.B.C. of the B.B.C." Has broadcast in both Great Britain and U.S.A. Invited to send in report and give evidence before Broadcasting Committee, 1935. Recreations: shooting, ski-ing, golf, caravanning. Private address: 2, Cowley Street, London, S.W.1

BROWN, Alice S. G.—S. G. Brown, Ltd., Victoria Road, N. Acton, London, W.3. Director, Telegraph Condenser Co., Ltd., National Radio Service Co.; 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. Recreations: zoology, botany, swimming, writing, dancing, travelling. Private address: 64, Northgate, Regent's Park, London, N.W.8.

BROWN, Harold Ernest.—Sales Manager, Halcyon Radio, Ltd., Sterling Works, Dagenham, Essex; 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: 30, Brantwood Avenue, Isleworth, Middlesex.

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: 64, Northgate, Regent's Park, London, N.W.8.

BROWNE, Rupert Pollard.—Assistant Secretary R.M.A. (since inception, 1926), 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: 15, Clarence Road, Kew Gardens, Surrey.

BRYAN, Harry.—Managing Director, Selecta Gramophones, Ltd., 81, Southwark Street, London, S.E.1. President 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, Burndept, Ltd., 1921; Advertising man-

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ager, 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. Chairman, 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. Born December 18th, 1885. Recreations : motoring, fishing, tennis. Private address : Hollycroft, 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, R.M.A., Member, 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.

CALKIN, Alan Bernard, M.A., A.M.I.E.E.—Technical Adviser, Philips Lamps, Ltd., 145, Charing Cross Road, London, W.C.2. Company's representative on Technical and Works Committee, B.R.V.M.A. 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. Private address : 5, 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 : " The Winnatts," Fairdene Road, Coulsdon, Surrey.

CHAMBERLAIN, Frank Joseph. — General Manager and Chief Buyer, Hellesens, Ltd., S. Wimbledon, S.W.19. 21 years with A. H. Hunt, Ltd., and Hellesens, Ltd. Private address : 61, Manor Drive, Worcester Park, Surrey.

CHAMP, Guy Henry.—Manager, Wireless Dept., Eagle Engineering Co., Ltd. ; Director & Secretary, Eagle Wireless Supply Co., Ltd., Saltisford, Warwick ; Secretary, Warwick & Leamington Engineering Employers' Association from 1921. Previously with Bellis & Morcom, Ltd., 1909–1912 ; Costs Dept., T. Chatwin, Ltd., Engineers, 1912–1914. War service, 1914–1919. Champ, Kay & Co., Electrical Engineers, 1919–1921. Born January 13, 1893. Recreations : golf, fishing. Private address : 133, Rugby Road, Leamington Spa.

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. 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 : " Gedling," Ellesmere Park, Eccles, Lancs.

CLARKE, H. — Managing Director, H. Clarke & Co. (Manchester), Ltd., Atlas Works, Patricroft, Manchester. Private address : " Gedling," Ellesmere Park, Eccles, Lancs.

CLARKE, R. C. W.—Sales Engineer, Hellesens, Ltd., Morden Road, South Wimbledon, London, S.W.19.

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 Cammel Tool Co. Born February 14, 1880. Recreations: golf, tennis. Private address: The Turret, Footscray Lane, Sidcup, Kent.

COLLE, Victor George Van.—Executive Technical Sales, 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: 70, The Avenue, Highams Park, Essex.

CONNOLLY, Jimmy.—Scottish Manager, Thompson, Diamond & Butcher, 104, Bath Street, Glasgow. For many years on entertainments committee and takes active part in Scottish Music Merchants' Conventions. Born: April 14th, 1893. Recreations: golf, football. Private address: 277, Mosspark Boulevard, Glasgow, S.W.

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 Council, R.M.A. and M.T.A.; 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.—Director, Automobile Accessories (Bristol), Ltd., Poole, Dorset. 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, to date. 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.

DAY, Wilfred Ernest Lytton.—Managing Director, Dayzite, Ltd., Will Day, Ltd., Musikon, Ltd., 17, 18, 19, Lisle Street, Leicester Square, London, W.C.2. Past-President, Veterans of Kinematography. F.R.P.S., F.R.S.A. Past President of Society of Model and Experimental Engineers. Spent most of his time since 1896, when he started showing kinematograph pictures, in the development of kinematography accompanied by sound. Has invented and patented television apparatus and loaned to the South Kensington Museum collection of kinematograph apparatus. Born July 18, 1873. Recreations: motoring, fishing, yachting. Private address: Hollydene, 15, Cholmeley Park, Highgate, London, N.6.

DIAMOND, Joseph.—Partner, Thompson, Diamond & Butcher, 34, Farringdon Road, London, E.C.1. Vice-Chairman, London and South Eastern Section, R.W.F. Born March 5th, 1894.

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

DISNEY, Henry Anthony Patrick, B.A. (Cantab.)—E. K. Cole, Ltd., late Director Kolster Brandes, Ltd., Standard Telephones and Cables, Ltd.; Standard Radio Relay Services, Ltd. First Commission Territorial Force 1912. Royal Flying Corps 1915. Retired 1919—lieut.-Col. rank. Officer of Order of the Crown of Italy.

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Member R.M.A. Council 1931. Entered radio 1922 with Western Electric Co. Born September 9, 1893. Private address: Uphanger, Shepherds Lane, Chorley Wood, Herts. (Chorleywood 175).

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.

DOHERTY, Harold Alfred.—Director, Edward Doherty & Sons, 718/728, Seven Sisters Road, London, N.15. Member of Committee of British Radio Cabinet Manufacturers' Association. Manufacturer of leather and wood sundries to dental and surgical trades. 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. Chairman, Crewe Branch, W.R.A. 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 Commercial and Radio Industry Luncheon Club Committee, B.V.A. Wireless operator, Marconi International Marine Communications Co., Ltd., 1912–13. During the war was Captain R.E.; Director and engineer, R. M. Radio, Ltd., 1919–21; American Representative, Marconi International Marine Communication Co., Ltd., 1924; B.E.C., 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.7. (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: "Four Chimneys," Hendon, London, N.W.

DYER, Henry Alfred James Shearman.—Proprietor, Shearman, Dyer & Son, 298–302, Camberwell Road, London, S.E.5. Vice-chairman W.R.A., 1929–31; Chairman W.R.A., 1931–32; Member Executive Committee National Council, W.R.A., 1931-32-33. Vice-President, W.R.A., 1934-35; A.M.I.R.E. Interested in house furnishing trade. Born July 5th, 1895. Recreation: music. Private address: 26, Stradella Road, Herne Hill, London, S.E.24.

DYER, Herbert John.—Editor "Wireless Trader." Press Representative, the Marconiphone Co., Ltd., 210, Tottenham Court Road, London, W.1, 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. Private address: 137, Upper Clapton Road, London, E.5.

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.

EDWARDS, Frederick William.—Director, C.A.C., Cabinets, Ltd. 18-20, Normans Bldgs., Central Street, London, E.C.1., 1930, founded F. W. Edwards, radio cabinet makers, 1933. Formed C.A.C. Cabinets, Ltd., associated company of City Accumulator Co., Ltd. Born: June 14th, 1894. Private address: 306, Watford Way, Hendon, London, N.W.

Van EENDENBURG, Daam Carel Frederik.—Managing Director, Philips Lamps, Ltd., 145, Charing Cross Road, W.C.2. Born July 27th, 1885. Recrea-

tions : tennis, swimming. Private address: Hindounid, Gloucester Road, Kingston-on-Thames.

ELLIS, Richard Milward.—Joint Managing Director, Pye Radio, Ltd., Africa House, Kingsway, London, W.C.2, and Director, Climax Radio Electric, Ltd., Haverstock Works, Parkhill Road, Hampstead, London, N.W.3. 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 the East London College. Private address: Tall Trees, Quarry Woods, Marlow, Bucks.

EMERY, Ernest John.—General manager, 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: 263, Church Road, Hayes, Middlesex.

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.—General Manager, British Belmont Radio, Ltd., Balfour House, 119-125, Finsbury Pavement, London, E.C.2. 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. After active war service in France, joined Bertram Day & Co., Ltd., 1920, as representative for radio newspapers; 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., Kingston

WHO'S WHO IN RADIO

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. Previously with Messrs. Clement Talbot. Born October 31, 1902. Recreations: ice hockey (Captain British Ice Hockey Team, 1932), tennis, 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: 71, South Hill Road, Bromley, 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, Dubilier, Eastick, etc.; with "Broadcaster" 1923–27; Woburn Advertising 1928-33. Born February 10, 1902. Recreations: golf, tennis. Private address: 118, Crowstone Road, Westcliff-on-Sea, Essex.

GODFREY, George William.—Asst. Sales Manager, H.M.V., 98, Clerkenwell Road, London, E.C.1. Has had experience as electrical, telephone, automobile and radio engineer. Born: April 17th, 1891. Recreation: photography. Private address: 44, Wordsworth Road, Wallington, Surrey.

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. Managing Director, Screnus, Ltd. Has been commercially connected with radio since its inception. Recreations: motoring and motor-racing. Private address: 47, Highfield Gardens, Golders Green, N.W.11.

GORRINGE, Rupert Clement.—Contracts and Motor Manager, Lissen, Ltd., Angel Road, Edmonton, Middlesex; formerly Sales Manager, Dry Battery Dept., The Edison-Swan Electric Co., Ltd., 1932-34. Born March 30th, 1898. Recreation: motoring. Private address: Birling Cottage, Woodcote Hurst, Epsom, Surrey (Epsom 1227).

GREEN, George Frederick.—Publicity Manager, The Mullard Wireless Service Co., Ltd., 111, Charing Cross Road, London, W.C.2, 1930–36. Life interest in publicity in U.S.A. and Great Britain. Recreations: cinematography. Private address: 2, The Bishop's Avenue, East Finchley, London, N.2.

HAIGH, Richard.—English Manager, 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: 38, Byron Road, N. Wembley, Middlesex. (Arnold 1616.)

HARRIS, Herbert Reginald.—Sales Organiser, Edison Swan Electric Co., Ltd. (A.E.I., Ltd.), 155, Charing Cross Road, London, W.C.2. Joined British Thomson-Houston Co., Ltd. (A.E.I., Ltd.), 1922. Member of Council, R.C.M.F., since formation. Chairman, Commercial Committee B.R.V.M.A., 1932-33. Member Radio Industries Luncheon Club Committee. Born November, 1889. Recreation: motoring. Private address: 44, Woodside Park Road, North Finchley, London, W.12.

HARRISON, Donald Frederick.—Sales Manager, The Mullard Wireless Service Co., Ltd., 111, Charing Cross Road, London, W.C.2. Born November 27th, 1899. Private address: 40, Gyllyngdune Gardens, Seven Kings, Essex.

HART, David.—General Sales Manager, E. K. Cole, Ltd., Southend-on-Sea. A.C.I., M.S.M.A. Nominated Deputy Member R.M.A. Executive Council. Has served with Marconiphone and linked up with E. K. Cole, Ltd., in 1926. Born December 6th, 1891. Recreations: motoring, golf. Private address: Sans Souci, 67, Broadclyst Gardens, Thorpe Bay, Essex.

HARVEY, Grinnell Strong.—Manager, Exide Service, The Chloride Electric Storage Co., Ltd., Clifton Junction, nr. Manchester. Born July 16th, 1893.

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

HEALY, Henry William, A.M.I.E.E.—Works Manager, Electric and Musical Industries, Ltd., Blyth Road, Hayes, Mdx. Born: February 16th, 1886. Private address: North Lee, Terrick, Princes Risborough, Bucks.

HEAVER, Ernest Frank.—Sales Manager and Publicity Manager of R.A. Rothermel, Ltd., and Sonochorde Reproducers, Ltd., 1, Willesden Lane, 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.

HESKETH, Benjamin.–Director McMichael Radio, Ltd., Wexham Road, Slough; B.Sc. Power Station Engineer, 1906; Power Station and Construction Engineer, 1910-14; Manufacturing Engineer, 1919-20 to present date, during which period formed B. Hesketh, Ltd., which company later amalgamated with L. McMichael, Ltd., to form the existing concern. Born February 15th, 1884. Recreations: golf, tennis, yachting, music, photography. Private address: Fernleigh, Iver Heath, Bucks.

HESTER, Jack Sydney Clement.—Managing Director, Truphonic Radio (Putney), Ltd., 27a, Bangalore Street, Putney, London, S.W.15. 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.—Partner, Hillman Bros., 123-5, Albion Street, Leeds.

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HILLMAN, Edgar Martin.—Partner, Hillman Bros., 123-5, Albion Street, Leeds, 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. Hon. Sec., North Midland Section, R.W.F., Jan., 1930–Mar., 1933. With A.E.G., 1910-1914; Willans & Robinson, Ltd., 1915-1916; Manager, Harland Engineering Co., 1916-1920. Founded Hirst, Ibbetson & Taylor, 1920. Born: January 23rd, 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. Council Member R.W.F. Chairman, Phoenix Tileries, Ltd., and 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.G.S. A.M.I.W.T.—272, High Road, London, N.15. Hon. Treasurer, Institute of Wireless Technology, 1934. Editor, Technical Publications, Philco Radio and Television Corp. Since 1917 has been doing private secretarial and courier work, followed by electro-therapeutic and television research work. Born: August 13th, 1901. Recreations: television research, psychology.

HOLMES, Herbert.—Managing Director, Holmes Bros. (London), Ltd., Holbro Works, Billet Road, Walthamstow, London, E.17. Founder-Member and Chairman, British Radio Cabinet Manufacturers' Association, 1934-36. President, Walthamstow Rotary Club, 1931-2. Originally camera manufacturer and patentee of many important inventions in that industry. Born September 12th, 1875. Recreations: motoring, gardening. Private address: "Heathcote," Chelmsford Road, Woodford, London, E.18.

HOLMES, Ronald Herbert.—Director and Sales Manager, Holmes Bros. (London), Ltd., Howard Works, Billet Road, Walthamstow, London, E.17. Born: March 17th, 1903. Recreations: motoring, walking, shooting, fishing. Private address: 7, Orleans Road, Hornsey Lane, Highgate, London, N.19.

HOUGHTON, Edgar William.—Chairman and Managing Director, Ensign, Ltd., 88-89, High Holborn, London, W.C.1. Chairman and subsequently President of the Radio Wholesalers' Federation, 1928–34. Born February 6th, 1870. Private address: Denehurst, Manor Hall Avenue, Hendon, London, N.W.

HOWITT, Harry.—Director of British Radio Valve Manufacturers Association, 59, Russell Square, London, W.C.1. Recreation: golf. Private address: 24, Cornwall Gardens Court, S.W.7 (Western 4803). Clubs: Eccentric, Golfers.

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, Hellesens, Ltd., Morden Road, South Wimbledon, London, S.W.19, until 1935; also Director, A. H. Hunt, Ltd. Born 1897. Recreations: tennis, golf, badminton, squash. Private address: 69, Princes Gate, London, S.W.7.

HUNT, William Arthur.—Managing Director, National Radio Service Co., 15–16, Alfred Place, Tottenham Court Road, London, W.C.1. Recreations: golf, motoring. Private address: 11, Alexander Place, Thurloe Square, London, S.W.7.

HUTCHINS, Maurice Ashley, A.M.I.W.T.—Incorporated Wireless Engineer, Principal, General Radio Service, Condor House, St. Paul's Churchyard, E.C.4. Late of Burndept Wireless, Ltd., and late Assistant Hon. Secretary, I.W.T. (London Section). Born: June 4, 1903. Recreation: music and amateur theatricals. Private address: 91, Whitworth Road, London, S.E.25.

HUXLEY, George Arthur, B.A. (Eng.) Cantab.—Director and Secretary, Wright & Weaire, Ltd., and George Nissen, Ltd., 740, High Road, Tottenham, London, N.17. Carried rank of Major R.E. during

[*Continued on page* 42.]

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SOUTHAMPTON: Marsh Lane.

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[*Continued from page* 40.]

War, has travelled the five Continents, Prior to War, represented Henry Simon. Ltd., in South America. Since War with present firms. Born January, 1888. Recreations : golf, fishing, motoring. Private address : Whithern, Cheshunt, Herts.

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

JASPER, Frederick Stephens, M.C. (Captain, late R.F.A.).—Pye Radio, Africa House, Kingsway, London, W.C.2. Stock Exchange, 1925-31. Pye Radio, 1931 to date. Born December 12, 1889. Recreations : golf, yachting, squash rackets. Private address : 38, Swan Court, Chelsea, S.W.3 ; and Pilgrim Cottage, Thurlestone, South Devon.

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.—Works Manager, E. K. Cole, Ltd., Ekco Works, Southend-on-Sea. Born : November 15th, 1902. Private address : "Wyvern," Sutherland Boulevard, Leigh-on-Sea.

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.—Chairman and Managing Director, Radio Instruments, Ltd., Purley Way, Croydon. Member of Council R.C.F. Honorary Treasurer, Trustee, Member of Council and Chairman Technical and Finance committees, R.M.A. 1934. 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 21st, 1904. Recreations : motoring, tennis, golf, riding. 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.

KENT, George Gordon.—Joint Managing Director, Johnson Talking Machine Co., Ltd., 96, Clerkenwell Road, London, E.C.1. Council Member R.W.F. Member Radio Industries Luncheon Club Committee. Born October 6, 1897. Recreations : music, sailing, squash. Private address : 10, Chester Place, Regent's Park, N.W.1.

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 : 4, 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 Arbitration Board American Chamber of Commerce in London. Councillor, Hendon Borough Council. Member of Council, Edgware Rotary Club. 1912–1921, British Westinghouse E. & M. Co., Ltd., 1921–1926, own business in Glasgow. 1922–1926, Wholesale Radio Factor. 1926–1927, Scottish Manager for Radio Communication Co., Ltd. 1927–1928, Sales Manager, Brownie Wireless Co., Ltd. 1928, Martindale Electric Co., Ltd., established. Born May 16, 1884. Recreations : golf, camping. Private address : Ardlui, 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, the Governor-General of 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. Born March 13, 1897. Recreations : tennis, golf, song writing. Private address : 9, Eccleston Court, S.W.1.

KOHN, Louis.—Manager of Leeds Branch, Ward & Goldstone, Ltd., 49a, Briggate, 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. 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. Recretions : 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. Interested in Bakelite Moulding and Brass and Casein Turning ; 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 : Bird-in-Hand Lane, Bickley, 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, Harold Victor.—Sales Manager, Tungsram Electric Lamp Works (Gt. Britain), Ltd., 72, Oxford Street, London, W.1. General sales manager of Philco Radio and Television Corporation of Great Britain, Ltd., 1931–1935. Born August 20th, 1897. Recreations : golf, shooting Private address : 48, Meadway Court, London, N.W.11.

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. Vice-Chairman, Midlands Section, R.W.F., 1935–6 ; 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 : 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.

LUCAS, Henry Antony Eric.—Director. National Radio Service Co., 15–16, Alfred Place, London, W.C.1. Director of Lucas Bros. (Tea Wholesalers), of East London, South Africa, 1932–34. Born : December 3, 1907. Recreations : golf, shooting, fishing. Private address : 16, Keats Grove, Hampstead, London, N.W.3.

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.

MACFARLANE, James.—Secretary, Radio Wholesalers Federation, 26, Hart Street, London, W.C.1. From 1898-1928 con-

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nected 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. On Council and committee, R.M.A. Born February 18th, 1898.

MAHONEY, Henry Charles, M.I.S.M.A.—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.

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 : Oak House, The Avenue, Bournemouth, W.

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, "Broadcaster and Wireless Retailer," 29, Bedford Street, Strand, London, W.C.2. Associate member of the Institute of Radio Engineers. 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 27th, 1908. Recreations, writing and riding. Private address : 112, St. Leonard's Road, East Sheen, London, S.W.14 (Prospect 1998).

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, 26, Sedgecombe Avenue, Kenton, Middlesex.

McKENZIE, James Patrick, A.M.I.E.E., M.I.R.E.—Managing Director, Sifam Electrical Instrument Co., Ltd., York Works, Browning Street, London, S.E.17. Director, Radioformer, Ltd., Works Manager, C. F. Elwell, Ltd., 1921 ; Standard Telephone & Cables, Ltd., 1923 ; Founded Sifam Co., 1925. Born January 14, 1889. Recreation : shooting. Private address : 2, Osberton Road, Lee, London, S.E.12.

McMICHAEL, Leslie.—Chairman and 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, Prince's Park Avenue, London, N.W.11.

MEDLAM, William Beresford, B.Sc., M.I.W.T., A.M.I.E.E.—Lecturer in Physics, including H.F. Measurements, Chelsea Polytechnic. Member of Council, Institute of Wireless Technology, 1928-31. Vice-President, 1931-33 ; President, 1934-35. Born : December 23rd, 1888. Recreations : research, motoring. Private address: 64, St. Dunstan's Avenue, Acton, London, W.3.

MICHELL, Philip Claud.—Successor to Trelleborg Ebonite Works, Ltd., 18, Nassau Street, London, W.1.

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 and Gramophone Trader," Dorset House, Stamford Street, London, S.E.1. With the Cambridge Instrument Co., Ltd., 1924. Joined "Wireless Trader" 1925. Born June 5th, 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.

MONTAGUE, Sidney.—Director, Beethoven Radio, Ltd., Chase Road, N. Acton, London, 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.—Special Products Dept., Marconiphone Co., Ltd., 210, Tottenham Court Road, London, W.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 16th, 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, 1895. Recreations : tennis, football, golf. Private address : "Otterleigh," 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, Charing Cross Road, London, W.C.2 ; 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. Vice-captain, R.I.G.S. Recreations : hunting, golf.

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

MURPHY, Frank, B.Sc., M.I.E.E., Assoc. I.R.E., M.B.E.—Managing Director, 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 16th, 1889. Recreations : tennis, walking. Private address : 30 High Oaks Road, Welwyn Garden City, Herts.

NEUMAN, Adalbert.—Managing Director, Tungsram Electric Lamp Works (G.B.), Ltd., 72, Oxford Street, London, W.1, and British Tungsram Radio Works, Ltd., West Road, Tottenham, N.17. Born : September 17th, 1900. Recreations : swimming, rowing. Private address : 59, Queensborough Terrace, London, W.2.

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NEWELL, Frederick Arthur, B.Sc.—Director, Eirco (Wholesale) Limited, 29, Wellington Place, and 28-30, College Street, Belfast. Connected with radio since 1921. Born: October 11th, 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. Interested in short wave transmission and reception. Member of R.N.W.A.R. 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. Music Industries Council. Captain, 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.

O'CONNELL, Henry.—Director, Climax Radio Electric Ltd., 59, Parkhill Road, London, N.W.3. With Belling Lee, Ltd., 1923; Regentone, Ltd., and Regent Radio Supply Co., 1926. Joined Climax, 1931. Born July 16th, 1891. Recreations: fishing, golf. Private address: Coverdale, Harcourt Road, Wallington, Surrey.

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 4th, 1900. Recreation: golf. Private address: 42, Chalkhill Road, Wembley Park, Middlesex.

OTTEN, J. H.—Publicity Manager, Philips Lamps, Ltd., 145, Charing Cross Road, London, W.C.2. Born: March 17th, 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. 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., 1932-33-34-35; 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., 1927. Born April 2, 1889. Recreations: golf, riding. Private address: Little Turret, Bourne End, Bucks. (Tel. No. 356). Club: Junior United Service.

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

PAGE, William Ivan Gregory, B.Sc. (Honours, London).—Chief Radio Engineer, City Accumulator Co., Ltd., 18-20, Normans Bldgs., Central Street, London, E.C.1; 1922-27, Joint Managing Director British and Colonial Industries Assoc., Ltd.; 1927-33, on Technical Editorial Staff of "The Wireless World." Born: September 11th, 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, 1931-1932. Born April 20, 1894. Recreation: golf. Private address: 84, Stewarton Drive, Cambuslang.

PAYMAN, Herbert Saul, B.Sc. (London), B.Sc.Tech. (Manchester), A.Inst.P.—Dept. of Chief Engineer, Murphy Radio Ltd., Broadwater Road, Welwyn Garden City. Formerly Chief Engineer, Radio Division, Igranic Electric Co., Ltd. Was with B.T.-H., Rugby, 1919-26; War Office (Signals Experimental Establishment, Woolwich), 1926-9. Joined Murphy Radio, 1933. Born February 24, 1898. Recreation: golf. Private address: 2, Edilom Road, Crumpsall, Manchester.

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 15th, 1889. Recreation: Golf. Private address: 31, Earls Court Gardens, London, S.W.5.

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

PHILIPS, Dr. Anton Frederik.—Managing Director, 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.

PRINCE, Herbert Stanley, A.M.I.R.E.—Director, The National Radio Service Co., Ltd., 15-16, Alfred Place, London, W.C.1. During war attached to R.E. Signals, awarded M.B.E., M.C., Chevalier le Ordre de l'Couronne, Croix de Guerre and '14 Star. Entered radio 1922. Service manager Philips Lamps, Ltd., 1928–9, and Selectors (1931), Ltd., 1931. Founded N.R.S., Ltd., 1932. Captain, Queen Victoria's Rifles. Born 1895. Recreations: tennis, motoring. Private address: 24, Mulgrave Road, Greystoke Park, London, W.5.

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

REES, John M. G.—Director, Varley (proprietors Oliver Pell Control, Ltd.), 103, Kingsway, London, W.C.2. A.M.I.E.E. Recreations: gardening, motoring. Private address: 79, Woodside, Wimbledon, S.W.

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

RICHMOND, Frank S. — Electrolytic Condenser Sales, Plessey Co., Ltd., Vicarage Lane, Ilford, Essex. Radio trade since its inception. Born: February 28th, 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 stations G.5SZ. and G.5J.R. 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 13th, 1903. Recreations: shooting, 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.

ROBERTS, Harry Charles.—Sales Superintendent, Mullard Wireless Service Co., Ltd. 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 5th, 1899. Private address: Moorfield, Huby, near Leeds (Huby 43).

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

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,

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London, W.C.2. Hon. Sec., Radio Industry Golfing Society. Formerly with Marconi's Wireless Telegraph Co., Ltd. Born May 6th, 1901. Recreation: golf. Private address: 28, Vernon Road, Leigh-on-Sea, Essex.

ROBINSON, Thomas Allen White.—Managing Director, Pye Radio, Ltd., Bush House, Aldwych, W.C.2, and Lissen Ltd. Director, 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.

ROSEN, Edward E.—Chairman and Managing Director Ultra Electric, Ltd., and Chairman of Directors, Ultra Electric (Holdings), Ltd., Western Avenue, Acton, London, W.3. Member R.M.A. Council 1930–34, Vice-Chairman, R.M.A., 1934–45. 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 22nd, 1896. Recreations: golf, cinematography.

ROTHERMEL, Royden Albert.—Managing Director, The Rothermel Corporation, Ltd., and Sonochorde Reproducers 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 13th, 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.

SADDINGTON, Frederick Marshall.—Sales Manager, H. Clarke & Co. (M/C), Ltd., Atlas Works, Patricroft, Manchester. General Electric Co., 1932–34. Murphy Radio, Ltd., 1930–34. Born: March 25, 1895. Recreations: photography, gardening, bee-keeping. Private address: "Ditton Dene," Litherland Road, Sale, Cheshire.

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 18th, 1890. Recreation: motoring. Private address: 26, Queen's Court, Hyde Park London, W.2.

SCOP, Leo, A.M.I.E.E. — Managing Director, Eirco (Wholesale), Ltd., 29, Wellington Place and 28–30, College Street, Belfast. Started Eirco (Wholesale), Ltd., who are also electrical factors, in 1921. Born: November 18th, 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. Chairman, Leeds Radio Luncheon Club; Chairman of Directors, Neil Larsen & Son, 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.

SHEPPARD, Arthur Henry.—Assistant Managing Director, The Ever-Ready Co. (Great Britain), Ltd., Hercules Place, Holloway, London, N.7. Director of the Ever Ready Trust Co., Ltd., and Lissen, Ltd. Private address: Beechwood, The Broad Walk, London, N.21.

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., 1923-27; 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 Music and Radio," 204, Gt. Portland Street, London, W.1. Born: April 2, 1914. Private address: 2, Moss Hall Crescent, N. Finchley, 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 Whittingham, Smith & 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.

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.

SPINK, John Ronald.—Managing Director, Reliance Manufacturing Co. (Southwark), Ltd., Westbury Works, Westbury Road, Walthamstow, London, E.17. Founded company in 1911. Also Director of T. A. Harris, Ltd. Born March, 1888. Recreations: tennis, gardening, fishing. Private address: Ravenswood, Gordon Avenue, Highams Park, Essex.

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

STANLEY, Edward James Walker, M.A., B.Sc.—Director, Climax Radio Electric, Ltd., Haverstock Works, Parkhill Road, Hampstead, London, N.W.3. 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, 205–81, 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).

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: "Beau Rivage," Riverside, Wraysbury, Bucks.

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.

TOBIN, J. Raymond, Mus.B., Dunelm.—Managing Editor, "The Music Seller," Montague House, Russell Square, London, W.C.1. Recreations: editing "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 Electrical 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

WHO'S WHO IN RADIO

Equipment, Croydon Polytechnic, since 1930, now Head of Dept. in Electrical Engineering, Croydon 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.—Partner, E. Upton & Sons, 175-9, Linthorpe Road, Middlesbrough and Stockton, Darlington, Redcar, South Bank, and North Ormesby. 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: 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: 26a, North End Road, London, N.W.11. (Speedwell 5935.)

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 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. — Member Veteran Wireless Operators' Association, Managing Director, Quadrant Carbon and Metal Products, Ltd., Cumberland Road, Stanmore, Middlesex. Chairman, Standardisation Committee, Canadian R.M.A., about 1927–31; 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 27th, 1899. Recreations: golf and motor yachting. Private address: 1, Vincent Court, Green Lane, Hendon, N.W.4.

WELHAM, Laurence.—Sales Manager, Columbia Graphophone 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.

WHITAKER, Alfred, M.A., F.Inst.P, A.M.I.E.E.—Director of Design, Electric and Musical Industries, Ltd., The Gramophone Co., Ltd., The Marconiphone Co., Ltd., and The Columbia Graphophone Co., Ltd., Hayes, Mlddlesex.

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 editorial publicity, Murphy Radio, Ltd., Broadwater Road, Welwyn Garden City. Formerly Editor "Wireless & Gramophone Trader" and associated publications. Lifelong association with journalism. Born November 22nd, 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. Vice-chairman, B.R.V.M.A. Chairman, R.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. Chairman, Eastern Counties W.R.A., and National Councillor; 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. Born January 28th, 1889. Private address: St. Ives, Sandfield Park, West Derby, Liverpool.

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

YOULE, Frederick.—Valve 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.

WHO'S WHO IN RADIO

CITY ACCUMULATOR Co., Ltd.

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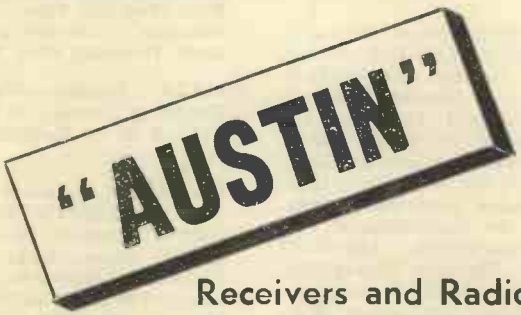

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TELEVISION REPORT AND SYSTEMS

The report of the Television Committee was approved by the Government in February, 1935, and contained the following conclusions and recommendations :—

(1) No low definition system of television should be adopted for a regular public service.

(2) High definition television had reached such a standard of development as to justify steps towards the early establishment of a service.

(3) The authority which is responsible for the sound broadcasting—at present the British Broadcasting Corporation—should also be entrusted with television.

(4) The Postmaster-General should forthwith appoint an Advisory Committee to plan and guide the initiation and early development of the television service.

(5) Ultra-short wave transmitting stations should be situated at elevated points and the masts should be as high as practicable.

(6) It is probable that at least 50 per cent. of the population could be served by 10 such stations.

(7) A comprehensive Television Patent Pool should eventually be formed.

(8) A start should be made in London with two systems operating alternately from one transmitting station.

(9) Baird Television, Limited, and Marconi-E.M.I. Television Company, Limited, should be given an opportunity to supply the necessary apparatus for the operation of their respective systems at the London station.

(10) In the light of the experience obtained with the first station, the Advisory Committee should proceed with the planning of additional stations—incorporating any improvements which come to light in the meantime—until a network of stations is gradually built up.

(11) Revenue should not be raised by the sale of transmitter time for direct advertisements, but the permission given in the British Broadcasting Corporation's existing licence to accept certain types of "sponsored programmes" should be applied also to the television service.

(12) Revenue should not be raised by an increase in the present 10s. fee.

(13) There should not be any separate licence for television reception at the start of the service, but the question should be reviewed later in the light of experience.

(14) No retailer's licence should be imposed on the sale of each television set, but arrangements should be made with the trade for the furnishing of periodical returns of the total number of such sets sold in each town or district.

(15) The cost of the television service—during the first experimental period at least—should be borne by the revenue from the existing 10s. licence fee.

Standard of Picture

As regards the standard of picture necessary, the report stated :—

"The degree of definition it is essential to obtain is necessarily a matter of opinion, but the evidence received and our own observations lead us to the conclusion that it should be not less than 240 lines per picture, with a minimum picture frequency of 25 per second. The standard which has been used extensively for experimental work is 180 lines, but we should prefer the figure of 240, and we do not exclude the possible use of an even higher order of definition and a frequency of 50 pictures per second.

"To attain such degrees of definition and picture frequency, very high modulation frequencies are required, which in practice can only be handled by radio transmitters working on ultra-short waves.

"The size of the picture reproduced by the cathode ray tube is usually 8 in. by 6 in.

Area Served

On the question of the area that can be served, the Report said :—

"Present experience both here and abroad seems to indicate that these ultra-short waves cannot be relied upon to be effective for a broadcast service much beyond what is commonly called 'optical range.' Generally speaking, it is at present assumed that the area capable of being effectively covered by ultra-short wave stations of about 10 kilowatts capacity will not exceed a radius of approximately 25 miles over moderately undulating country. In more hilly districts this may be considerably reduced, and indeed in certain areas an entirely reliable service may be impracticable. We think that with 10 stations, probably at least 50 per cent. of

TELEVISION

the population could be covered from suitable locations.

"In order that a general television service may eventually be arranged television broadcasts may be relayed by wire or wireless, and recent developments in cable design make this possible."

No national network is at present advised because of :—

Lack of information as to the total number of stations required.

Cost is speculative.

The modifications almost certainly required as the science develops.

Commercial Aspects

Dealing with commercial aspects, the report states that the price to the public of a "sound" receiver, together with television set capable of reproducing an 8 by 6 picture, would be in the neighbourhood of £50 to £80, which price might be reduced by large-scale manufacture under competitive conditions.

"We are of the opinion that there are two factors which for a number of years will tend to prevent a television service being made use of to the same extent as present-day sound broadcasting :—

(1) The difficulties of wireless communication on ultra-short wavelengths, particularly in hilly districts, may seriously limit the extent to which the country can be effectively covered.

(2) Some time is likely to elapse before the price of an efficient television receiver will be comparable with that of the average type of receiver now in use for sound broadcasting.

"Nevertheless, the time may come when a sound broadcasting service entirely unaccompanied by television will be almost as rare as the silent cinema film is to-day. **We think, however, that in general sound will always be the more important factor in broadcasting. Consequently, the promotion of television must not be allowed to prevent the continued development of sound broadcasting."**

Advisory Committee

In connection with the establishment of the service at the beginning, the report says :—

"We recommend that the initiation and early development of this service should be planned and guided by an Advisory Committee appointed by the Postmaster-General on which the Post Office, the Department of Scientific and Industrial Research and the British Broadcasting Corporation should be represented, together with such other members as may be considered desirable. We recommend that this Committee should be appointed forthwith, for a period of, say, five years.

The Committee should advise on the following :—

(*a*) The performance specification for two sets of apparatus for the Baird and the Marconi-E.M.I. systems, which are later in the report advised for first use at the London Station, including acceptance tests, and the selection of the location of the first transmitting station.

(*b*) The number of stations to be built subsequently, and the choice of districts in which they should be located.

(*c*) The minimum number of programme hours to be transmitted from each station.

(*d*) The establishment of the essential technical data governing all television transmissions, such as the number of lines per picture, the number of pictures transmitted per second, and the nature of the synchronising signals.

(*e*) The potentialities of new systems.

(*f*) Proposals by the British Broadcasting Corporation with regard to the exact site of each station, and the general lines on which the stations should be designed.

(*g*) All patent difficulties of a serious nature arising from the operation of the service in relation to both transmission and reception.

(*h*) Any problem in connection with the television service which may from time to time be referred to it by His Majesty's Government or the British Broadcasting Corporation.

The members of this Advisory Committee were announced with the publication of the report. They are : Lord Selsdon (chairman), Sir Frank Smith, Secretary of the Department of Scientific and Industrial Research (to be also chairman of the technical sub-committee), Col. Angwin, Assistant-Engineer-in-Chief of the Post Office, Mr. Noel Ashbridge, Chief Engineer of the B.B.C., Vice-Admiral Sir Charles Carpendale, Controller of the B.B.C., and Mr. F. W. Roberts, Assistant Secretary of the Post Office. Mr. J. Varley Roberts, of the Post Office, will be secretary of the Committee.

Patent Problems

Referring to patent difficulties, the Committee said :—"**The ideal solution, if it were feasible, would be that, as a preliminary to the establishment of a public service, a Patent Pool should be formed into which all television patents should be placed. We have seriously considered whether we should advise you to refuse to authorise the establishment of a public service of high definition tele-**

vision until a comprehensive Patent Pool of this type had been formed, on terms considered satisfactory by the Advisory Committee. From evidence we have received, however, we are convinced that, under present conditions, when the relative value of the numerous television patents is so largely a matter of conjecture, the early formation of such a Pool would present extreme difficulty.

" While, however, we have been compelled to abandon the idea that the formation of a comprehensive Patent Pool should be a condition precedent to the establishment of a public service, we are strongly of opinion that it is in the public interest, and in the interest of the trade itself, that such a Pool should be formed."

Conditions of Contract

The two systems recommended are the Baird and Marconi-E.M.I.

" Besides any other conditions imposed, acceptance of offers should be subject in each case to the following conditions precedent :—

(*a*) The price demanded [presumably for the supply of transmitting apparatus] should not, in the opinion of the Advisory Committee, be unreasonable.

(*b*) The British Broadcasting Corporation to be indemnified against any claim for infringement of patents.

(*c*) The Company to undertake to grant a licence to any responsible manufacturer to use its existing patents or any patents hereafter held by it, for the manufacture of television receiving sets in this country on payment of royalty.

(*d*) The terms of a standard form of such licence to be agreed upon by the Company with the Radio Manufacturers' Association, or, in default of agreement, to be settled in accordance with the provisions of the Arbitration Acts, 1889 to 1934, or any statutory modification thereof, either by a single arbiter agreed upon by the Company and the Radio Manufacturers' Association, or failing such agreement, by two arbiters —each of the parties nominating one—and an umpire nominated by the P.M.-G.

(*e*) The Company to agree to allow the introduction into its apparatus at the station of devices other than those claimed to be covered under its own patents, in the event of such introduction being recommended by the Advisory Committee.

(*f*) Transmissions from both sets of apparatus should be capable of reception by the same type of receiver without complicated or expensive adjustment.

(*g*) The definition should not be inferior to a standard of 240 lines and 25 pictures per second.

(*h*) The general design of the apparatus should be such as to satisfy the Advisory Committee, and when it has been installed, tests should be given to the satisfaction of the Committee."

As the construction of additional stations in the network proceeds, and other systems may be adopted, the above conditions should always be applied.

" With regard to the duration of television programmes," said the report, " we do not consider that it will be necessary at the outset to provide programmes for many hours a day. An hour's transmission in the morning or afternoon which will give facilities for trade demonstrations and, say, two hours in the evening, will probably suffice."

Committee and Witnesses

The members of the committee were : The Rt. Hon Lord Selsdon, K.B.E. (chairman), Sir John Cadman, G.C.M.G., D.Sc. (vice-chairman), Col. A. S. Angwin, D.S.O., Mr. Noel Ashbridge, B.Sc., Mr. O. F. Brown, B.Sc., Vice-Admiral Charles D. Carpendale, C.B., and Mr. F. W. Phillips.

The witnesses examined were : Major A. G. Church, D.S.O., M.C., Mr. A. G. D. West, M.A., B.Sc., representing Baird Television, Ltd. ; Mr. W. R. Bullimore, Mr. J. H. Thomas, M.I.E.E., Mr. L. H. Bedford, M.A., B.Sc., of A. C. Cossor, Ltd. ; Mr. Alfred Clark, Mr. I. Shoenberg, Mr. C. S. Agate, Mr. A. D. Blumlein, Mr. C. O. Browne, Mr. G. E. Condliffe, Mr. N. E. Davis, Mr. S. J. Preston, representing Electric and Musical Industries, Ltd., and Marconi–E.M.I. Television Co., Ltd. ; Mr. V. Z. de Ferranti, Mr. A. Hall, of Ferranti, Ltd. ; Mr. C. C. Paterson, O.B.E., M.I.C.E., M.I.E.E., Mr. T. W. Heather, M.C., of General Electric Co., Ltd. ; Dr. C. G. Lemon, of Plew Television, Ltd. ; Mr. S. Sagall, Mr. G. W. Walton, Mr. G. Wikkenhauser, of Scophony, Ltd. ; Sir J. C. W. Reith, C.B.E., British Broadcasting Corporation ; Col. the Hon. F. E. Lawson, Sir Thomas McAra, J.P., Mr. A. J. Polley, Mr. F. W. Jarvis, Mr. E. J. Robertson, representing Newspaper Proprietors' Association : Mr. W. W. Burnham, Mr. R. Milward Ellis, representing Radio Manufacturers' Association ; Dr. J. H. T. Roberts, F.Inst.P., of *Popular Wireless* and *Wireless Constructor* ; Dr. C. Tierney, F.R.M.S., Mr. Ronald R. Poole, B.Sc., Mr. W. G. W. Mitchell, B.Sc., representing Television Society ; and Sir William Jarratt, Mr. W. Barrie Abbott, B.L., Mr. J. Guibiansky, Mr. A. B. Storrar and Mr. R. W. Hughes.

Baird & E.M.I. Systems

In October, 1935, both the Baird and Marconi-E.M.I. companies issued specifications of the wave-forms of their system for the guidance of manufacturers wishing to produce receivers suitable for the transmissions.

With the Baird system the total number of lines in the complete picture is 240, scanned

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sequentially and horizontally at 25 picture traversals per second and 25 complete frames per second. The line frequency is thus 6,000 impulses per second and the frame frequency 25 impulses per second. The dimensions of the picture have the ratio of 4 horizontal to 3 vertical.

Amplitude modulation is employed, which results in light intensity modulation in the observed picture, the transmitter carrier increasing towards the white. The line synchronising signals and the frame synchronising signals are in the sense opposite to increasing picture modulation. The maximum frequency band involved in the transmission is 2 megacycles and the average component of light in the picture is transmitted, a black in the picture being transmitted as black and a white transmitted as white, in accordance with the modulation percentages referred to above.

The Marconi-E.M.I. television system transmits 25 complete pictures per second of each of 405 total lines. These lines are interlaced so that the frame and flicker frequency is 50 per second. The transmitter will radiate signals with sidebands extending to about 2 megacycles either side of the carrier frequency. The picture ratio will be 5 : 4.

The picture brightness component (or the D.C. modulation component) is transmitted as an amplitude modulation so that a definite carrier value is associated with a definite brightness.

In this interlaced scanning system, each picture is thrown twice in rapid succession on to the viewing screen, the interval between each successive presentation being so short that the eye is unable to detect any "gap," but effectively merges the two into one. The main advantage of interlacing is that it reduces "flicker" without increasing the total side-band spread of the signals in the ether.

Marconi-E.M.I. claim to reproduce each picture fifty times a second. In terms this is perfectly true, but it must not be forgotten that the first picture will begin to fall off in brilliance before the second picture can be laced into it, so that it hardly represents a full 100 per cent. advance in brilliance, as compared, say, with a straight-sequence picture repeated twenty-five times a second.

Again, each of the two interlaced pictures contains a total of only 202½ line-traversals, as compared with 240 lines per picture in the Baird transmission. The definition of each of the Marconi-E.M.I. half-pictures must therefore be slightly less than the complete picture of their rivals, though this is, of course, offset by the fact that the two half-pictures are projected on to the viewing-screen in the same time as the single Baird picture.

Technical Points

The principal bar to the inauguration of a nation-wide television service is the fact that the ultra short waves, which must be employed for high-definition transmissions, behave in a "quasi-optical" manner. Even with the advantage of the Alexander Park site, which is on high ground in North London, the B.B.C. does not expect to serve an area much greater than that within a radius of 35 miles.

The range is limited because only direct waves are available and these are more susceptible to the screening effect of hills and buildings than the normal broadcast frequencies.

Ultra short waves are essential for high-definition transmissions. A station of this type operating on normal wavelengths would monopolise the ether from approximately 100 to 7,000 metres.

This fact also indicates why highly specialised receivers are necessary for high-definition reception. In the first place the radio-frequency circuits have to be designed to respond, in as "square-topped" a manner as possible, to this wide-frequency range. In the case of a 240-line picture the waveband is nearly 2,000 kilocycles wide. Compare this with the 9 kc. band which normal receivers are designed to accept!

Secondly, after signal rectification, a television receiver has to amplify a frequency band of approximately 1,000 kilocycles. The ordinary radio set has little response above 5–6,000 cycles.

Television receivers will rely almost exclusively on the cathode-ray tube for the formation of the picture. The image is seen at its best in a dark or semi-dark room, and so looking-in is unlikely to be indulged in to the same extent as listening-in.

For some time at least both electronic and mechanical scanning methods are likely to be used at the transmitting end. The former system involves the use of the electron camera, which is in some ways similar to a cathode-ray tube, but has a mosaic of minute photo-electric cells in place of the fluorescent screen.

The scene is focused on the mosaic and causes the cells to become charged. As the cathode ray sweeps over them at the required scanning speed the cells discharge and thereby provide the "signal."

The scanning disc is used for the direct transmission of scenes and for scanning films. For direct transmissions, particularly of large scenes, indoors and out, the Baird company has developed an "intermediate film" system. In this the scene is filmed and the sound recorded. Within 30 seconds the film is developed and scanned in the transmitter. Simultaneously the sound, delayed the necessary 30 seconds, is picked up from the sound film and broadcast.

QUICK TESTS for Tracing Faults in Sets

Compiled from "The Service Engineer"

The correct operating voltages measurable at readily accessible points in approximately 60 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 fairly 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 65.

Aerodyne "Blackbird" Battery Four.—The combined H.T. and G.B. battery is a Hellesen 130v. + 9v. G.B. unit. Connections are: H.T.+, white, 130v.; H.T.—, brown; L.T.—, black; L.T.+, buff; G.B.—1, blue, —4.5v.; G.B.—2, green, —9v. Valve readings: VP2 met., anode 110v., 2.2 m.a.; aux. grid 110v. PM1HL, anode 80v. 1.1 m.a.; PM2A anode, 130v., 4.5 m.a.; PM2B each anode, 130v., 1.7 m.a.

Aerodyne "Silver Wing."—Voltages between chassis and terminals on speaker transformer: Top (1) black, H.T. unsmoothed, 325v.; (2) blue, output valve anode, 227v.; (3) and (4) red, H.T. smoothed, 240v. Valve readings: FC4 met., anode 240v., 1.5 m.a.; aux. grid 97v.; osc. anode 131v., 4.7 m.a. VP4 met (I.F. 125 k.c.), anode 240v., 6 m.a.; aux. grid, 97v. 2D4A met., cathode, 16.5v. Pen.4VB, anode 227v., 27 m.a.; aux. grid, 240v., 5 m.a.

Aerodyne Nightingale.—Battery voltages are H.T.+, purple lead, 120v.; G.B.—1, blue, —4.5v.; G.B.—2, green, —9v. Valve readings: VP2 met., anode 112v., 1.6 m.a.; aux. grid, 112v., .4 m.a. PM1HL met., anode, 70v., 1.25 m.a. PM22A, anode, 115v., 5.8 m.a.; aux. grid, 120v., 1.2 m.a.

Alba Model 57 Superhet A.C. Six.—Voltages between chassis and speaker transformer: Top, (1) and (2) joined, H.T. smoothed, 236v.; (4) output valve anode, 214v.; (5) H.T. unsmoothed, 356v. Valve readings: FC4 met., anode, 236v.; aux. grid, 86v.; osc. anode, 82v. VP4A met. (I.F. 117.5 k.c.), anode, 204v.; aux. grid, 86v. 2D4A, no readings. VP4A, anode, 56v., 2 m.a.; aux. grid, 86v. Pen.4VA anode, 236v., 31 m.a.; aux. grid, 214v., 5.5 m.a.

Alba Model 501A.C.—Voltages between chassis and tags on speaker transformer: Top, (1) 325v., H.T. unsmoothed; (2) 235v., output valve anode; (3) and (4) 246v., H.T. smoothed. Valve readings: VP4 met. anode, 245v., 4.3 m.a.; aux. grid, 120v. SP4 met. anode, —v., .6 m.a.; aux. grid. —v. Pen.4VB anode, 235v., 29 m.a.; aux. grid, 246v., 3.5 m.a.

Amplion "Radiolux" A.C. Superhet.—Voltages between speaker transformer terminals and chassis, from the top: (1) white, H.T. unsmoothed 360v.; (2) black, output valve anode, 225v.; (3) blank; (4) and (5) red, H.T. smoothed, 240v. (1) and (5) are field coil; (2) and (4) are primary of output transformer. Valve readings: VP4A met. anode, 175v., 4.6 m.a.; aux. grid, 90v. FC4 met. anode, 172v., 3 m.a.; aux. grid., 80v.; osc. anode, 83v. SP4 met. (I.F., 110 k.c.) anode, 60v.; aux. grid, 45v. Pen.4VA anode, 225v., 30 m.a.; aux. grid, 240v., 4 m.a. FC4 readings obtained with valve stabilised by anode-to-chassis condenser.

Atlas Model B345 Battery Set.—Battery voltages are: H.T.+, red, 120v.; H.T.+, yellow, 80v.; G.B.+, grey; G.B.—, yellow, —4½v.; G.B.—, white, —9v. Valve readings: VP2 met. anode, 120v., 1.3 m.a.; aux. grid, 80v. SP2 met. anode, 116v., .4 m.a.; aux. grid., high resistance in circuit gives entirely erroneous reading. PM22A anode, 120v., 4.1 m.a.; aux. grid, 120v., .9 m.a.

Burgoyne Screen-grid Four Portable.—The battery is a Drydex S.53 combined H.T. and G.B. unit. The connections are: H.T.+1, 54v.; H.T.+2, 99v.; G.B.—1, 1.5v.; G.B.—2, 4.5—6v. Valve readings: SP2 met. anode, 100v., .1 m.a.; aux. grid, 54v. PM1HL anode, 97v., 3.8 m.a. PM2 anode, 97v., 6.6 m.a. (4.5v. G.B.).

Burgoyne Universal "Fury."—The earth lead may be "live." Voltages between chassis and speaker transformer terminals: Left (1) grey, output valve anode, 150v.; (2) red, H.T. smoothed, 160v.; (3) black, H.T. unsmoothed, 250v.

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Valve readings: VP13A met. anode, 160v., 4.2 m.a.; aux. grid, 120v. SP13 met. anode, 80v., 6 m.a.; aux. grid, 40v. Pen.3520 anode, 150v., 33 m.a.; aux. grid, 160v., 7.5 m.a.

Burgoyne 2P Comet and 2-Pen.-3.—Battery is Drydex type S48. Connections: H.T.+1, 84v.; H.T.+2, 120v.; G.B.—1, —1.5v.; G.B.—2, —9v. Valve readings: SP2 met. anode, 120v., 3 m.a.; aux. grid, 84v. PM1HL anode, 64v., 2 m.a. PM22 anode, 120v., 3.3 m.a.; aux. grid, 84v., 1 m.a.

Burndept 209 Ethodyne Five.—Between chassis and following points on right-hand speaker transformer: Lower tag, H.T. smoothed, 240v.; upper tag, output valve anode, 230v.; junction of red lead from set to black of speaker field, 420v. Valve readings: FC4 met. anode, 235v; aux. grid, 85v.; osc. anode, 83v. VP4A met. (I.F. [473 K.C.]), anode, 235v.; aux. grid, 100v. 2D4A, no voltages. Pen.4VB or 42MP anode, 230v., 33 m.a.; aux. grid, 240v., 3 m.a.

Bush S.A.C.5 Five-valve Superhet.—Voltages between chassis and terminals on speaker transformer: Top (1) red, 105v., negative; (2) blue, H.T. smoothed, 250 v. positive; (3) brown, 0v.; (4) and (6) 0v.; (5) green, output valve anode, 235v. positive. Valve readings: FC4 met. anode, 226v., 1.8 m.a.; aux. grid, 75v.; osc. anode, 75v. VP4 met. (I.F. [123 K.C.]) anode, 115v., 3.5 m.a.; aux. grid, 75v. 354V met. anode, 150v. 3 m.a. Pen.4VA anode, 235v., 30 m.a.; aux. grid, 250v., 5 m.a.

Bush D.A.C.1 Universal Superhet.—Voltages between chassis and two terminals on speaker transformer: Top (red) H.T. smoothed, 230v.; bottom (green), output valve anode 206v. Valve readings: FC13 met. anode, 190v., 4 m.a.; aux. grid, 82v., 4 m.a.; osc. anode, 82v, 2 m.a. VP13A met. (I.F. [frequency 123 K.C.]) anode, 145v., 3.75 m.a.; aux. grid. 82v., 1 m.a. Pen. 3520, anode, 206v., 42 m.a.; aux. grid, 230v., 10 m.a.

Climax S.5 A.C. Superhet.—Voltages between speaker transformer terminals and chassis: Top (1) and (2) H.T. smoothed, 260v.; (3) blank; (4) output valve anode, 250v.; (5) H.T. unsmoothed, 350v. (1) and (5) are field. (2) and (4) are output transformer primary. Valve readings: FC4 met. anode, 250v., 1.3 m.a.; aux. grid. 80v.; osc. anode, 80v., 1.5 m.a. MM4V or VP4 met (I.F. [115 K.C.]) anode, 250v., 4 or 2.5 m.a.; screen, 80v. 354v. met. anode, 120v., 5 m.a. AC2Pen. anode, 250v., 34 m.a.; aux. grid. 200v., 7 m.a.

Climax "534" A.C. Superhet.—Voltages between chassis and terminals on speaker transformer (noise suppressor switch down): Top (1) and (2), blue, H.T. smoothed, 210 v.; (3) blank; (4) black, output valve anode, 195v.; (5) green, H.T. unsmoothed, 300v. Valve readings: FC4 met. anode, 200v., .7 m.a.; aux. grid 90v.; osc. anode, 90v. VP4A met. (I.F. 111 K.C.) anode, 200 v., 1.3 m.a.; aux. grid, 90v. MHD4 met. anode, 135v., 3.2 m.a. AC2 Pen., anode, 195v., 37 m.a.; aux. grid, 210v., 4.5 m.a.

Cossor 369 Super Ferrodyne.—Between terminals on speaker transformer and chassis (on 240v. D.C. mains): Right, blue, output valve anode, 146v.; left, blue, H.T. smoothed, 156v. Resistance test across mains lead, 750 ohms. approx. Valve readings: 13VPA met. anode, 150v., 3.8 m.a.; screen, 55v. 13SPA met. anode, —v., .9 m.a.; screen, —v., .1 m.a. 402P anode, 146v., 28 m.a.

Cossor 364 A.C. Superhet.—Voltages between chassis and terminals on speaker transformer, counting from the bottom: (1) Yellow, H.T. smoothed, 235v.; (2) blue, H.T. unsmoothed, 340v.; (3) red, output valve anode, 210v. Valve readings: 41MPG met. anode, 215v., 2.1 m.a.; screen, 100v.; osc. anode, 105v., 2.4 m.a. MVSPen. (I.F. [128 K.C.]) anode, 200v., 5.5 m.a.; aux. grid, 100v. DD4, no readings. 42MP Pen., anode, 210v., 25 m.a.; aux. grid, 235v., 5 m.a.

Cossor 535 A.C. Superhet.—Voltages between speaker transformer terminals and chassis: Top, (2) red and white, output valve anode, 180v.; (3) red, H.T. unsmoothed, 305v.; (4) green, H.T. smoothed, 207v. Valve readings: 41MPG anode, 210v., 3.2 m.a.; aux. grid, 81v.; osc. anode, 74v. MVS Pen. (I.F. [128 K.C.]) anode, 210v., 4.5 m.a.; aux. grid, 81v. DD4, no voltages. 42MP Pen. anode, 205v., 35 m.a.; aux. grid, 210v., 6 m.a. 41MPG, stabilised by .1mfd. condensers between anodes and cathode.

Ever Ready 5001 Battery Superhet.—Battery connections are: Yellow, 130v.; blue, 90v.; green, 69v.; brown, 4.5v (G.B). Valve readings: PM12M met. anode, 128v., 1 m.a.; screen 90 v. FC2 met. anode, 130v., .5 m.a.; aux. grid, 69v.; osc. anode, 130v., 1.1 m.a. VP2 met. (I.F. [127 K.C.]) anode, 130v., 1.2 m.a.; aux. grid, 130v. PM2D1 met. anode, 128v., 1.7 m.a. PM2B, each anode, 130v., 1 m.a.

Ever Ready 5002 Mains Superhet.—Between upper ends of terminals on speaker plug and chassis: Black (heater pin), speech winding; red (heater pin), H.T. smoothed, 275v.; white, H.T. unsmoothed, 365v.; green, speech winding. Valve readings: AC/TP met. anode, 248v., 4.3 m.a.; aux. grid, 212v.; osc. anode, 72v., 1.2 m.a. AC/VP1 met. (I.F. [127 K.C.]) anode, 275v., 7.1 m.a.; aux. grid, 220v. AC2Pen.DD anode, 250v., 29 m.a.; aux. grid, 275v., 6 m.a.

Ferranti "Nova" Superhet.—Between chassis and upright connectors on mains transformer (note colours and polarity): Front of cabinet, (1) black, chassis, 0v.; (2) red, H.T. smoothed, 280v. positive; (3) green, output valve anode, 276v.; (4) blue, H.T. negative, 100v. Valve readings: VHT4 met anode, 275v., 4.1 m.a.; screen 90v.; osc. anode, 95. VPT4 met. (I.F. [125 K.C.]) anode, 275v., 4 m.a.; aux. grid, 90v., 2 m.a. PT4D, anode 276v., 34 m.a.; aux. grid, 280v., 7.25 m.a.

Ferranti "Universal" Superhet.—Remember chassis may be "live" to earth. Voltages between speaker tags (looking from back and counting from right) and chassis: (1) black, earth of speaker; (2) red, H.T. smoothed, 221v.; (3) green, output valve anode, 210v.; (4) blue, H.T. unsmoothed, 260v. Valve readings; VHTS or X30 anode, 212v., 6.5 m.a.; aux. grid, 80v., 2.5 m.a.; osc. anode, 80v., 1.5 m.a. VPTS met. (I.F. [125 K.C.]) anode, 212v., 5 m.a.; aux. grid, 80v., 2 m.a. HSD met., anode, 160v., 3 m.a. PTS anode, 210v., 43 m.a.; aux. grid, 220v., 6.5 m.a.

Ferranti Gloria A.C. Superhet.—Voltages between the projecting connectors in front of the terminal strip mounted on top of the mains transformer and chassis: A (left, looking from back), blue, 118v. negative; B, green, output valve anode, 250v. positive; C, red, H.T. smoothed, 263v.; D, black, 0v. Valve readings: VHT4 met. anode, 200v., 4 m.a.; screen, 100v.; osc. anode, 80–100v., 1.5 m.a. VPT4 met. (I.F. [125 K.C.]) anode, 200v., 5.5 m.a.; aux. grid, 100v. H4D anode, 150v., 1.7 m.a. LP4 anode, 250v., 48 m.a. MHL4 (muting valve), negligible readings.

G.E.C. Battery S.G.3.—The battery is type BB120 and the connections are: H.T.+, red, 120v.; H.T.+, blue, 60v. Bias is automatic. Valve readings: VS24 met. anode, 110v., 1.5 m.a.; screen, 60v. VP21 met. anode, 44v., 2 m.a.; screen, 60v. PT2 anode, 106.5v., 4 m.a.; aux. grid, 120v. Average set current, 9 m.a.

G.E.C. "D.C. Five."—Voltages between chassis and speaker transformer (200v. mains): Left-hand (1) red and black, speaker field; (2) red. H.T. smoothed, 170v.; (3) green and black, speech coil; (4) red and black, speech coil; (5) orange and black, speech coil; (6) orange, output valve anode, 145v.; (7) grey, speaker field. Valve readings: DSB anode, 150v., 1 m.a.; screen 55v. VDS anode, 170v., 6 m.a.; screen, 55v. DSB anode, —v., .3 m.a.; screen, 65v. DPT anode, 145v., 30 m.a.; aux. grid, 170v., 5 m.a.

G.E.C. A.C. Mains Four.—Voltages between chassis and top row of terminals on speaker transformer: Left, (1) red and white, 330v.,

H.T. unsmoothed; (2) orange, 225v., output valve anode; (3) and (5) joined, 0v.; (4) black, 0v.; (6) and (7) joined, red, 240v., H.T. unsmoothed. Valve readings: VMS4 met. anode, 240v., 6 m.a.; screen, 70v. MS4B anode, 120v., 2.7 m.a.; screen, 60v. N41 anode, 225v., 38 m.a.; aux. grid, 240v.

G.E.C. "Battery AVC6."—Battery is G.E.C. type L259. Connections are: H.T.+1, red, 141v.; H.T.+2, light blue, 58v.; H.T.— and G.B.+, dark blue; G.B.—1, yellow, —1.5v.; G.B.—2, orange, —6v.; G.B.—3, brown, —9v. Valve readings: VS24 met. anode, 141v., 1.6 m.a.; screen 58v. X21 anode, 141v., 1 m.a.; screen 58v.; osc. anode, 50v., 1 m.a. VS24 met. (I.F. [125 K.C.]) anode, 141v., 1.6 m.a.; screen, 58v. HD22, anode 100v., 1 m.a. L21, anode, 139v., 1.9 m.a. B21, each anode, 140v., 1 m.a.

Halcyon 6701 Superhet.—Voltages between chassis and terminals on speaker transformer: Top (1) blue, H.T. unsmoothed, 355v.; (2) yellow, H.T. smoothed, 215v.; (3) blank; (4) green and black, output valve anode, 200v. Valve readings: MS4B anode, 200v., 4-5 m.a.; screen, 100v. MH4 anode, 100v. VMS4 (I.F., [110 K.C.]) anode, 200v., 7.5 m.a.; screen, 85v. VMS4 anode, 200v., 9 m.a.; screen, 85v. MH4D anode, 125v. MPT4 anode, 200v., 32 m.a.; aux. grid, 215v., 6.5 m.a.

Halcyon Battery Four.—Battery voltages: Yellow, 144v.; white, 75v.; blue and red, 1.5v. G.B.; pale grey, 4.5 G.B.; blue-grey, 6v G.B. Valve readings: VS24 met. anode, 115v., 3 m.a.; screen, as tapping. HL2 anode, 68v., 4.1 m.a. L21, 138v., 2.1 m.a. B21, each anode, 138v, 2.25 m.a.

Halcyon A.C.7 Superhet.—Voltages between chassis and terminals on speaker transformer: Top, (1) yellow and green, 0v.; (2) blue and white, H.T.+ smoothed, 230v.; (3) yellow and black, output valve anode, 210v.; (4) brown and white, 0v. Red lead to speaker field is H.T. unsmoothed, 350v. Valve readings: FC4 met. anode, 230v., .5 m.a.; aux. grid, 60v., 4 m.a.; osc. anode, 75v., 3 m.a. VP4, met (I.F. [110 K.C.]) anode, 170v., 4.5 m.a.; aux. grid, 75v., 2.5 m.a. MHD4 met., anode, 75v., 2 m.a. Pen.4VA anode, 210v., 30 m.a.; aux. grid, 230v., 6 m.a.

Kolster-Brandes 935 A.C. Superhet.—Voltages between chassis and speaker transformer terminals (note the polarity): Outer row, top (1) red and black, H.T.—, 80v. negative; (2) red, H.T. smoothed, 232v. positive; (3) blue, output valve anode, 220v. positive; (4) black, chassis negative. (1) and (4) are speaker field, (2) and (3) are transformer primary. Valve readings; 9A1 met. anode, 200v., .8 m.a.; aux. grid, 44v. ACS2Pen. met. anode, 200v., .8 m.a.; aux. grid, 30v. 9A1 met (I.F. [130 K.C.]) anode, 200v., 4 m.a.; aux. grid, 80v. 11A2 met. anode, 100v., 1 m.a. MPT4, anode, 220v. 30 m.a.; aux. grid, 230v., 4 m.a.

Kolster-Brandes Model 383 Universal Console Seven.—Voltages between smoothing choke and chassis: lower terminal, red and black, H.T. unsmoothed, 210v.; upper terminal, black with red tracer, 195v. Between speaker transformer and chassis: lower two, joined, H.T. smoothed, 145v.; blue, output valve anodes, 135v.; (4) to smoothing choke, 195v. Valve readings: 15D1, anode, 140–190v., 3–4 m.a.; aux. grid, 100v., 3–5 m.a.; osc. anode, 50v., 3 m.a. 9D2 (I.F. [130 K.C.]) anode, 140–190v., 3 m.a.; aux. grid, 115v, 2 m.a. 11D3 anode, 0–60v., .1 m.a. 8D2 anode, 0–60v., .5 m.a.; aux. grid, 0–50v., 2 m.a. 7D3 (both valves) anode, 135v., 34 m.a.; aux. grid, 145v., 7 m.a.

Kolster-Brandes Cavalcade.—Between chassis and following terminals looking from the rear: Smoothing choke: right (red and black) H.T. unsmoothed, 230v.; left, black, 215v. Output transformer: left, top (1), black, 215v.; (2) blue, output valve anode, 140v.; (3) and (4) red, H.T. smoothed, 150v. Valve readings: 15D1 or 13PGA anode, 125v., 5 m.a.; aux. grid, 55v., 7.5 m.a.; osc. anode, 120v., 5 m.a. 9D2 or 13VPA anode, 140v., 8 m.a.; aux. grid, 100v., 2 m.a. 11D3 or 13DHA anode, 80v., .1 m.a. 7D3 or 40PPA anode, 128v., 35 m.a.; aux. grid, 140v., 8 m.a.

Lissen Models 8111, 8116 and 8117 Four-valve A.C. Superhets.—Voltages between right-hand terminals on speaker and chassis: Outside, H.T. unsmoothed, 450v.; inside, H.T. smoothed, 275v. Valve readings: A/80/A met. anode, 275v. 1.2 m.a.; aux. grid, 72v.; osc. anode, 77v., 2.2 m.a. A/50/N met (I.F. [127 K.C.]) anode, 275v., 6 m.a.; aux. grid, 105v. A/20/B met., no readings. A/70/C anode, 258v., 27 m.a.; aux. grid, 275v., 3.1 m.a.

Lissen Four-valve Battery Portable.—Battery connections: H.T.— and L.T.— lead is connected to 9v. positive socket to allow bias voltages; pink lead, 120v.; mauve, 60v.; black, 9v.; white, 6v.; yellow, H.T.—. White and yellow are G.B. leads. Valve readings: S.G.2V met. anode, 115v., 1.2 m.a.; screen 60v. HL2 met. anode, 43v., 1.6 m.a. L2 anode, 113v., 1.9 m.a. BB220A, each anode, 113v., 2.5 m.a.

Lotus Model 66 Universal Receiver.—Voltages between chassis and speaker transformer terminals (225v. A.C. mains): Left, (1) red, chassis: (2) blue, 230v., H.T. smoothed; (3) blue, 216v., output valve anode; (4) yellow, 256v., H.T. unsmoothed. Valve readings: S.2034N met. anode, 230v., 3.6 m.a.; screen, 78v. S2035N met. anode, 104v., 1.7 m.a.; screen, 43v. P2460 anode, 216v., 35 m.a.; aux. grid, 110v.

Marconiphone 257 Battery Superhet.—Battery connections: Red lead, 159v.; mauve, 72v.; grey, 9v. G.B.; blue, 1.5v. G.B. Pink lead should be inserted to the voltage corresponding to lettering on the output valve as follows: W. 138v.; X, 144v.; Y, 151.5v.; Z, 157.5v. Total H.T. current measured in negative lead should be 9-9.5 m.a. Valve readings: X21 anode, 159v., .35 m.a.; screen 30v.; osc. anode, 30v. VS24 (I.F. [456 K.C.]) anode, 159v., .35 m.a.; screen, 72v. HD21 anode, 70–100v., 1 m.a. QP21, each anode, 159v., 1.8–2.8 m.a.; screen, according to tapping.

Marconiphone 260 Battery Set.—The battery is a 175v. combined H.T. and G.B. unit. The connections are: H.T.+3, 175v.; H.T.+2 (two leads), voltages should be adjusted to give a no signal current of not more than 1.2 m.a. for each valve. Valve reading: SG2 met. anode, 145v., 1 m.a.; screen, 50v. HL2 met., anode, 60v., 1.5 m.a. PT2 anode, 166v., 1.2 m.a.; aux. grid, see above.

Marconiphone Model 276 7-valve A.C. Superhet.—Voltages between numbered terminals on speaker transformer and chassis: (3) yellow, output valve anode, 285v.; (4) red, H.T. smoothed by choke, 293v.; (5) yellow and red, screen tapping, 88v.; (6) red and black, H.T. smoothed by second choke, 300v. Valve readings: VMS4B anode, 230v., 2.5 m.a.; screen, 80v. MH4 anode, 80v., 2.5 m.a. VMS4B (I.F. [120 K.C.]) anode, 230v., 1.4 m.a.; screen, 80v. MS4B anode, 230v., 1.5 m.a.; screen, 80v. MH4 anode, 145v., 1.5 m.a. PX4 anode, 285v., 40 m.a.

Marconiphone 223 Universal Superhet "Three."—Valve readings: X30 met. anode, 200v., .5–1.3 m.a. (varies with local-distance switch). WD30 met. (I.F. [456 K.C.] anode, 65v., 3 m.a.; aux. grid, 50v., 1.8 m.a. N30 Cat. anode, 180v., 24 m.a.; aux. grid, 145v., 4.6 m.a.

Marconiphone "Jubilee" Chassis, Receivers 264, 297 and 287.—Voltages between chassis and terminals on speaker panel: Red, 240v.; yellow, output valve anode, 215v. Voltage between green (+) and grey (—), 115v. Valve readings: MX40 anode, 220v., 1.4 m.a. (with "Q" knob out); aux. grid, 80v.; osc. anode, 120v., 1.5–2 m.a. VMS4 met. anode, 220v., 8 m.a.; screen, 75v. MHD4 met. anode, 95v., 1.5 m.a. MPT4, anode, 215v., 25 m.a.; aux. grid, 170v., 4–7 m.a.

McMichael Twin Speaker Superhet.—Voltages between the following points and chassis: Positive plate of rectifier, 370v., H.T. unsmoothed; left hand speaker terminals (looking from back and counting tags from left), (1) and (2) 250v.; (3) 248v., H.T. smoothed; (4) 240v., output valve anode; (5) 370v., H.T. unsmoothed; left-hand tag on right-hand speaker, 200v. Valve readings: AC/TP met. anode, 215v.; aux. grid, 170v.; osc. anode, 112v. (the connection of lead for current readings makes receiver unstable).

QUICK TESTS

AC/VP1 met. (I.F. [410 or 428 K.C.]) anode, 250v., 3.9 m.a.; aux. grid, 150v. **AC/VP1 met.** anode, 250v., 3.9 m.a.; aux. grid, 150v. **AC/HL met.**, no appreciable reading because of high resistance in circuit. **AC2 Pen.DD** anode, 250v., 37 m.a.; aux. grid, 240v., 6 m.a.

McMichael Superhet Mains Transportable.—Voltages between speaker transformer and chassis: Top, (1) red, H.T. unsmoothed, 370v.; (2) black, output valve anode, 235v.; (3) and (4) H.T. smoothed, 250v. Between case of middle electrolytic condenser on power pack and chassis, 185v. (half H.T.). Valve readings: **ACVP1 met.** anode, 210v., 2 m.a.; aux. grid, 105v. **ACTP** met. anode, 220v., 1.1 m.a.; anx. grid, 105v.; osc. anode, 110v., 2 m.a. **ACVP1 met.** (I.F. [110 K.C.]) anode, 240v., 2.8 m.a.; aux. grid, 105v. **ACHLDD** anode, 70v., 1.7 m.a. **AC Pen.** anode, 235v., 24 m.a.; aux. grid, 250v., 4.5 m.a.

McMichael 135 Superhet.—Voltages between chassis and terminal strips on right-hand side: Top (F), pink, H.T. unsmoothed, 380v.; (1) and (2) L.T. to pilot lamp; (3) and (4) speech coils. F, cream, H.T. smoothed, 250v. Valve readings: **AC/TP met.** anode, 180v.; aux. grid, 190v.; osc. anode, 110v. **MVS Pen. met.** (I.F. [128 K.C.) anode, 250v., 7.5 m.a.; aux. grid, 120v. **DD4**, no voltages. **AC/2/Pen.** anode, 230v., 29 m.a.; aux. grid, 250v., 4.8 m.a.

Mullard MU35 A.C.-D.C. Superhet.—Voltages between speaker transformer tags (two underneath the winding) and chassis: Front, red, output valve anode, 154v.; back, black, H.T. smoothed, 182v. Valve readings: **FC13 met** anode, 177v., .5 m.a.; aux. grid, 68v.; osc. anode, 68v. **VP13A met.** (I.F. [115 K.C.]), anode, 177v., 1.4 m.a.; aux. grid, 68v. **2D13A**, no readings. **HL13** anode, 80v., .46 m.a. **Pen.26** anode, 154v., 42 m.a.; aux. grid, 86v., 5.7 m.a.

Murphy A24 Console.—Voltages between chassis and terminals on the speaker transformer mounted on the chassis near V1 (counting from the front): (1) speech coil; (2) H.T. smoothed, 225v.; (3) blank; (4) output valve anode, 210v.; (5) speech coil. Valve readings: **AC/TP met.** anode, 195v., 3.5 m.a.; aux. grid, 190v.; osc. anode, 40–70v. **AC/VP1 met.** (I.F. [117 K.C.]) anode, 224v., 9 m.a.; aux. grid, 225v., 3 m.a. **AC/HL/DD met.** anode, 130v. 2.4 m.a. **AC/2 Pen.** anode, 210v., 2.5 m.a.; aux. grid, 225v., 6 m.a.

Orr Radio's Fisherman's Receiver.—The battery is a 120v. unit and connections are: H.T.+1, 120v.; H.T.+2, 72v.; G.B., 6 or 9v. Valve readings: **PM12A met.** anode, 113v., 1.7 m.a.; screen, 72v. **PM1HL met.** anode, —v. **PM22A.** anode, 117v., 2.2 m.a.; aux. grid, 120v.

Philips 585U Superhet Five.—Voltages between chassis and the two terminals on the output transformer bobbin: Front (red), output valve anode, 167 volts; rear (black), H.T. smoothed, 190 volts. Valve readings: **FC13 met.** anode, 190v., .7 m.a.; aux. grid, 65v.; osc. anode 65v. **VP13A** (I.F. [115 K.C.]) anode, 180v., 1.5 m.a.; aux. grid, 60v. **2D13A**, no readings. **HL13**, anode, 140v., .75 m.a. **Pen.26** anode, 167v., 40 m.a.; aux. grid, 90v., 5.5 m.a.

Philips 584A Superhet Five.—Voltages between chassis and two terminals on speaker transformer, 227 and 210v. Valve readings: **FC4 met.** anode, 230v., 1.25 m.a.; aux. grid, 73v. **VP4A met** (I.F. [125 K.C.]) anode, 230v., .6 m.a.; aux. grid, 73v. **2DD4A**, no voltages. **SP4 met.** anode, 140v., .36 m.a.; aux. grid, 73v. **PM24M** anode, 210v., 26 m.a.; aux. grid, 227v., 4 m.a.

Philips Twenty-watt Amplifier, Type 3750.—Valve readings: F4/60 anode, 270-330v., 9.5-10.5 m.a. MC1/60 anode, 950-1050v., 48-52 m.a.

Philips 634C D.C. Superinductance Receiver.—Voltages between speaker transformer and chassis: Top, H.T.+, 177v.; bottom, V5 anode, 162v. Valve readings: **SG20 met.** anode, 195v., .45 m.a.; screen, 116v. **SG20 met.** anode, 195v., .8 m.a.; screen, 118v. **SD20** anode, 110v., .1 m.a.; screen, 38v. **Pen.20** (both valves) anodes, 162v., 15 m.a.; aux. grids, 177v., 6.4 m.a.

Philco 267 "Straight" Four.—Valve readings: 77E anode, 135v. 77E, high resistance in circuit gives erroneous readings. 42E, anode 250v.; aux. grid, 260v.

Portadyne Jubilee Superhet.—Voltages between chassis and terminal on speaker transformer: Top (1) H.T. unsmoothed, 320v.; (2) and (3) H.T. smoothed, 225v.; (4) output valve anode, 200v. Valve readings: **FC4 met.** anode, 195v., 1-1.5 m.a.; aux. grid, 65v. **VP4 met.** (I.F. [112 K.C.]) anode, 223v., 3.5 m.a.; aux. grid, 80v. **TDD4** anode, 100v., 2 m.a. **AC2Pen.** anode, 200v., 27 m.a.; aux. grid, 225v.

Pye SE/A.C. Superhet.—Valve readings: **AC/VP1 met.** anode, 270v., 3.6 m.a.; aux. grid, 230v. **AC/TP met.** anode, 270v., 4 m.a.; aux. grid, 220v.; osc. anode, 60v., 1.6 m.a. **AC/VP1 met.** (I.F. [127 K.C.]) anode, 270v., 6.3 m.a.; aux. grid, 205v. **AC2Pen.DD** anode, 235v., 35 m.a.; aux. grid, 260v., 4 m.a.

Pye E-A.C. Superhet.—Voltages between positive end of rectifier and chassis, 285v.; between negative end and chassis, 95v. negative. The latter is the voltage drop across the speaker field and the parallel bias potentiometer. Valve readings: **AC/SG/VM met.** anode, 145v., 7 m.a.; screen 45v. **AC/S2/Pen. met.** anode, 185v., 4.8 m.a.; aux. grid, 186v. **AC/S1/VM met.** (I.F. [114 K.C.]), anode, 200v., 5.3 m.a.; screen, 63v. **AC/HL/DD met.** anode, 146v., 7.7 m.a. **PP3/250** anode, 275v., 24.7 m.a.

Radio Gramophone Development Co.'s Model 1201.—Between speaker field plugs at sides of power pack and chassis (withdraw plugs slightly to obtain connection): 1,000 ohm field, red 360v., blue, 460v.; 6,500 ohm field, purple, 460v., grey 253v. Valve readings: **VMS4** anode, 190v., 4.5 m.a.; screen, 55v. **VMS4** anode, 200v., 1 m.a.; screen 55v. **MHL4 met.** anode, 25v., 1.5 m.a. **VMS4** (I.F. [110 K.C.]) anode, 300v., 6 m.a.; screen 55v. **MHD4** anode, 100v. **MH41** anode, 75v., 2 m.a. **MH4** anode, 100v., 2 m.a. **MH4** (both valves) anode, 240v., .7 m.a. **PP3/250** (both valves) anode, 340v., 40 m.a.

Radio Instruments Four-valve Battery Superhet.—The standard battery is a special Hellesen model, type RI 144, containing H.T. and G.B. sections. Connections are: Red, 135v.; white, depending on letter on QPP valve. Valve readings: **TP22 met.** anode, 125v., 1.7 m.a.; aux. grid, 123v.; osc. anode, 120v., 2.3 m.a. (not oscillating). **VP215 met.** anode, 133v., 2.3 m.a.; aux. grid, 123v. **L21DD met.** anode, 93v., 1 m.a. **QP240**, each anode, 133v., 1-1.5 m.a.

Savage 306B Public Address Amplifier.—Valve readings: **H30** anode, 180v., 4.5 m.a. **H30** anode, 200v., 5 m.a. **N30** (both valves) anode, 250v., 25-30 m.a.; aux. grid, 245v., 5 m.a.

Trix T240 P.A. Amplifier.—Valve readings: **AC/HL** anode, 200v., 5-6 m.a. **PM24D** (both valves) anode, 450-490v., 40-55 m.a.; aux. grid, 180-210v.

Ultra Model 25.—Voltages between field coil and chassis: Right (looking from back), red, 364v., H.T. unsmoothed; left, black, 274v., H.T. smoothed. Valve readings: **AC/TP** anode, 274v.; aux. grid, 200v.; osc. anode, 110v. **AC/VP1** (I.F. [456 K.C.]) anode, 165v.; aux. grid, 195v. **AC2Pen.DD** anode, 260v., 37 m.a.; aux. grid, 274v., 4 m.a.

Ultra Battery "Tiger."—Battery connections (Grosvenor type DBA586 battery), H.T.—, brown, to H.T.—; H.T.+1, white, to 70v.; H.T.+2, yellow, 150v.; G.B.—1, green, —4.5v.; G.B.—2, blue, —7.5v. Total anode current with no signal approx. 8 m.a. Valve readings: **SG215** anode, 135v., 1.4 m.a.; screen 66v. **S215VM** anode, 135v., 2.2 m.a.; screen, 66v. **H2 met.** anode, 125v., 1.4 m.a. **L2** anode, 135v., 1.5 m.a. **PD220**, each anode, 135v., 1.3 m.a.

Ultra Electric's Model 66.—Between chassis and two lower terminals (next to speaker field) on the output transformer: Nearer back, output valve anode, 250v.; ncarer front, H.T. smoothed, 260v. Valve readings: **AC/VP1 met.** anode, 260v., 14 m.a.; aux. grid, 265v. **AC/S2/Pen.** anode, 92v.; aux. grid, 125v. **AC/2Pen.** anode, 250v., 34 m.a.; aux. grid, 265v., 5 m.a.

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

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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

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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.

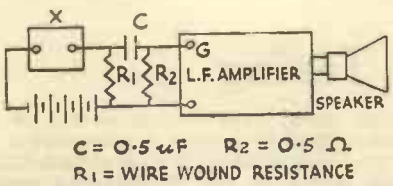
A.C. Meters.

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

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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 monthly supplement, "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

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two headings, "Valve Readiugs" and "Quick Tests."

These figures for over 60 of the receivers dealt with during the past year in "Service Engineer" are given on pages 57–60 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 69–91.

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-

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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

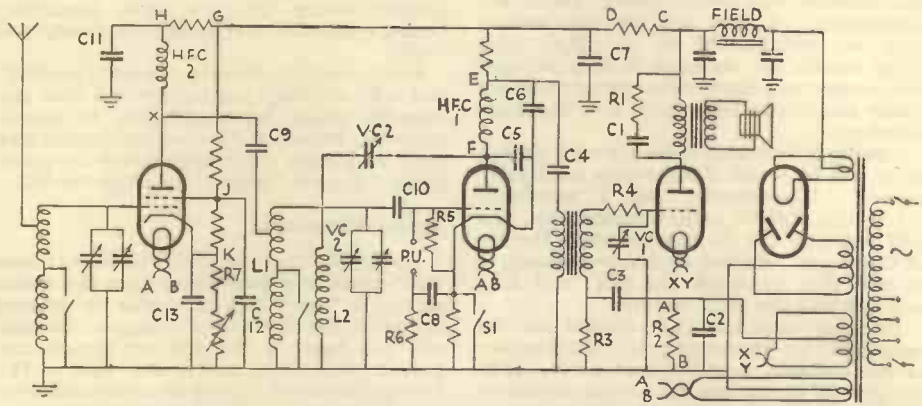

FIG. 1.—A typical A.C. mains receiver circuit incorporating a screen-grid H.F. valve (an H.F. pentode might just as well be used), a leaky grid detector and a directly heated output triode which obtains its filament current from a separate L.T. winding. Tuned grid H.F. coupling and resistance-fed transformer coupling are further features.

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 over-biased. 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

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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

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

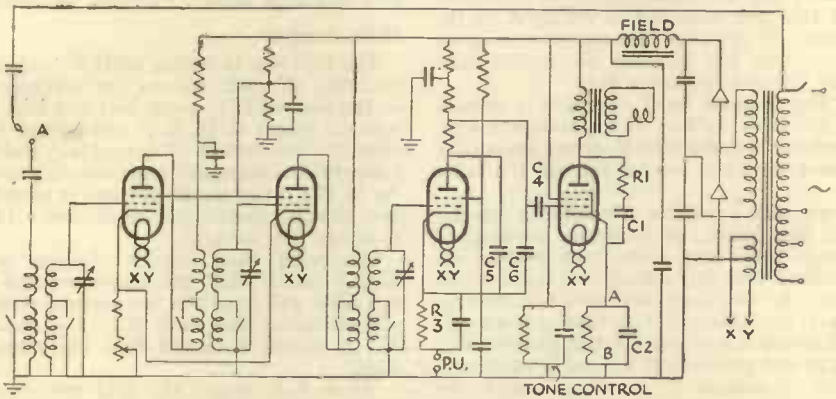

FIG. 2.—A circuit of a receiver employing H.F. transformer coupling between the H.F. valves, an anode bend detector, an indirectly heated output pentode and metal rectification of the H.T. supply. The pick-up connection, the use of a resistance as an H.F. stopper in the detector anode circuit and resistance-capacity L.F. coupling are points of interest.

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 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-

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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 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

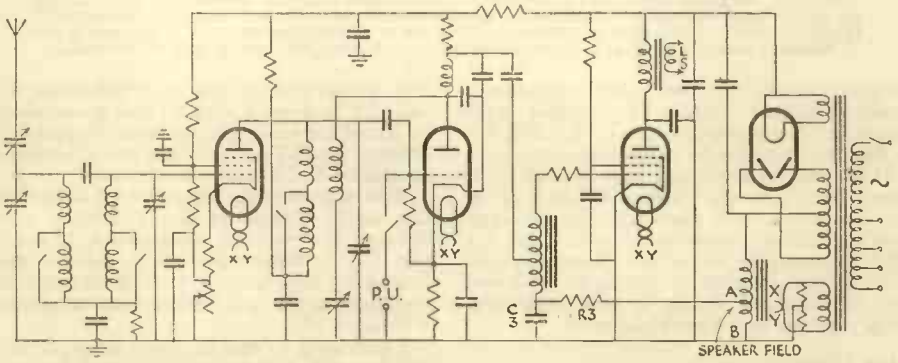

FIG. 3.—Here the speaker field winding is in the negative lead and a tapping provides the bias for the output valve. Band pass coupling precedes an H.F. pentode, which is tuned-anode coupled to a leaky grid detector.

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 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"

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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

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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,

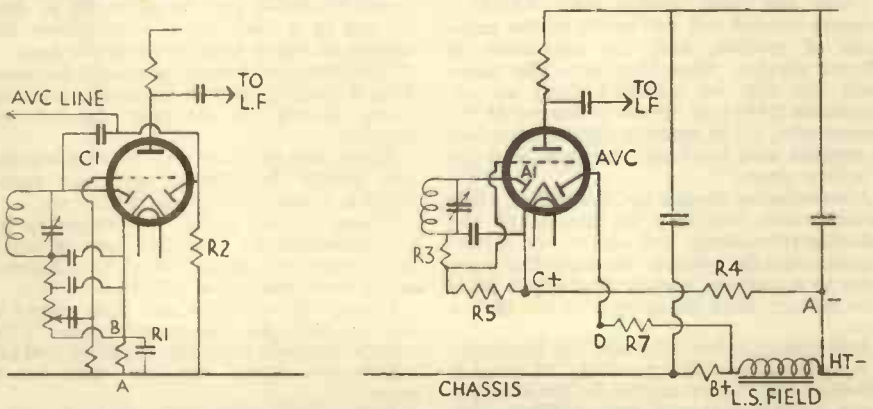

FIG. 4 (on the left) shows the simplest delayed A.V.C. circuit, and FIG. 5 (right) gives the most popular arrangement for amplified A.V.C. The A.V.C. line to the H.F. valves is taken from D in FIG. 5.

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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 Units.

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. Most band pass units have a ganged control, and 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 and the use of a band pass unit of an unscreened type with a closely fitting screen will unbalance it.

In the most usual forms of band pass tuner, the second coil is connected to the input of the receiver, while there is no connection between the set and the first coil. The aerial coupling coil is generally fixed. No attempt should be made to modify any portion of the tuner in any way, as the correct matching of the two halves is an absolute necessity.

Car Radio.—*See* "Motor Radio."

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

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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

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36 RANGES with One Instrument.

A.C. RANGES

Current.	Voltage.
0-12 amps.	0-1,200 volts.
0- 6 ,,	0- 600 ,,
0- 0.12 ,,	0- 480 ,,
0- 0.6 ,,	0- 240 ,,
0-120 milliamps	0- 120 ,,
0- 60 ,,	0- 60 ,,
	0- 12 ,,
	0- 6 ,,

D.C. RANGES

Current.	Voltage.	Resistance.
0-12 amps.	0-1,200 volts.	0-1 megohm.
0- 6 ,,	0- 600 ,,	0-100,000 ohms.
0- 1.2 ,,	0- 120 ,,	0- 10,000 ,,
0- 600 m.a.	0- 60 ,,	0- 1,000 ,,
0- 120 ,,	0- 12 ,,	
0- 60 ,,	0- 6 ,,	
0- 12 ,,	0- 1.2 ,,	
0- 6 ,,	0- 600 millivolts	
	0- 120 ,,	
	0- 60 ,,	

The Universal Avometer gives no less than 36 ranges of *direct* readings (A.C. and D.C.) of current, voltage and resistance. The movement is dead-beat and a mirror on the 5-inch scale obviates parallax errors. The world's largest and most important radio and electrical undertakings depend on the unfailing precision of the Universal Avometer. It is the ONE instrument that facilitates EVERY test.

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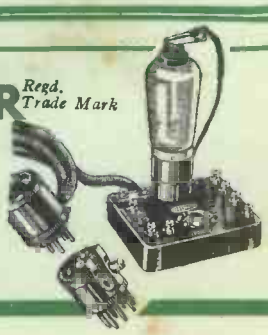

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SERVICE CHART

This chart has been compiled to assist service engineers and dealers in selecting the correct type of Hivac valves for use in all replacement work or in the selection of suitable valves to ensure perfect results in the circuit for which they are required.

The full characteristics of all Hivac Battery, Mains and "Midget" Valves are set out in the special Hivac Valve Guide "B.A." Free on request.

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2-VOLT BATTERY VALVES.

HIVAC.			MAZDA.		MULLARD.		COSSOR.		MARCONI-OSRAM.	
H 210	H.F. Amplifier	3/9	HL 210	5/6	PM 1 HL	5/6	210 HL	5/6	HL 210	5/6
D 210	Non-microphonic Detector ...	3/9	L 2	5/6	PM 2 DX	5/6	210 Detector	5/6	HL 2	5/6
DDT 220	Duo-Diode Triode	7/-	L/2 DD	9/-	TDD 2	9/-	—	—	HD 21	9/-
L 210	L.F. Amplifier	3/9	L 2	5/6	PM 2 DX	5/6	210 LF	5/6	L 210	5/6
P 220	Small Power	5/6	P 220	7/-	PM 2 A	7/-	220 P	7/-	LP 2	7/-
P 215	Economical Super Power ...	4/9	—	—	—	—	215 P	7/-	—	—
PP 220	Medium Power	6/6	P 220A	12/-	PM 202	12/-	220 P	8/9	P 2	12/-
PX 230	Super Power	7/6	—	—	PM 202	12/-	230 XP	12/-	P 2	12/-
Y 220	Med. Power Output Pen. Type	10/6	Pen 220	13/6	PM 22 A	13/6	220 HPT	13/6	PT 2	13/6
Z 220	Super Power Output Pen. Type	10/6	Pen 220 A	13/6	PM 22	13/6	230 PT	13/6	—	—
B 230	Class "B"	10/6	PD 220	14/-	PM 2 B	14/-	220 B	14/-	B 21	14/-
DB 240	Driver Class "B"	15/6	—	—	—	—	—	—	—	—
QP 240	Double-Pen Type for Quiescent Push-Pull	19/6	QP 240	22/6	—	—	—	—	QP 21	22/6
SG 215	Screen Grid	10/6	SG 215	12/6	PM 12	12/6	215 SG	12/6	S 21	12/6
SG 220	High Slope Screen Grid ...	10/6	S 215 B	12/6	PM 12 A	12/6	220 SG	12/6	S 22	12/6
VS 215	Variable-mu Screen Grid ...	10/6	S 215 VM	12/6	PM12 M	12/6	220 VSG	13/6	VS 24	12/6
HP 215	H.F. Pentode Type	10/6	SP 215	13/6	SP 2	13/6	210 SPT	13/6	SP 21	13/6
VP 215	Variable-mu H.F. Pentode Type	10/6	HP 215	13/6	VP 2	13/6	210 VPT	13/6	VP 21	13/6
TP 230	Triode-Pen. Frequency Changer	15/6	TP 22	18/6	—	—	—	—	—	—
J 240	Multi-System Valve	21/-	—	—	—	—	—	—	—	—

MIDGET 2-VOLT BATTERY VALVES.

XSG	Midget Screen Grid	15/6	—	—	—	—	—	—	—	—
XD	Midget Detector	10/6	—	—	—	—	—	—	—	—
XL	Midget L.F. Amplifier ...	10/6	—	—	—	—	—	—	—	—
XP	Midget Power	12/6	—	—	—	—	—	—	—	—
XY	Midget Output Pentode Type	15/6	—	—	—	—	—	—	—	—

4-VOLT A.C. MAINS VALVES.

AC/V	Variable-mu Double Triode ...	15/6	—	—	—	—	—	—	—	—
AC/HL	Detector	9/6	AC/HL	13/6	354 V	13/6	41 MHL	13/6	MH 4	13/6
AC/DDT	Duo-Diode-Triode	12/6	AC/HL-DD	15/6	TDD 4	15/6	DDT	15/6	MHD 4	15/6
AC/DD	Double Diode	4/6	V 914	5/6	2 D 4	5/6	DD4	5/6	—	—
AC/L	Small Power	12/6	AC/P	14/-	104 V	14/-	—	—	ML 4	14/-
AC/Y	Output Pentode Type ...	15/6	AC Pen	18/6	Pen 4 V	18/6	MP/Pen	18/6	MPT 4	18/6
AC/Z	High Slope Output Pen. Type	15/6	AC 2/Pen	18/6	—	—	42 MP/Pen	18/6	—	—
AC/SL	Screen Grid Amplifier... ...	13/6	—	—	S 4 VB	17/6	MSG/LA	17/6	—	—
AC/SH	High Gain Screen Grid Amplifier	13/6	AC/SG	17/6	S 4 VA	17/6	MSG/HA	17/6	MS 4 B	17/6
AC/VS	Variable-Mu Screen Grid ...	13/6	AC/SIVM	17/6	MM 4 V	17/6	MVSG	17/6	VMS4B	17/6
AC/VH	Variable-Mu High Gain S.Grid	13/6	AC/SG VM	17/6	—	—	—	—	—	—
AC/HP	H.F. Pentode Type	13/6	AC/S2 Pen.	17/6	SP 4	17/6	MS/Pen	17/6	MSP 4	17/6
AC/VP	Variable-Mu H.F. Pen. Type	13/6	AC/VP 1	17/6	VP 4	17/6	MVS/Pen	17/6	VMP 4	17/6
UU 60/250	Full Wave Rectifier (I.H.C.)...	8/6	UU 2 (IHC)	12/6	1 W 2 (DHC)	12/6	506 BU (DHC)	12/6	U 10 (DHC)	12/6
UU 120/350	Full Wave Rectifier (I.H.C.)	10/6	UU 120/350	15/-	1 W 3	15/-	442 BU	15/-	MU 12	15/-
UU 120/500	Full Wave Rectifier (I.H.C.) ...	15/-	UU 120/500	20/-	DW/4 DH	20/-	460 BU	20/-	MU 14	20/-

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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.

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

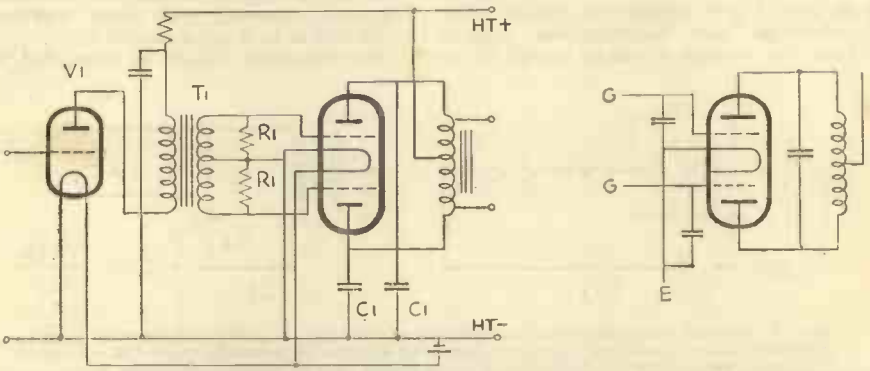

FIG. 6.—V1 is a driver valve of the small power type, and the secondary of the Class B transformer T1 is connected to the two grids and negative filament of the B valve without bias. Two condensers C1 between the anodes and earth give stability and correct tone, while fixed resistances R1 prevent parasitic 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.

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

Teconomically CORRECT

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 now being 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

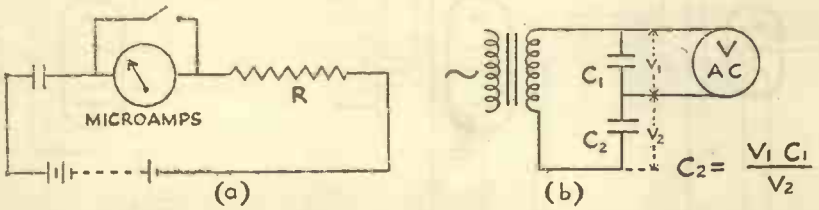

FIG. 7A.—When measuring the insulation of a condenser, a safety resistance R must be included in the circuit, the microammeter being shorted by a switch, while the condenser charges. How the capacity of a condenser can be checked is shown in (B).

WESTON SUPER OSCILLATOR

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

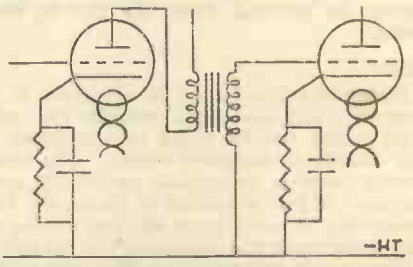

FIG. 8.—The most usual auto-bias arrangement with separate resistances and condensers in each cathode lead.

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.

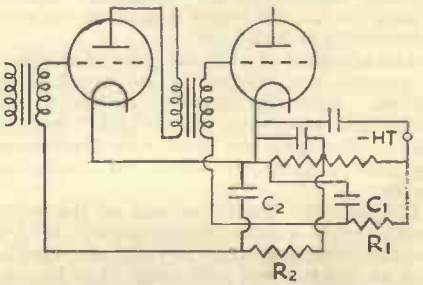

FIG. 9.—A common auto-bias resistance in series with the main negative high-tension lead tapped off for various bias voltages. Decoupling resistances and condensers are also shown.

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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

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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 on pages 94–96.

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 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 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 C8. An intermediate tapping is taken across the resistance R1 which acts as 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

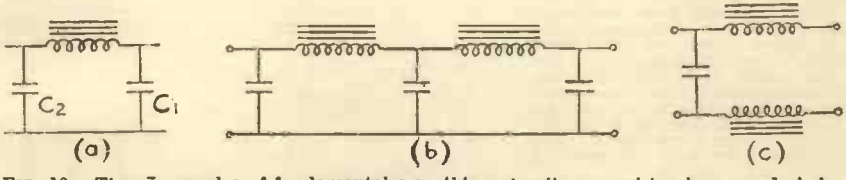

FIG. 10.—Three examples of fundamental smoothing circuits comprising iron cored chokes and large condensers.

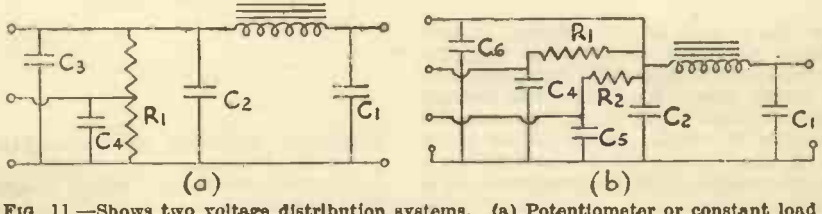

FIG. 11.—Shows two voltage distribution systems. (a) Potentiometer or constant load method. (b) Series resistance method.

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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.

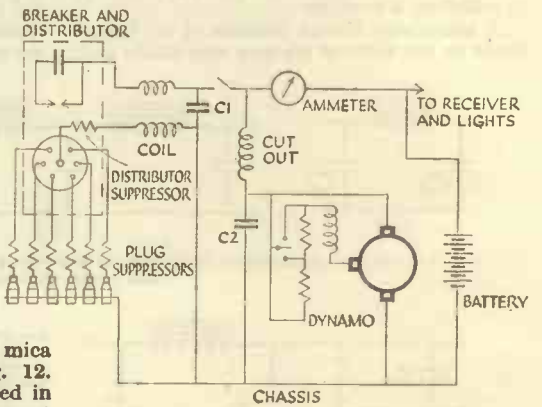

FIG. 13.—A typical car ignition circuit showing how suppressor resistances and condensers should be added to prevent interference with a receiver fitted to the car. The special heat and vibration-proof resistors should be connected as close as possible to the sparking plugs and the distributor and the high voltage condensers C_1 and C_2 should be near the sparking points.

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 of the suppression of interference originating in the care itself, the fitting of a motor radio receiver is usually a matter involving only straightforward practical problems.

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 an interrupter unit. When results are poor the

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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 on the "ceiling" 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

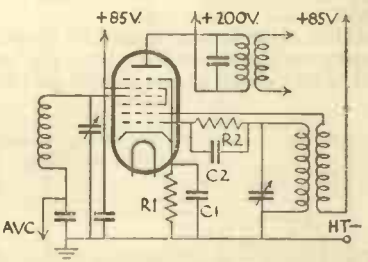

FIG. 14.—How a mains type octode valve is used as a combined first detector and oscillator with electronic coupling.

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

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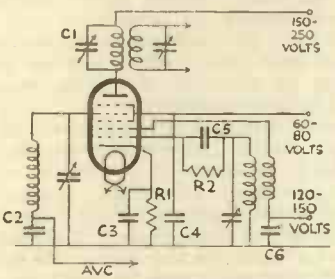
or mixing section, however, being the equivalent of a screen-grid valve instead of an H.F. pentode.

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.



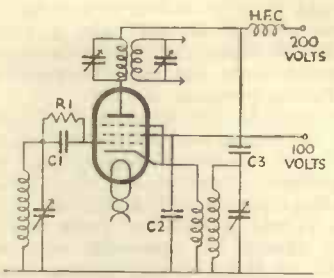


FIG. 15.—On the left is a circuit (simplified as regards coil switching) showing how a heptode is used as a combined detector-oscillator or frequency-changer. In FIG. 16 (right) the connections for using an H.F. pentode for the same purpose are indicated.

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

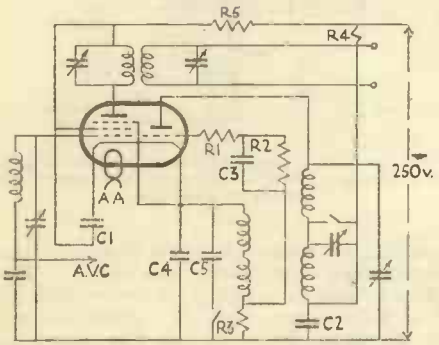


FIG. 17.—The triode-pentode which is virtually two valves with a common cathode is employed for frequency-changing in this manner.

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 values 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

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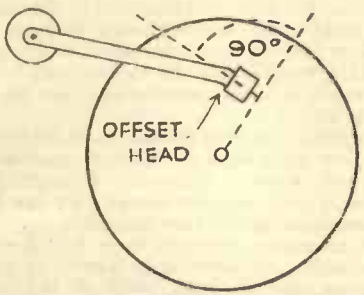
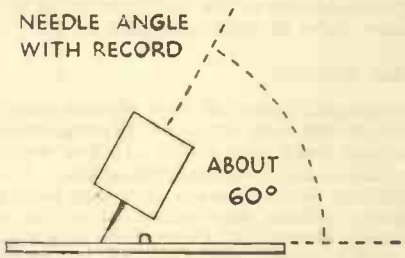
wears slack and the needle is not clamped properly. This gives rise to chatter. There is no real cure for this. Undue wear can be prevented by using less force in screwing up the needle clamp.

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





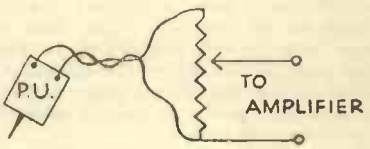


FIG. 18.—These three sketches show the correct position of a pick-up with respect to the record and how to connect an external volume control.

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.

Some portable sets, unfortunately, are not well designed and they operate rather inefficiently. This is generally due to the fact that the high-frequency and low-frequency currents are not properly separated—a fundamental principle underlying set design.

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.

The set is tested through in exactly the same way as an ordinary receiver, but the mere connection of test meters and leads or anode adaptors may introduce sufficient stray coupling to make the set oscillate.

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.

Many portable sets are actually designed

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on compromises and certain practices are frequently adopted which are theoretically unsound, in order to stabilise a set.

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.

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.

A good powerful demonstration receiver which seems to be excellent in the showroom is utterly useless for public address. A set which is overpowering in the showroom becomes a mere whisper in a hall or an open space. It is essential, therefore, to use special apparatus for public address work.

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.

At a really important demonstration it is advisable to duplicate the apparatus. One faulty connection can ruin a demonstration completely.

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. Each stage of the latter should be completely screened, and this again should have ample reserve power.

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.

Amplifiers are conveniently built into stout tin-plate cases with screened compartments for each stage. Adequate decoupling is necessary, and volume controls on the first and second amplifiers are desirable.

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.

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

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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

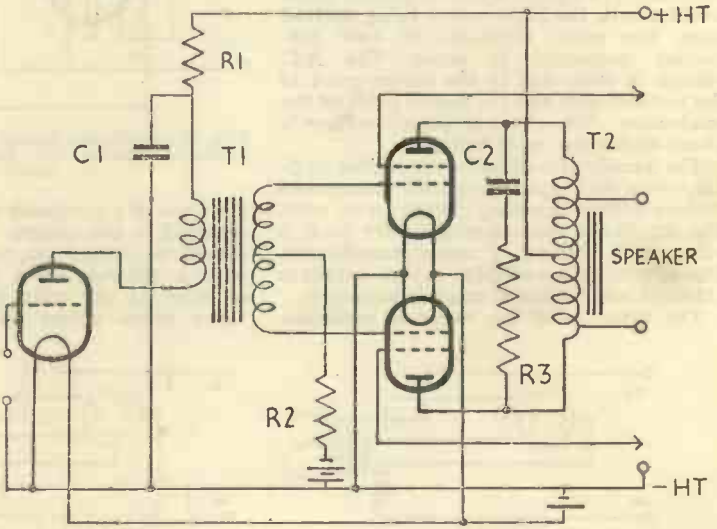

FIG. 19.—The Q.P.P. input transformer T1 is decoupled through R1 and C1. The resistance R2 in the grid bias lead prevents instability, while C2 and R3 form a tone correction to the centre tapped matching choke T2. The quiescent currents of the output pentodes are matched by individual adjustment of the 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-

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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

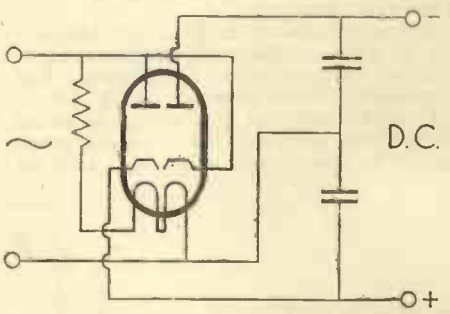

FIG. 22.—Indirectly-heated cathode rectifiers are available suitable for use in voltage-doubler circuits.

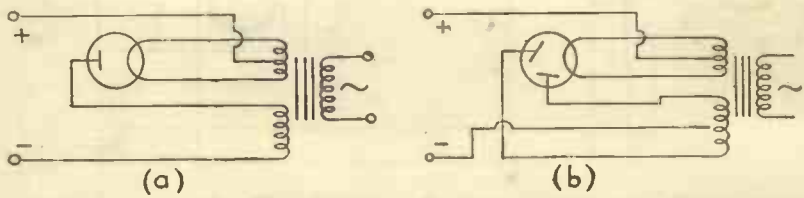

FIG. 20.—Half and full wave valve rectifier circuits.

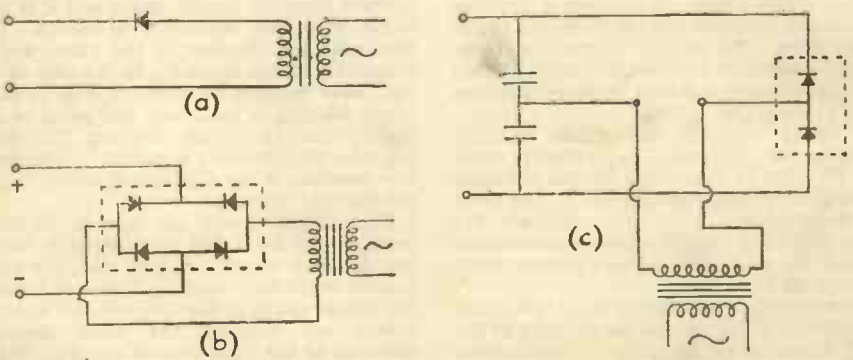

FIG. 21.—Half wave, full wave, and voltage doubling metal rectifier circuits.

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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.

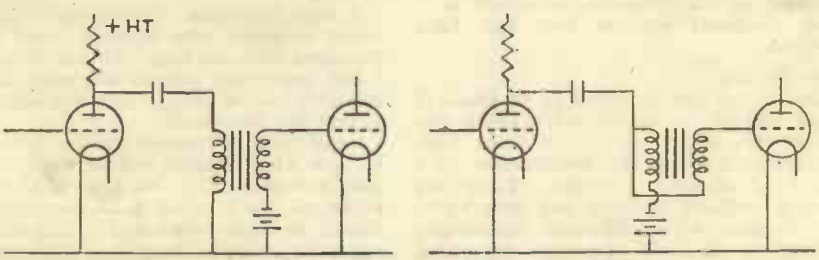

FIG. 23.—Anode feed system for a transformer giving (A) a direct connection and (B) an auto-connection, which increases the step-up ratio.

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

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been allocated. The colours and figures are :—

Colour.	Figure.	Colour	Figure.
Black ...	0	Green ...	5
Brown ...	1	Blue ...	6
Red ...	2	Violet ...	7
Orange ...	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 :—

$$2\sqrt{\frac{\text{Optimum Load}}{\text{Speaker impedance}}}$$

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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 :—

$$2\sqrt{\frac{32,000}{4{\cdot}2}} = 87$$

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. A good speaker should be capable of producing this effect.

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.

Speakers, Moving Iron.

Moving iron speakers should be tested in the same way as moving coil speakers, with the exception that the 50 cycle test is not applicable, since practically no moving iron speaker other than an inductor has any appreciable radiation at 50 cycles.

Short circuited turns cause loss of volume and thinness of quality. Defective windings give rise to scraping noises.

Loose cone clamps or the edge of a diaphragm in intermittent contact with the cabinet or supporting chassis will give rise to jingles.

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

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high frequency. Signals obtained at this frequency in supersonic reception are converted 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 usually 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.

When a large amount of reaction or regeneration is applied to a sharply tuned circuit, the sharpness of tuning is increased still further. In a suitably designed circuit the reaction can be increased to a point at which the circuit is extremely critically tuned. In other words, the resonance curve becomes highly peaked.

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 an ordinary tuned circuit the resonance curve is somewhat flat at the top, and this flatness extends over a range which would include all the side bands. Intense reaction, however, on a low loss copper circuit produces 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.

This is frequently achieved by using an extra stage comprising a choke coupling unit in which the choke has an inductance of only a fraction of a henry, or at the most, perhaps two henries.

Correct value can be found very simply from the amplification formula if the shape of the radio-frequency response curve is known. As this is not usually the case, it is best to try the set experimentally by using different chokes, until the best results are obtained.

A rough approximation to tone correction can be obtained simply by using an ordinary transformer which has a low primary inductance. This has a falling bass characteristic, and in many cases it approximates closely to the inverse of the distorted radio-frequency response.

Transformers, Low-Frequency.

Low-frequency or inter-valve transformers can be divided into two classes: Those employing the normal soft iron alloy

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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. If the fault is bad, it can be detected by connecting the windings in series with a small battery and a pair of headphones.

With the special high-permeability nickel-iron type of transformer design for use in parallel-feed circuits it is inadvisable to pass any current through the windings, and tests are best carried out by substituting a transformer known to be correct.

A noisy transformer can be tested very accurately by means of the arrangement shown in page 63. It will be seen that a small current is passed through the winding in series with a resistance which is connected across the input of an amplifier. Any intermittency will produce voltages across the resistance which are tremendously magnified by the amplifier. It is essential, of course, to use very tight connections between the battery, winding and resistance, and to use only a wire-wound resistance known to be perfect.

Short-circuited turns cause a loss in amplification and, generally, raising of the tone, the reproduction sounding very thin and high pitched. A resistance measurement will not show short-circuited turns, as the change in actual resistance is almost infinitesimal.

If there is any doubt as to the existence of shorted turns when other tests have shown everything correct, substitution of a similar transformer must be tried.

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. They should be tested in a similar manner to low-frequency transformers.

The ratio of an output transformer is not always 1 to 1. Very frequently a step down is provided so that the secondary is better suited to the impedance of the speaker with which the set is used. In the case of an output transformer used to energise a moving coil, a step down ratio of the order of anything from 10 to 1 to 30 to 1 should be employed, according to the constants of the coil.

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.

Great care should be taken in testing the secondary winding of an output transformer, since the resistance is very low. If this precaution is not taken, there is a possibility of a meter being burnt out. A moving coil output transformer with a large ratio has a secondary winding with a fractional resistance, very heavy gauge wire being used. Accordingly, if it is found necessary to test this, and such an occurrence would be very rare, the test must be made with an ammeter and a 2-volt accumulator.

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.

Electronic 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.

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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.

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. The measurement of filament current is perfectly simple, as it involves merely the inclusion of an ammeter in the filament circuit, the valve being connected, of course, to a battery of the correct voltage.

The filament current should coincide fairly accurately with the maker's rating. This measurement immediately shows whether the filament is intact. It is better to test the filament continuity in this way rather than use one of the circuit testers, since we have known cases of intermittency arising as soon as the filament becomes hot. The filament current as indicated by the ammeter should remain perfectly constant, even if the valve is moved or tapped gently.

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 current is correct 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 these are found in order, the valve should be returned to the manufacturers for their examination. There is frequently a few milliamps difference between the actual recorded values and those of the maker's curves.

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 in the following manner.

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. Most manufacturers rate their valves at zero grid bias, and 100 volts on the anode.

The circuit shown in Fig. 24 should be arranged, and the change in anode current noted while the grid bias is increased to, say, minus 1.5. By simple proportion the change in anode current for 1 volt can be calculated.

Measurements should not be taken at zero grid volts on power valves, since the total filament emission may be greater than the maximum for which the valve is rated.

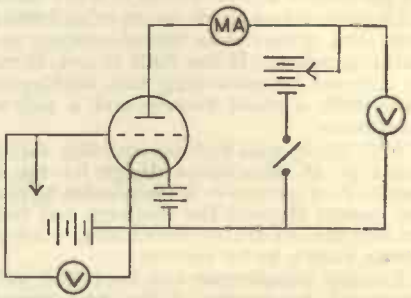

FIG. 24.—A simple circuit for obtaining a fairly accurate measurement of the amplification factor and slope, or mutual conductance, of a valve.

The measurements should be made at a higher anode voltage with the requisite grid bias as shown by the maker's chart.

The amplification factor is the ratio of the voltage produced in the anode circuit to the applied grid voltage. The circuit shown in Fig. 24 is again utilised, but the method of procedure is slightly different. 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 falls. 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

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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.

As a final word of warning, high-tension should never be applied to a large valve without the necessary grid bias. Grid bias should only be altered when the high-tension circuit has been switched off.

Valves, Universal.

Valves for operation from either A.C. or D.C. supplies have heater ratings which 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 happens in the case of the variable-mu valve. The construction is different from the normal type, and the properties are usually obtained by having a gap control grid.

Constants of the valve are entirely controlled by the grid bias. In practice, the grid voltage is generally obtained on the auto bias system.

It is essential to run the valve at the correct screen and anode voltages, and a little more care is necessary in the correct adjustment of these voltages than in the case of the ordinary screen grid valve. The bias variation is quite large, and in the maximum position the mutual conductance is reduced to a fractional value.

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. In this case it is best to provide a switch for disconnecting the potentiometer when the set is not in use, as this prolongs the life of the battery.

When two variable-mu valves are used, the grid potentials of the valves can be simultaneously controlled through a common potentiometer.

When converting a set from ordinary screen grid to variable-mu valves, the value of the potentiometer can be worked out very simply from the bias abacs. With a knowledge of the anode current and the maximum grid bias that will be required, it is easy to determine the value of the potentiometer. The resistance should be made too big rather than too small, so that the maximum desired bias can be obtained with a certain factor of safety.

When a common potentiometer for two valves is arranged, if it is connected so that the anode currents of both valves pass through it, it must be remembered in calculating the value that the current flowing is double that of a single valve.

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.

The resistance of the control can be measured by any resistance measuring arrangement. If the degree of control is slow or too rapid, it is due to a change in the grading of the resistance, which sometimes occurs in the case of a composition type.

DESIGNED FOR THE JOB

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.

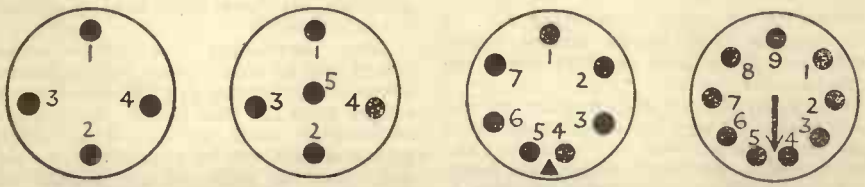
Only Continental valves with unorthodox bases, therefore, are dealt with in the separate chart and diagram below.

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	—	—	OG
" M	OA	OG	AG*	H	H	C	A	—	—	OG
H.F. pentode triode, B	AG	A	S	F	F	—	OA	OG	Met	CG
" M	AG	A	S	H	H	C	OA	OG	Met	OG
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	—

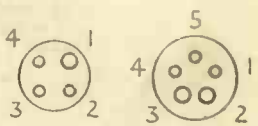
These bases are (left to right) four, five and six pin Continental types, and the "P" and "V" type Mullard universal side-contact bases, respectively.

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

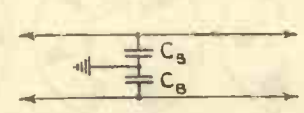


Fig. 1.

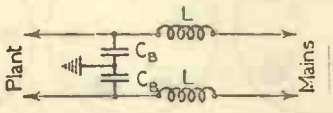


Fig. 2

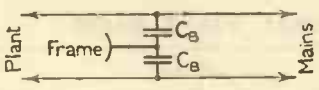


Fig. 5

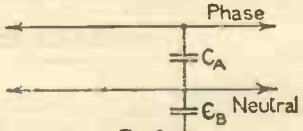


Fig. 6.

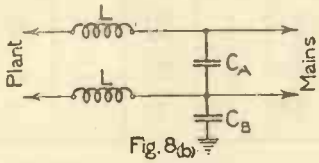


Fig. 8(b)

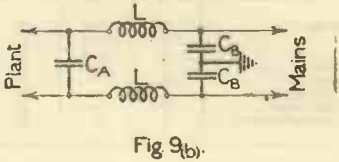


Fig 9(b).

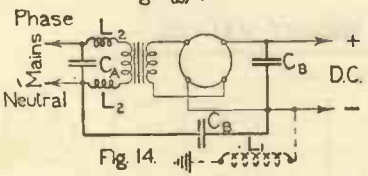


Fig. 14.

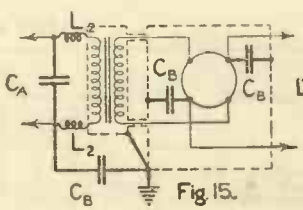


Fig. 15.

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.

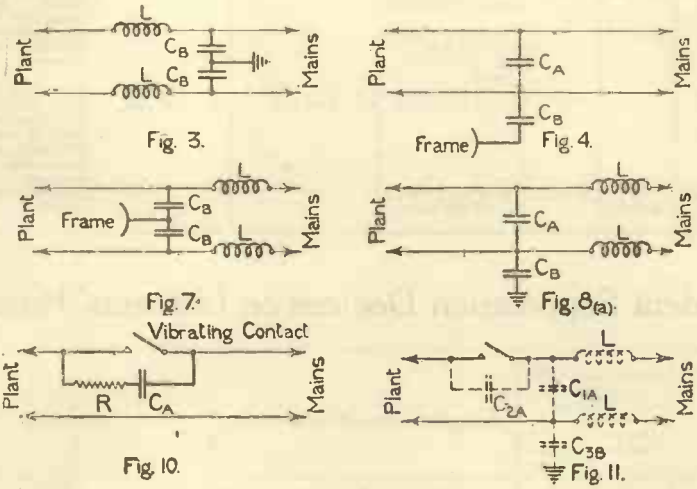
In addition to the recommended circuits and tables of values reproduced herewith the specification contains similar information dealing with commercial apparatus and plant.

In the tables given overleaf on page 96 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 96. 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.
			With earthed Frames.	Frames not earthed.		
	Universal or A.C.	D.C.		Universal or A.C.	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: $C2_A$; $C2_A$ $C1_A + C3_B$; 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	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	$L=l_1+l_2+l_3$	$L=\frac{1}{\frac{1}{l_1}+\frac{1}{l_2}+\frac{1}{}}$

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.

$$\underset{\text{(metres)}}{\text{Wavelength}} = \frac{300 \text{ million}}{\underset{\text{(cycles per sec.)}}{\text{Frequency}}}$$

FOR OSCILLATORY CIRCUITS.

Wavelength of a circuit LC is given by :—

$$\lambda = 1885\sqrt{LC}$$

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 :—

$$W = \frac{I_a E_a}{1{,}000}$$

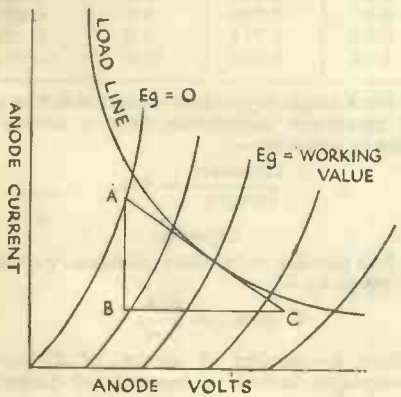
where I_a equals the steady anode current in milliamps and E_a is the anode voltage.

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.

$$\text{Permeability} = \frac{\text{Flux Density}}{\text{Magnetising force}}$$

$$i.e. \quad \mu = \frac{B}{H}$$

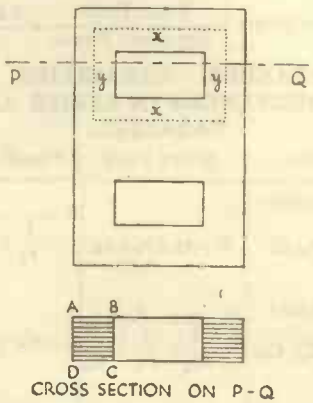
IRON CORE INDUCTANCES.

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	·684	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.

	Beacon Wire.			Iron Wire.		German Silver.	
Gauge.	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	1,375
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	18,450	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

Supply Voltages in Great Britain.

By Courtesy of "The Practical Electrician's Pocket Book."

Abberlady .. 230A
Abberton .. 230A
Abbey Wood .. 200A
220A
Abbeytown .. 230A
Abbots Bromley 230A
Abbots Langley 200A
240A
Abbots Leigh .. 230A
Abbotsham .. 230A
Abbotskerwell .. 200A
Abdie 250A
Aberangell .. 230C
Aberayron .. 230C
Aberbargoed .. 230A
Aberbeeg .. 250C
Abercanaid .. 250A
Abercarn .. 230A
Abercave .. 240C
Abercynon .. 230A
Aberdeen .. 220C
230A
Aberdour .. 250A
Aberfan .. 250A
Aberford .. 230A
Abergwili .. 230A
Abergwynfi .. 230A
Abersychan .. 230A
Aberthin .. 230A
Abertillery .. 250A
Abertridwr .. 230A
Aberystwyth .. 220C
Abingdon .. 230A
Abinger .. 230A
Abinghall .. 230A
Abington
Piggotts .. 240A
Abram 230A
Abthorpe .. 230A
Accrington .. 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 Grange .. 250A
Addiewell .. 230A
Addingham .. 230A
Addington .. 230A
Addington Great 230A
Addington Little 230A
Addlestone .. 200A
Adlington (Ches.) 230A
Adlington
(Lancs.) .. 230A
Adstock .. 230A
Adstone .. 230A
Adswood .. 230A
Adwick-le-Street 230A
Agden 250A
Aglionby .. 230A
Ahewas 230A
Aikton 230A
Ailsworth .. 230A
Ainsworth .. 230A
Airdale 230A
Airdrie 240C
Airmyn 230A
Airth 250A
Akeley 230A
Albrighton .. 230A
Albury 230A
Alby-with-
Thwaite .. 230A
Aldborough .. 230A
Aldeburgh .. 200C
Aldeby 230A
Aldenham .. 200A
Alderley Edge .. 230C
Aldersey .. 230A
Aldersford .. 230A
Aldershot .. 210C
230A
Alderton .. 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
Allerton
Bywater .. 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
Altham .. 230A
Althorne .. 230A
Altofts 230A
Altrincham .. 100A
200A
Alva 250A
Alvanley .. 250A
Alvaston .. 200A
Alverdiscott .. 230A
Alverstoke .. 240C
Alverthorpe .. 230A
230A
Alverston .. 230A
Alwalton .. 240A
Alwoodley .. 230A
Amberley .. 230A
Amble 250A
Ambleeote .. 200A
Ambleside .. 100A
200A
Amersham .. 200A
Amersham Hill.. 200A
Amesbury .. 220C
Amington .. 250A
Ammanford .. 230A
250C
Ampthill .. 230A
Ancrum .. 250A
Anderton .. 220A
Andover .. 230A
Anerley 200A
Angmering .. 230A
Anlaby 230A
Annables .. 240A
Annfield Plain .. 250A
Ansley 250A
Anslow 230A
Anstey 250A
Anstey Pasture.. 240A
Anston 230A
Anstruther .. 250A
Ansty 250A
Antrobus .. 250A
Appleby.. .. 230A
Appledore .. 230A
Appleton .. 250A
Apuldram .. 230A
Arbroath .. 250A
250C
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
Ascot 220C
Ascott 240A
Asfordby .. 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
Ashford 230A
Ashill 230A
Ashingdon .. 230A
Ashington .. 230A
Ashley (Ches.) .. 220A
Ashley (Shrops.) 230A
Ashley Green .. 200A
Ashow 250A
Ashtead 230C
Ashton (Ches.) .. 230A
Ashton (Lancs.) 230A
Ashton-in-
Makerfield .. 230A
Ashton-on-
Ribble .. 230A
Ashton-under-
Lyne 240C
240A
Ashton-upon-
Mersey .. 240A
Ashurst (Hants.) 230A
Ashurst (Kent).. 220A
Ashurst Wood .. 230A
Ashwell (Herts.) 240A
Ashwell (Leics.) 230A
Ashwellthorpe .. 230A
Ashwick.. .. 230A
Askam 220A
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
(Warwicks.) .. 250A
Aston (Herts.) .. 240A
Aston (Lancs.) .. 250A
Aston (London) 240A
Aston (Staffs.) .. 230A
Aston Clinton .. 220A
Aston-cum-
Aughton .. 230A
Aston Flamville 250A
Aston Grange .. 250A
Athelstoneford .. 230A
Atherstone .. 250
Atherton .. 240A
Attleborough .. 230A
Atworth.. .. 230A
Auchencairn .. 230A
Atworth.. .. 230A
Auchencairn .. 230A
Auchendinny .. 230A
Auchenheath .. 240A
Auchlineck .. 240A
Auchterderran .. 250A
Auchtermuchty 250A
Audenshaw .. 230A
Aughton .. 230A
Austrey.. .. 250A
Austwick .. 230A
Aveley 230A
Aveton Gifford.. 240A
Avonbridge .. 250A
Awlescombe .. 230A
Axbridge .. 230A
Axminster .. 250A
Aylburton .. 230A
Aylesbury .. 220A
220C
Aylesford .. 230A
Aylsham .. 230A
Aynho 230A
Ayot St. Law-
rence .. 240A
Ayr 240A
240C
Babraham .. 240A
Bache 230A
Backbarrow .. 230A
Backford .. 230A
Backwell .. 230A
Bacton 230A
Bacup 230A
Badby 230A
Baddeley .. 230A
Baddesley Ensor 250A
Badgemore .. 230A
Badgeworth .. 210A
Badshot Lea .. 230A
Bagnall 230A
Bagshot .. 230A
Bagworth .. 250A
Baildon 230A
Baillieston .. 240A
Balcombe .. 230A
Balderstone .. 230A
Baldock .. 240A
Baldrina .. 230A
Balerno 230A
Balham 205A
230A
Ballater .. 220C
Ballaugh .. 230A
Balmaclellan .. 230A
Balmerino .. 250A
Balmore.. .. 240A
Balsall Common 230A
Bampton .. 230A
Banavie .. 150C
Bangor 230A
Banningham .. 230A
Bannockburn .. 250A
Banstead .. 230A
230A
Banwell .. 230A
Bapchild .. 230A
Barassie .. 240A
Barbon 230A
Barby 230A
Bardney .. 230A
Bardon 250A
Bardsea .. 230A
Bardsey .. 230A
Bardsley .. 240A
Barford (Norfolk) 230A
Barford
(Warwicks.) .. 250A
Bargeddie .. 240A
Bargoed .. 230A
Barkby 250A
Barking .. 230A
Barkisland .. 230A
Barkley Thorpe 240A
Barkston .. 230A
Barkston Ash .. 230A
Barkway .. 240A
Barlaston .. 230A
Barlborough .. 250A
Barlby 230A
Barlestone .. 250A
Barley 240A
Barleythorpe .. 230A
Barmby Moor .. 230A
Barming .. 230A
Barmbarrock .. 230A
Barnby 230A
Barnby Dun .. 230A
Barnby Moor .. 230A
Barnes 210C
Barnet 240A
240C
Barnham .. 230A
Barnham Broom 230A
Barnoldby-le-
Beck 230A
Barnoldswick .. 230A
Barnsley .. 230C
230A
Barnstaple .. 230C
Barnton .. 220A
Barnwell All
Saints.. .. 230A
Barnwell St.
Andrew .. 230A
Barnwood .. 230A
Barrow (Ches.) .. 230A
Barrowby .. 230A
Barrowfield .. 240A
Barrowford .. 230A
Barrow Gurney 230A
Barrow-in-
Furness .. 220C
220A
Barry 230A
Barrymarbor .. 250A
Barsby 230A
Barston 230A
Barton (Beds).. 240A

Barston (Ches.) .. 230A
Barton (Lancs.) 230A
Barton (Somst.) 230A
Barton Mills .. 220C
Barton-on-Humber .. 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
Basing 230A
Basingstoke .. 230C 230A
Bassingbourne .. 440A
Baston 230A
Batcombe .. 230A
Bath 230C 230A
Bathampton .. 230A
Batheaston .. 230A
Bathford .. 230A
Bathgate .. 230A
Batley 220C 230A
Battersea .. 230C 230A
Battle 230A
Batts Corner .. 230A
Bawburgh .. 230A
Bawdeswell .. 230A
Bawdsey .. 230A
Bawtry .. 230A
Bayford .. 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 .. 239A
Beaumont Leys 240A
Bebington .. 230A
Beccles 230A
Beckenham .. 200A
Beckermet .. 230A
Beckington .. 230A
Beckley 230A
Bechwithshaw .. 230A
Beddingham .. 230A
Beddington .. 205A 230A
Bedfont .. 200A 230A
Bedford .. 105A 210A
Bedhampton .. 230A
Bedingham .. 230A
Bedlars Green .. 240A
Bedlinog .. 230A
Bedwas 230A
Bedwellty .. 230A
Bedworth .. 250A
Beeding .. 230A
Beeford 230A
Beer 220C
Beeston (Beds.) 210A
Beeston (Ches.) .. 203A
Beeston St. Andrew .. 230A
Beetham .. 230A
Beetley .. 230A
Beighton .. 200A
Beith 240A
Bellshill .. 240A
Belisquarry .. 230A
Belmont (Lancs.) 230A
Belstone 230A
Belton (Derby) .. 250A
Belton (Lincs.) .. 230A
Belton (Norfolk) 230A
Belvedere .. 200A
Bembridge .. 240A
Bempton .. 230A
Bendish .. 240A
Benenden .. 230A
Benfleet .. 230A
Benhall 230A
Beningborough .. 230A
Benington .. 230A
Benninghoime .. 230A
Ben Rhydding .. 230A
Bentham .. 230A
Bentley (Surrey) 230A
Bentley (Warwicks.) .. 200A
Bentley-with-Arksey .. 230A
Bere Alston .. 230A
Bere Ferrers .. 230A
Bergh Apton .. 230A
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Windermere .. 100A
200A
Windle 230A
Windlesham .. 220C
Windlesham
(Chertsey Rd.) 240A
Windygates .. 250A
Winford .. 230A
Wing (Beds.) .. 240A
Wing (Lincs.) .. 230A
Winkfield .. 240A
Winkfield Row 240A
Winnersh .. 230A
Winnington .. 220A
220C
Winscombe .. 230A
Winsford .. 220A
Winskill .. 230A
Winsley .. 230A
Winslow .. 230A
Winstanley .. 230A
Winterbourne .. 210A
Winterton .. 230A
Winwick-with-
Hulme .. 250A
Wirral 230A
Wisbech .. 240C
Wiseton .. 230A
Wishanger .. 230A
Wishaw (Lanark) 240C
Wishaw
(Warwicks.).. 230A
Wisley .. 200A
Wissendene .. 230A
Wiswell .. 230A
Witham .. 230A
230A
Witheridge .. 230C
Witherley .. 250A
Withernsea .. 230A
Withnell .. 230A
Withybrook .. 250A
Withyham .. 230A
Witney .. 220C
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
Wollaston .. 230A
Wollescote .. 200A
Wolstanton .. 240A
Wolston .. 250A
Wolverton .. 230A
Wolviver .. 250A
Wolvey.. .. 250A
Wombourn .. 200A
Wombwell .. 230A
Wouersh .. 230A
Woodall .. 230A
Woodbank
(Ches.) .. 230A
Woodbastwich.. 230A
Woodbridge .. 230A
Woodbury .. 230A
Woodchester .. 230A
Woodchurch .. 230A

Wood Dalling .. 230A
Wood End .. 250A
Woodford
(Ches.) .. 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
Woodmaucote
(Sussex) .. 230A
Woodmansey .. 230A
Woodmansterne 230A
Wood Newton.. 230A
Wood Norton .. 230A
Wood Plumpton 230A
Wood Rising .. 230A
Woodseaves .. 230A
Woodside .. 240A
Woodstock .. 230A
Woodston .. 230A
Wood Street
(Surrey) .. 230A
Woodthorpe
(Derby) .. 250A
Woodthorpe
(Leic.) .. 230A
Woodton .. 230A
Woodville .. 230A
Wookey .. 230A
Woolacombe .. 230A
Woolley .. 230A
Woolmer .. 230A
Woolwich .. 220A
Woolsthorpe .. 230A
Woolston .. 230A
Woolston with
Martinscroft 250A
Woore 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 Vill .. 230A
Wootton Wawen 250A
Worcester .. 200A
Wordsley .. 200A
Workington .. 240A
Worksop .. 220A
220C
230A
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
Wortom .. 230A
Wothorpe .. 230A
Wotton .. 230A
Wouldham .. 230A
Wrabness .. 230A
Wrafton .. 220C
Wrangle .. 230A
Wraxall .. 230A
Wray 230A
Wraysbury .. 230A
200A
Wrayton .. 230A
Wrea Green .. 230A
Wrecclesham .. 230A
Wrenthorpe .. 230A
Wrexham .. 230A
230C
Wrightington .. 230A
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
Wyton (Yorks.) 230A

Yalding .. 230A
Yapton.. .. 230A
Yardley Gobion 230A
Yardley
Hastings .. 230A
Yarmouth
(I.O.W.) .. 240A
Yarnfield .. 230A
Yate 230A
Yateley .. 230A
Yatton .. 230A
Yaverland .. 240A
Yaxham .. 230A
Yaxley .. 230A
Yeadon .. 230A
Yealand
Conyers .. 230A
Yealand
Redmayne .. 230A
Yealmpton .. 230A
Yelvertoft .. 230A
Yelverton .. 230A
Yeovil 230A
240C
Yeovil Without 230A
Yetminster .. 230A
Yiewsley .. 200A
Ynismeudw .. 230A
Ynysawdre .. 230A
Ynyslas .. 230C
Ynysybwl .. 230A
Yoker 240A
York 230A
230C
Yorktown .. 250A
Youlton .. 230A
Yoxall 230A
Ystalyfera .. 230A
Ystradgynlais 220C
Ystrad Mynach 230A
Ystradowen .. 230A

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.

CLASSIFIED VALVE DATA CHART

The chart is arranged in twelve sections, as follows: Frequency changers, screen grids and H.F. pentodes, diode valves, diode combination valves, general purpose triodes, power output triodes, pentode output valves, double output valves, rectifiers, metal rectifiers, Westectors, and barretters.

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.

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; † indicates D.C. valves; A. (in base pins column) indicates an American base; C (in base pins column) indicates a Continental base; M indicates amplification factor; S.C. side contacts; V, variable; and V.D., voltage doubler. In the screen grid and H.F. pentode section the application of the valve is indicated in the column following the type number. S, indicates screen grid; V.S., variable-mu screen grid; P, H.F. pentode; and V.P., variable-mu H.F. pentode.

FREQUENCY CHANGERS.

Maker.	Type.	Circuit.	Fil. volts.	Fil. amps.	Anode volts.	Screen volts.	Oscillator volts.	Conv. cdt. m'hos.	Grid. bias.	Base pins.	Price.
Brimar	*15A2	Heptode	4.0	0.65	250	100	200	550	—3—40	7	20/-
	°15D1	Heptode	13.0	0.2	250	100	200	550	—3	7	20/-
Cossor	210PG	Heptode	2.0	0.1	150	80	150	1,000	0—9	7	18/6
	210DG	Double Grid	2.0	0.1	100	—	—	—	—	6	20/-
	*41MPG	Heptode	4.0	1.0	250	100	100	1,200	—1½—10	7	20/-
	*41MDG	Double Grid	4.0	1.0	200	—	—	—	—	6	19/-
	°13PGA	Heptode	13.0	0.2	250	100	200	700	—1½—20	7	20/-
Dario	*TK24	Octode	4.0	0.65	250	70	70	600	—1½	7	15/6
Ever Ready	K80A	Octode	2.0	0.125	150	70	70	240	0	7	18/6
	*A80A	Octode	4.0	0.65	250	90	90	600	—1½	7	20/-
Ferranti	VHT2A	Heptode	2.0	0.1	150	70	120	—	0—9	7	18/6
	*VHT4	Heptode	4.0	1.0	200	100	200	—	—1—25	7	20/-
	°VHTA	Heptode	13.0	0.2	250	100	200	—	—1—25	7	20/-
Hivac	TP230	Triode Pentode	2.0	0.3	150	80	100	325	1½	9	15/6
Marconi	X21	Heptode	2.0	0.1	150	70	70	200	0—9	7	18/6
	*X41	Triode Hexode	4.0	1.2	250	80	120	640	—1½—35	7	20/-
	*MX40	Heptode	4.0	1.0	250	100	150	500	—3—40	7	20/-
	°X31	Triode Hexode	13.0	0.3	250	80	120	640	—1½—35	7	20/-
	°X30	Heptode	13.0	0.3	250	100	150	800	—3—37	7	20/-
	°X32	Heptode	13.0	0.3	250	100	150	800	—3—37	7	20/-
Mazda	TP22	Triode Pentode	2.0	0.25	150	150	150	500	—1½	9	18/6
	*ACTP	Triode Pentode	4.0	1.25	250	250	200	700	—5	9	20/-
	°TP2620	Triode Pentode	26.0	0.2	250	250	200	700	—5	9	20/-
	TP1340	Triode Pentode	13.0	0.4	250	250	200	700	—5	9	20/-

VALVE DATA CHART

Maker.	Type.	Circuit.	Fil. volts.	Fil. amps.	Anode volts.	Screen volts.	Oscillator volts.	Conv. cdt. m'hos.	Grid. bias.	Base pins.	Price.
Mullard	PC2	Octode ..	2.0	0.125	150	70	150	240	—	7	18/6
	*PC4	Octode ..	4.0	0.65	250	90	90	600	—1½	7	20/-
	*TP4	Triode Pentode	4.0	1.25	250	150	150	650	—5	9	20/-
	*PC13 .. }	Octode ..	13.0	0.2	200	90	90	600	1½	8SC	20/-
	*PC13C }									7	
Osram	X21	Heptode ..	2.0	0.1	150	70	70	200	0—9	7	18/6
	*X41	Triode Hexode	4.0	1.3	250	80	150	550	—1½	7	20/-
	*MX40 ..	Heptode ..	4.0	1.0	250	100	150	500	—3	7	20/-
	*X30 .. }	Heptode ..	13.0	0.3	250	100	150	750	—3	7	20/-
	*X32 .. }										
	*X31	Triode Hexode	13.0	0.3	250	80	150	550	—1½	7	20/-
Ostar-Ganz ..	*G5	Heptode ..	250	0.02	250	75	250	—	—3—30	7	19/6
Philco	1A6	Heptode ..	2.0	0.06	180	67.5	135	300	—3—22½	6A	16/-
	1C6	Heptode ..	2.0	0.13	180	67.5	135	325	—3—14	6A	16/-
	*2A7	Heptode ..	2.5	0.8	250	100	250	475	—3—50	7A	16/-
	*6A7	Heptode ..	6.3	0.3	250	100	250	475	—3—42.5	7A	16/-
Triotron	O202	Octode ..	2.0	0.14	150	70	70	250	—1	7	13/6
	*O406	Octode ..	4.0	0.65	250	70	70	650	—1½	7	15/6
	*O1307 ..	Octode ..	13.0	0.2	200	70	70	650	—3	7	15/6
Tungsram ..	DG2100 ..	Doublegrid ..	2.0	0.12	100	—	—	—	—	4	15/-
	VO2	Octode ..	2.0	0.06	135	45	70	300	—12	7	15/-
	MH206 ..	Heptode ..	2.0	0.06	180	66	135	300	0—22½	7	15/-
	*VO4	Octode ..	4.0	0.65	250	70	90	600	—1½—25	7	16/-
	*MH1118 ..	Heptode ..	10.0	0.18	200	100	130	470	V	7C	16/-
	*VO13 ..	Octode ..	13.0	0.2	250	70	90	600	—1½—25	7	16/-
	2A7	Heptode ..	2.5	0.8	250	100	150	520	V	7A	14/-
	6A7	Heptode ..	6.3	0.3	250	100	150	520	V	7A	14/-
362..	*ACFC4 ..	Octode type	4.0	1.0	250	80	150	—	0—8	7	15/-
	*UFC	Heptode ..	6.5	0.3	250	150	90	120	0—10	7	15/-

SCREEN GRID AND H.F. PENTODE VALVES.

Maker.	Type.	Description.	Fil. volts.	Fil. amps.	Anode volts.	Screen volts.	Grid bias.	Anode current.	Screen current.	Bias res. ohms.	Slope mA/v.	Base pins.	Price.
Brimar ..	*8A1	P ..	4.0	1.0	200	80	—1½	2.5	—	500	4.0	7	17/6
	*9A1	VP	4.0	1.0	200	80	—1½—35	1.0	2.0	V	4.25	7	17/6
	*9D2	VP	13.0	0.2	250	125	—3—40	10.0	3.5	V	1.65	7	17/6
Cossor ..	215SG ..	S ..	2.0	0.15	150	80	—1½	0.7	—	—	1.1	4	12/6
	220SG ..	S ..	2.0	0.2	150	80	—1½	0.7	—	—	1.6	4	12/6
	210SPT ..	P ..	2.0	0.1	150	80	—1½	2.0	—	—	1.3	4 & 7	13/6
	220VS ..	VS ..	2.0	0.2	150	80	0—9	1.6	—	—	1.6	4	12/6
	220VSG ..	VS ..	2.0	0.2	150	80	0—15	2.6	—	—	1.6	4	12/6
	210VPT ..	VP	2.0	0.1	150	80	0—9	2.9	—	—	1.1	4 & 7	13/6
	*MSG-HA ..	S ..	4.0	1.0	200	100	—1½	2.0	—	600	2.0	5	17/6
	*41MSG ..	S ..	4.0	1.0	200	80	—1½	0.8	—	1,500	2.5	5	17/6
	*MSG-LA ..	S ..	4.0	1.0	200	100	—1½	5.2	—	250	3.75	5	17/6
	*MVSG ..	VS ..	4.0	1.0	200	100	—1½—35	7.8	—	V	2.5	5	17/6
	*MS-Pen. ..	P ..	4.0	1.0	200	100	—1½	4.5	1.3	250	2.8	5 & 7	17/6
	*MS-Pen. A ..	P ..	4.0	1.0	200	150	—2½	9.0	5.0	200	4.0	5	17/6
	*MVS-Pen. ..	VP	4.0	1.0	200	100	0—20	4.2	—	V	3.0	5 & 7	17/6
	*13SPA ..	P ..	13.0	0.2	200	100	—1½	5.0	—	300	2.5	7	17/6
	*13VPA ..	VP	13.0	0.2	200	100	0—30	10.0	—	V	1.8	7	17/6
	†DVSG ..	VS ..	16.0	0.25	200	100	—1½—35	7.5	—	V	2.8	5	17/6
	†DS Pen. ..	P ..	16.0	0.25	200	100	—1½	5.0	1.7	250	2.3	5	17/6
	†DVS Pen. ..	VP	16.0	0.25	200	100	—1½—20	6.0	—	V	2.0	5	17/6
Dario ..	TE622 ..	S ..	2.0	0.18	150	90	—½	2.0	0.5	—	1.4	4	9/6
	TB452 ..	VS ..	2.0	0.15	150	75	0—9	2.0	0.4	—	1.5	4	9/6
	PF462 ..	P ..	2.0	0.18	150	150	—½	3.0	1.0	—	1.85	7	10/0
	PF472 ..	VP	2.0	0.18	150	150	—½—16	2.5	0.5	—	1.7	7	10/0
	*TE424 ..	S ..	4.0	1.0	200	100	—1½	1.5	0.5	—	0.9	5	12/6
	*TE524 ..	S ..	4.0	1.0	200	100	—2	3.0	1.0	—	2.0	5	12/6
	*TE554 ..	VS ..	4.0	1.0	200	100	—1½—40	3.0	1.0	V	3.0	5	12/6
	*TE464 ..	P ..	4.0	1.1	200	100	—2	3.0	1.5	—	2.5	5 or 7	12/6
	*TE474 ..	VP	4.0	1.1	200	100	—1½—30	4.5	2.0	V	2.0	5 or 7	12/6
Ever Ready	K40N ..	VS ..	2.0	0.18	150	90	0—7	2.5	—	—	1.4	4	12/6
	K50M ..	VP	2.0	0.18	150	150	0—7	3.7	—	—	1.7	7	13/6
	*A50A ..	P ..	4.0	1.0	200	100	—1½	4.5	1.0	350	3.0	5	17/6
	*A50N ..	VP	4.0	1.2	200	100	—1½	5.0	—	—	3.2	5 & 7	17/6
	*C50N ..	VP	13.0	0.2	200	200	—2	9.0	3.5	—	3.0	7	17/6
Ferranti ..	*VPT4 ..	VP	4.0	1.0	200	100	—2—25	5.5	2.0	V	2.6	5	17/6
Hivac ..	XSG ..	S ..	2.0	0.06	120	60	0	1.75	0.35	—	0.6	Midget	15/6
	SG215 ..	S ..	2.0	0.15	150	80	—1½	4.0	0.4	—	1.0	4	10/6
	SG220 ..	S ..	2.0	0.2	150	80	—1½	5.0	0.4	—	1.5	4	10/6
	VS215 ..	VS ..	2.0	0.15	150	80	0—14	5.0	0.4	—	1.0	4	10/6
	HP215 ..	P ..	2.0	0.15	150	70	—1½	1.5	0.3	—	1.2	7	10/6
	VP215 ..	VP	2.0	0.15	150	70	0—9	3.75	0.75	—	1.25	7	10/6
	*AC/SL ..	S ..	4.0	1.0	200	80	—1	7.0	0.8	125	3.3	5	13/6
	*AC/SH ..	S ..	4.0	1.0	200	80	—1½	12.0	0.8	120	3.5	5	13/6
	*AC/HP ..	P ..	4.0	1.0	200	100	—2	4.0	1.75	450	3.2	5 & 7	13/6
	*AC/VS ..	VS ..	4.0	1.0	200	80	0—40	9.0	0.8	V	3.0	5	13/6
	*AC/VH ..	VS ..	4.0	1.0	200	80	0—40	14.0	0.9	V	3.3	5	13/6
	*AC/VP ..	VP	4.0	1.0	200	100	0—30	10.0	3.0	V	3.0	5 & 7	13/6

Maker.	Type.	Description.	Fil. volts.	Fil. amps.	Anode volts.	Screen volts.	Grid bias.	Anode current.	Screen current.	Bias res. ohms.	Slope mA/v.	Base pins.	Price.
Lissen ..	SG215 ..	S ..	2.0	0.15	150	80	—1	1.5	0.3	—	1.1	4	12/6
	SG2V ..	VS ..	2.0	0.15	150	80	0—10	12.0	3.5	—	1.2	4	12/6
	*AC/SG ..	S ..	4.0	1.0	200	80	—1½	7.0	0.5	200	3.25	5	17/6
	*AC/SGV ..	VS ..	4.0	1.0	250	80	0—20	6.0	0.5	V	3.5	5	17/6
Marconi ..	S23	S ..	2.0	0.1	150	70	0—1½	2.8	0.7	—	1.1	4	12/6
	S24	S ..	2.0	0.15	150	70	0—1½	3.3	0.7	—	1.4	4	12/6
	VS2	VS ..	2.0	0.15	150	75	0—15	5.0	2.0	—	1.25	4	12/6
	VS24	VS ..	2.0	0.15	150	75	0—9	4.4	0.3	—	1.5	4	12/6
	VP21	VP ..	2.0	0.1	150	60	0—9	2.9	0.7	—	1.1	4	13/6
	*MS4B	S ..	4.0	1.0	200	80	—2	3.4	1.2	250	3.2	5	17/6
	*MS4	S ..	4.0	1.0	200	70	—1½	2.4	0.3	550	1.1	5	17/6
	*VMS4	VS ..	4.0	1.0	200	80	2—30	7.5	2.0	V	2.6	5	17/6
	*VMS4B	VS ..	4.0	1.0	200	80	—1—15	5.0	1.2	V	2.9	5	17/6
	*MSP4	P ..	4.0	1.0	200	100	—2	4.0	1.0	400	4.0	5 & 7	17/6
	*VMP4/G	VP ..	4.0	1.0	250	100	—1—25	8.0	5	V	2.7	7	17/6
	*VMP4/K	VP ..	4.0	1.0	250	100	—1—25	7.0	4.3	V	2.5	7	17/6
	*VMP4	VP ..	4.0	1.0	200	100	—1—20	5.5	1.5	V	3.5	5 & 7	17/6
	°W30	VP ..	13.0	0.3	250	100	—1—35	12	6	V	4.0	7	17/6
	°W31	VP ..	13.0	0.3	250	100	—2—25	8	5	V	2.7	7	17/6
	†DS	S ..	16.0	0.25	200	70	—1½	2.4	0.3	600	1.1	5	17/6
	†DSB	S ..	16.0	0.25	200	80	—1	3.4	1.2	220	3.2	5	17/6
	†VDS	VS ..	16.0	0.25	200	80	—1—30	11.0	1.2	V	2.4	5	17/6
	†VDSB	VS ..	16.0	0.25	200	80	—1—25	5.5	0.6	V	3.0	5	17/6
Mazda ..	8G215	S ..	2.0	0.15	150	80	—1½	1.5	0.25	—	1.1	4	12/6
	S215A	S ..	2.0	0.15	150	80	—1½	1.9	0.3	—	1.1	4	12/6
	S215B	S ..	2.0	0.15	150	80	—1½	1.5	0.3	—	1.7	4	12/6
	S215VM	VS ..	2.0	0.15	150	80	0—9	1.0	0.15	—	1.4	4	12/6
	SP215	P ..	2.0	0.15	150	150	—1½	1.35	0.47	—	1.3	4	13/6
	VP215	VP ..	2.0	0.15	150	150	0—9	1.1	0.385	—	0.82	4	13/6
	*AC8G	S ..	4.0	1.0	200	80	—2	4.5	0.8	400	1.9	6	17/6
	*AC82	S ..	4.0	1.0	200	80	—1½	7.0	1.2	170	3.4	5	17/6
	*AC81VM	VS ..	4.0	1.0	200	100	—1½—40	4.5	1.0	V	1.1	5	17/6
	*AC8GVM	VS ..	4.0	1.0	200	80	—2—35	5.0	1.0	V	2.0	5	17/6
	*AC82 Pen. ..	P ..	4.0	1.0	250	100	—4½	6.5	2.2	500	5.5	7	17/6
	*AC/SP1	P ..	4.0	1.0	250	250	—3	5.0	3.5	370	3.0	7	17/6
	*AOVP1	VP ..	4.0	0.65	250	250	—4—43	8.8	2.2	V	2.0	7	17/6
	*SP1320	P ..	13.0	0.2	250	100	—1½	4.5	0.9	300	3.0	7	17/6
	*SP2220	P ..	22.0	0.2	250	250	—3	5.0	3.5	370	3.0	7	17/6
	*VP1321	VP ..	13.0	0.2	250	250	—4—43	8.8	2.2	V	2.0	7	17/6
	†DC2/8G	S ..	20.0	0.1	200	100	—1½	5.5	1.5	170	1.8	5	17/6
	†DC2/SGVM	VS ..	20.0	0.1	200	100	—1—30	5.0	1.0	V	1.5	5	17/6
Mullard ..	PM12A	S ..	2.0	0.18	150	90	0	2.9	0.5	—	1.5	4	12/6
	PM12M	VS ..	2.0	0.18	150	90	0—7	2.5	0.5	—	1.4	4	12/6
	PM12	S ..	2.0	0.15	150	75	—	4.25	0.8	—	1.1	4	12/6
	PM12V	VS ..	2.0	0.15	150	90	0—15	5.4	1.0	—	0.75	4	15/6
	SP2	P ..	2.0	0.18	150	150	0	3.6	1.0	—	2.2	7	13/6
	VP2	VP ..	2.0	0.18	150	150	0—7	3.75	0.5	—	1.75	7	13/6
	*S4V	S ..	4.0	1.0	200	75	—1	1.5	0.6	600	1.1	4 & 5	17/6
	*S4VA	S ..	4.0	1.0	200	110	—1½	2.75	0.7	500	2.0	5	17/6
	*S4VB	S ..	4.0	1.0	200	110	—1½	5.0	1.5	300	2.5	5	17/6
	*VM4V	VS ..	4.0	1.0	200	100	1½—40	8.5	0.8	V	2.0	5	17/6
	*MM4V	VS ..	4.0	1.0	200	110	—1½—40	6.0	2.0	V	3.0	5	17/6
	*SP4	P ..	4.0	1.0	200	100	—1½	4.5	1.0	350	3.5	5 & 7	17/6
	*SP4B	P ..	4.0	0.65	250	250	—2	6.0	2.4	180	4.0	7	17/6
	*VP4	VP ..	4.0	1.0	200	100	—1½—22	6.0	1.5	V	2.5	5 & 7	17/6
	*VP4A	VP ..	4.0	1.2	200	100	1½—16	5.0	1.5	V	3.27	5 & 7	17/6
	*VP4B	VP ..	4.0	0.65	250	250	—3—40	11.5	4.25	V	3.5	7	17/6
	*SP13	P ..	13.0	0.2	200	100	—2	3.5	1.0	400	2.2	880	17/6
	*SP13C	P ..	13.0	0.2	200	200	—1½	2.5	2.0	270	3.5	7	17/6
	*VP13A	VP ..	13.0	0.2	200	100	—2—20	4.0	1.0	V	2.2	880	17/6
	*VP13C	VP ..	13.0	0.2	200	200	—2—30	9.0	2.7	V	3.0	7	17/6
	†8G20	S ..	20.0	0.18	200	100	—1½	3.0	0.2	420	2.0	5	17/6
	†SP20	P ..	20.0	0.18	200	100	—1½	4.5	1.0	250	2.7	5	17/6
	†VP20	VP ..	20.0	0.18	200	100	—1½—22	4.5	1.0	V	2.5	5	17/6
Osram ..	S23	S ..	2.0	0.1	150	70	—1½	2.8	0.8	—	1.1	4	12/6
	S24	VS ..	2.0	0.15	150	70	—1½	3.2	1.0	—	1.4	4	12/6
	VS24	VS ..	2.0	0.15	150	75	0—9	4.5	0.5	—	1.5	4	12/6
	VP21	VP ..	2.0	0.1	150	60	0—9	2.8	0.7	—	1.1	7	13/6
	*MS4	S ..	4.0	1.0	200	70	—1½	2.4	0.3	550	1.1	5	17/6
	*MS4B	VS ..	4.0	1.0	200	80	—1	3.4	1.2	250	3.2	5	17/6
	*VMS4	VS ..	4.0	1.0	200	80	—½—40	12.0	2.1	V	2.4	5	17/6
	*VMS4B	VS ..	4.0	1.0	200	80	—½—15	6.7	1.3	V	2.9	5	17/6
	*MSP4	P ..	4.0	1.0	200	100	—1½	3.0	1.0	400	4.0	5 & 7	17/6
	*VMP4G	VP ..	4.0	1.0	250	100	—2½	8.1	5.0	V	2.78	7	17/6
	°W30	VP ..	13.0	0.3	250	250	—1	12.3	6.0	V	4.0	7	17/6
	°W31	VP ..	13.0	0.3	200	100	—2½	8.1	5.0	V	2.78	7	17/6
Ostar Ganz	°S25	S ..	250	0.02	250	100	—2	7.0	—	200	3.8	7	17/—
	°S100	S ..	250	0.02	250	100	—1	1.0	—	600	4.0	7	17/—
	°MS18	VS ..	250	0.02	250	100	—2	5.0	—	V	3.0	7	17/—
	°MS70	VS ..	250	0.02	250	100	—2—40	4.0	—	V	3.0	7	17/—
	°H3	P ..	250	0.02	250	200	—1½	3.5	—	700	3.5	7	17/6
	°V3	VP	250	0.02	250	200	—1—20	4.0	—	V	3.0	7	17/6
Philco ..	32E	S ..	2.0	0.06	180	67.5	—3	1.7	0.4	—	0.65	4A	12/6
	15E (heater)	P ..	2.0	0.24	135	67.5	—1½	1.85	0.6	—	0.62	5A	15/6
	1A4E ..	VP	2.0	0.06	135	67.5	—3—18	—	—	—	—	—	13/—
	34E	VP	2.0	0.06	180	67.5	—3—23	2.8	—	—	0.62	4A	12/6
	*24E	S ..	2.5	1.75	250	90	—3—9	4.0	0.33	—	1.05	5A	12/—
	*35E	VS ..	2.5	1.75	250	90	—3—28	6.3	0.33	V	1.05	5A	11/—
	*36E	S ..	6.3	0.3	250	90	—3	3.4	0.33	—	1.1	5A	13/—
	*6D6E	P ..	6.3	0.3	250	100	—3	8.2	2.0	—	1.6	6A	18/—
	*77E	P ..	6.3	0.3	250	100	—3	2.3	0.6	—	1.25	6A	13/—
	*39/44E	VP	6.3	0.3	250	90	—3—42½	5.8	1.4	V	1.05	5A	14/—
	*78E	VP	6.3	0.3	250	125	—3—52½	10.5	3.0	V	1.65	6A	13/—
	†14E	S ..	14.0	0.3	250	90	—3—9	4.0	0.33	—	1.05	5A	16/3
Pix ..	25	S ..	2.0	0.15	150	75	—1½	2.5	0.5	—	1.0	4	8/6
	*450/AC ..	S ..	4.0	1.0	200	100	—3	3.5	0.8	700	3.0	5	10/6

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.	Base pins.	Price.
Triotron ..	S207.. ..	S ..	2.0	0.15	200	100	—1	3.5	0.5	—	0.7	4	9/6
	S215.. ..	S ..	2.0	0.15	150	90	—1	2.8	0.25	—	1.5	4	10/0
	S208.. ..	VS ..	2.0	0.15	200	100	0—20	5.0	0.5	—	0.8	4	9/6
	S218.. ..	P ..	2.0	0.18	150	150	—¼	3.0	1.0	—	1.85	7	10/0
	S217.. ..	VP	2.0	0.18	150	150	—¼—16	2.5	0.5	—	1.7	7	10/0
	*S410N ..	S ..	4.0	1.0	200	60	—2	4.0	1.0	400	1.0	5	12/6
	*S430N ..	S ..	4.0	1.0	200	100	—2	3.0	1.0	500	3.0	5	12/6
	*S431N ..	VS ..	4.0	1.0	200	100	—2—30	3.5	1.0	V	3.0	5	12/6
	*S415N ..	VS ..	4.0	1.0	200	100	—2—40	6.0	1.0	V	1.5	5	12/6
	*S435N ..	P ..	4.0	1.1	200	100	—2	5.0	1.0	V	3.5	5 & 7	12/6
	*S434N ..	VP	4.0	1.1	200	100	—2—35	5.5	1.0	V	3.5	5 & 7	12/6
	*S1328 ..	P ..	13.0	0.2	200	100	—2	3.0	1.0	400	3.0	7	12/6
	*S1323 ..	VP	13.0	0.2	200	100	—2—22	4.5	1.0	V	2.8	7	12/6
	*S2035N ..	P ..	20.0	0.18	200	100	—2	5.0	2.0	250	3.5	5	12/6
	*S2034N ..	VP	20.0	0.18	200	100	—2—35	5.0	2.0	V	3.5	5	12/6
Tungsram	S210.. ..	S ..	2.0	0.12	200	100	—1	1.5	0.4	—	1.2	4	10/0
	S8210 ..	S ..	2.0	0.12	150	75	—1	1.5	0.25	—	1.0	4	10/0
	SE311 ..	VS ..	2.0	0.12	150	75	—1—9	1.75	0.3	—	1.5	4	10/0
	HP210 ..	P ..	2.0	0.12	150	150	—1½	1.9	0.7	—	1.9	4 & 7	11/0
	HP211 ..	VP	2.0	0.12	150	150	0—9	2.6	0.6	—	1.7	4 & 7	11/0
	*AS4120 ..	S ..	4.0	1.0	200	100	—1½	3.0	0.8	150	3.0	5	14/0
	*AS4125 ..	VS ..	4.0	1.2	200	100	0—40	3.0	0.8	V	3.0	5	14/0
	*HP4101 ..	P ..	4.0	1.0	200	100	—1½	3.5	1.5	600	3.5	5 & 7	14/0
	*HP4106 ..	VP	4.0	1.0	200	100	—2—35	5.0	1.25	V	3.5	5 & 7	14/0
	*HP4115 ..	VP	4.0	1.1	200	100	—2—20	4.3	1.5	V	3.2	5 & 7	14/0
	*HP2018 ..	P ..	20.0	0.18	200	100	—1	4.0	1.2	200	3.5	5 & 7	14/—
	*HP1018 ..	P ..	10.0	0.18	250	150	—¼	2.3	0.6	300	1.25	7C	14/—
	*HP1118 ..	VP	10.0	0.18	250	150	—3—52	10.5	3.0	V	1.65	7C	14/—
	*HP2118 ..	VP	20.0	0.18	200	100	—2—35	5.0	1.1	V	3.5	5 & 7	14/—
	*SP13 ..	P ..	13.0	0.2	250	100	—2	3.0	1.2	600	2.4	7	14/—
	*HP13 ..	VP	13.0	0.2	250	100	—3—20	8.0	2.7	V	2.8	7	14/—
	*VP13 ..	VP	13.0	0.2	250	100	—3—50	8.0	2.7	V	2.8	7	14/—
	24A	S ..	2.5	1.75	275	90	—1	4.0	1.7	300	1.0	5A	11/—
	35	VS	2.5	1.75	275	90	—2—45	6.5	2.5	V	1.06	5A	10/—
	57	P ..	2.5	1.0	250	100	—1	2.3	0.5	300	1.25	6A	12/—
	77	P ..	6.3	0.3	250	100	—1	2.3	0.6	300	1.25	6A	12/—
	58	VP	2.5	1.0	250	150	—2—52	10.5	3.0	V	1.65	6A	12/—
	78	VP	6.3	0.3	250	150	—2—52	10.5	3.0	V	1.65	6A	12/—
	6C6	P ..	6.3	0.3	250	100	—2½	2.0	0.5	1,000	1.2	6A	12/—
	6D6 ..	VP	6.3	0.3	250	100	0—50	8.2	2.0	V	1.6	6A	12/—
362 ..	SG2 ..	S ..	2.0	0.2	150	80	—3	1.5	1.0	—	1.5	4	7/6
	VS2 ..	VS ..	2.0	0.2	150	80	0—20	5.0	1.0	—	1.2	4	7/6
	VP2 ..	VP	2.0	0.2	150	80	0—9	4.0	0.8	—	1.2	4	9/—
	VP2C ..	VP	2.0	0.2	150	80	0—9	4.0	0.8	—	1.2	7	9/—
	*AC8G4 ..	S ..	4.0	1.0	250	80	—3	6.0	2.0	500	2.5	5	12/6
	*ACVS4 ..	VS	4.0	1.0	250	80	0—40	9.0	2.0	V	2.0	5	12/6
	*ACHM4 ..	P ..	4.0	1.0	250	150	—8	15.0	3.0	800	2.5	5	13/—
	*ACVP4 ..	VP	4.0	1.0	250	150	0—30	12.0	2.4	V	3.0	7	13/—
	*UVP ..	VP	6.5	0.3	250	150	0—10	8.0	1.3	V	2.0	7	13/—

DIODE VALVES

Maker.	Type.	Description.	Fil. volts.	Fil. amps.	Max. diode volts.	Max. diode current.	Base pins.	Price.
Brimar	*10D1	DD	13.0	0.2	—	—	5	5/6
Cossor	220DD	DD	2.0	0.2	150	—	4	5/6
	*DD4	DD	4.0	0.75	—	—	5	5/6
Dario	*TB24	DD	4.0	0.65	200	0.8	5	4/6
Ever Ready ..	*A20B	DD	4.0	0.65	—	—	5	5/6
Hivac	*AC/DD	DD	4.0	1.0	—	—	7	9/6
Marconi	*D41	DD	4.0	0.3	—	—	5	5/6
Mazda	*V914	DD	4.0	0.3	100	1.0	5	5/6
	*DD620	DD	6.0	0.2	100	1.0	5	5/6
Mullard	*2D4A	DD	4.0	0.65	200	0.8	5	5/6
	*2D13	DD	13.0	0.2	200	0.8	5 S.C.	5/6
	*2D13A	DD	13.0	0.2	200	0.8	5 S.C.	5/6
	*2D13c	DD	13.0	0.2	200	0.8	5	5/6
Osram	*D41	DD	4.0	0.3	—	—	5	5/6
Ostar Ganz ..	*B2	DD	250	0.024	100	15.0	7	15/9
Triotron	D200	DD	2.0	0.1	125	0.5	5	3/6
	*D400	DD	4.0	0.65	200	0.8	5	4/6
	*D1300	DD	13.0	0.2	200	0.8	5	4/6
Tungsram	**D418	D	4.0	0.18	100	1.5	3	4/—
	*DD465	DD	4.0	0.65	100	3.0	5	4/6
	*DD4	DD	4.0	0.65	200	1.6	5	4/6
	*DD818	DD	8.0	0.18	100	3.0	5	4/6
	*DD13	DD	13.0	0.2	200	0.8	5	4/6

DIODE COMBINATION VALVES

Maker.	Type.	Description.	Fil. volts.	Fil. amps.	Anode volts.	Screen volts.	Triode "M."	Slope mA/v.	Grid volts.	Bias res. ohms.	Anode current.	Output m/w.	Base pins.	Price.
Brimar ..	*11A2 ..	DDT ..	4.0	1.0	200	—	50	2.8	—2	500	4.0	—	7	15/6
	*11D3 ..	DDT ..	13.0	0.2	250	—	100	1.2	—1	500	2.0	—	7	15/6
Cossor ..	*DDT ..	DDT ..	4.0	1.0	200	—	41	2.4	—3	850	3.0	—	7	15/6
	*DDPen ..	DDPen	4.0	1.0	250	200	—	2.7	—1-40	V	7.0	—	7	20/-
	*13DHA ..	DDT ..	13.0	0.2	250	—	125	1.5	—1	500	2.0	—	7	15/6
	†DDT16 ..	DDT ..	16.0	0.25	200	—	40	2.5	—3	1,250	3.0	—	7	15/6
Ever Ready	K23B ..	DDT ..	2.0	0.12	150	—	30	1.4	—3	—	1.5	—	5	9/-
	*A23A ..	DDT ..	4.0	0.65	200	—	30	2.9	—3½	1,000	3.5	—	7	15/6
Ferranti ..	*H4D ..	DDT ..	4.0	1.0	200	—	39	2.7	—2	500	4.0	—	7	15/6
	*PT4D ..	DDPen	4.0	2.0	250	250	—	7.5	—6	140	3.4	2,500	7	21/-
Hivac ..	DDT220 ..	DDT ..	2.0	0.2	150	—	20	1.6	—3	—	2.5	—	5	7/-
	*AC/DDT ..	DDT ..	4.0	1.0	200	—	35	2.3	—3	750	4.0	—	7	12/6
Lissen ..	L2/D ..	D Triode	2.0	0.1	150	—	18	1.5	—4	—	2.0	—	5	9/-
	AVC2 ..	D Pentode	2.0	0.15	150	100	500	1.0	0	—	2.0	—	4	17/6
	*AC/AVC ..	D Pentode	4.0	1.0	200	150	1,000	2.0	—1½	500	3.0	—	5	20/-
Marconi ..	HD21 ..	DDT ..	2.0	0.2	150	—	27	1.5	—3	—	1.8	—	5	9/-
	HD22 ..	DDT ..	2.0	0.2	150	—	27	1.5	—3	—	1.8	—	5	9/-
	*MHD4 ..	DDT ..	4.0	1.0	200	—	40	2.2	—3	1,000	2.4	—	7	15/6
	*WD40 ..	DD, HFPen	4.0	1.0	250	100	—	3.5	1—30	V	7.7	—	9	20/-
	*DN41 ..	DD, LFPen	4.0	2.3	250	250	—	10.0	—3½	90	32.0	3,500	7	21/-
	*WD30 ..	DD, HFPen	13.0	0.3	250	100	—	3.5	1—30	V	7.7	—	9	20/-
	*DH30 ..	DDT ..	13.0	0.3	200	—	80	4.5	—2	800	2.8	—	7	15/6
	†DHD ..	DDT ..	16.0	0.25	200	—	40	2.7	—3	800	3.0	—	7	15/6
Mazda ..	HL21/DD ..	DDT ..	2.0	0.15	150	—	32	1.5	—3	—	2.0	—	5	9/-
	L2/DD ..	DDT ..	2.0	0.1	150	—	16	1.6	—4½	—	1.9	—	5	9/-
	L21/DD ..	DDT ..	2.0	0.15	150	—	18	1.8	—4½	—	2.3	—	5	9/-
	*AC/HLDD ..	DDT ..	4.0	1.0	250	—	36	2.6	—3	700	4.3	—	7	15/6
	*AC/HLDDD ..	Triple DT	4.0	1.0	250	—	35	2.7	—3	700	4.9	—	9	16/6
	*AC2/Pen DD ..	DDP ..	4.0	2.0	250	250	—	8.0	—5	150	32.0	3,400	7	21/-
	*HL/DD 1320 ..	DDT ..	13.0	0.2	250	—	30	2.0	—3	700	4.3	—	7	15/6
	PenDD1360 ..	DDP ..	13.0	0.6	250	250	—	8.0	—5	140	32.0	4,600	7	21/-
	*PenDD4020 ..	DPP ..	40.0	0.2	250	250	—	7.0	—8	150	43.0	4,100	7	21/-
	†DC2/HLDD ..	DDT ..	25.0	0.1	200	—	30	2.0	—3	700	3.75	—	7	15/6
Mullard ..	TDD2 ..	DDT ..	2.0	0.1	150	—	16.5	1.4	—5½	—	2.5	—	5	9/-
	TDD2A ..	DDT ..	2.0	0.12	150	—	31.0	1.2	1½—3	—	1.4	—	5	9/-
	*TDD4 ..	DDT ..	4.0	0.65	200	—	30.0	2.9	—3½	1,000	7.0	—	7	15/6
	*SD4 ..	SD .. Tetrode	4.0	1.0	200	100	—	3.0	—2.3	800	7.0	—	7	20/-
	*TDD13C ..	DDT ..	13.0	0.2	200	—	31	1.2	—3½	500	7.0	—	7	15/6
	†SD20 ..	SD Tetrode	20.0	0.18	200	100	—	3.0	—1½	200	5.0	—	7	20/-
	†TDD25 ..	DDT ..	25.0	0.18	200	—	30	2.0	—4	1,000	4.0	—	7	15/6
Osram ..	HD22 ..	DDT ..	2.0	0.2	150	—	27	1.5	—3	—	2.0	—	5	9/-
	*MHD4 ..	DDT ..	4.0	1.0	200	—	40	2.2	—3	1,000	3.0	—	7	15/6
	*WD40 ..	DDVm Pen.	4.0	1.0	250	100	—	2.6	—1	100	7.7	—	9	20/-
	*DN41 ..	DD LFPen	4.0	2.3	250	250	—	10.0	—5	100	32.0	3,500	7	21/-
	*DH30 ..	DDT ..	13.0	0.3	200	—	80	4.5	—1½	800	3.8	—	7	15/6
	*WD30 ..	DDVm Pen.	13.0	0.3	250	100	—	2.6	—1	100	7.7	—	9	20/-
Philco ..	2102 ..	DDT ..	2.0	0.06	135	—	—	—	—1½	—	—	—	—	13/-
	*55	DDT ..	2.5	1.0	250	—	8.3	1.1	—20	—	8.0	—	6A	12/-
	*75	DDT ..	6.3	0.3	250	—	100	1.1	—2	—	0.8	—	6A	14/-
	*85	DDT ..	6.3	0.3	250	—	8.3	1.1	—20	—	8.0	—	6A	12/-
	*6B7E ..	DDPen.	6.3	0.3	250	125	—	1.125	—3	—	9.0	—	7A	16/-
Triotron ..	DT215 ..	DDT ..	2.0	0.1	135	—	16	1.0	—4½	—	2.5	—	5	6/6
	*B430N ..	SD Tetrode	4.0	1.0	200	33	—	0.3	—2½	800	3.0	—	7C	13/6
	*DT436 ..	DDT ..	4.0	0.65	200	—	27	3.6	—4	5,000	0.5	—	7	12/-
	*DT1336 ..	DDT ..	13.0	0.2	200	—	27	3.6	—4	5,000	0.5	—	7	12/-
Tungsram ..	DDT2 ..	DDT ..	2.0	0.1	150	—	30	1.4	—3	—	1.4	—	5	7/-
	*DDT4 ..	DDT ..	4.0	0.65	200	—	30	3.6	—4	1,000	4.0	—	7	12/6
	*DDT13 ..	DDT ..	13.0	¦ 0.2	200	—	30	3.6	—5	1,000	4.6	—	7	12/6
	2A6 ..	DDT ..	2.5	1.5	250	—	100	1.1	—2	10,000	0.8	—	6A	12/-
	75	DDT ..	6.3	0.3	250	—	100	1.1	—2	10,000	0.8	—	6A	12/-
	6B7 ..	DDPen.	6.3	0.3	250	125	750	1.13	—3	5,000	9.0	—	7A	12/-
362	*ACHL4dd ..	DDT ..	4.0	1.0	250	—	38	2.5	—3	400	7.0	—	7	9/-
	*UHdd ..	DDT ..	6.5	0.3	250	—	40	2.0	—3	600	5.0	—	7	9/-

VALVE DATA CHART

GENERAL PURPOSE TRIODES

Maker.	Type.	Fil. volts.	Fil. amp.	Anode volts.	Amp. factor.	Impedance.	Slope mA/v.	Grid bias.	Anode current.	Bias resistance.	Price.
Brimar	4215A	1.0	0.25	60	6	25,000	0.4	—3	1.6	—	10/-
	*HLA2	4.0	1.0	200	50	9,000	5.5	—2	10.0	500	13/6
Cossor	210RC	2.0	0.1	150	40	50,000	0.8	—1½	0.9	—	5/6
	210HL	2.0	0.1	150	24	22,000	1.1	—3	1.6	—	5/6
	210HF	2.0	0.1	150	24	15,800	1.5	—3	1.6	—	5/6
	210Det.	2.0	0.1	150	15	13,000	1.15	0	3.0	—	5/6
	210LF	2.0	0.1	150	14	10,000	1.4	—4½	4.8	—	5/6
	*41MRC	4.0	1.0	200	50	19,000	2.6	—2	2.7	750	14/-
	*41MH	4.0	1.0	200	72	18,000	4.0	—1½	3.2	500	13/6
	*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	13/6
	*41MLF	4.0	1.0	180	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	23,000	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
	*TE384	4.0	1.0	200	38	120,000	1.5	—2½	3.0	660	8/6
	*TE994	4.0	1.0	200	99	100,000	4.0	—1½	4.0	380	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	—	5/6
	K30C	2.0	0.1	150	28	20,000	1.4	—3	2.0	—	5/6
	K30B	2.0	0.1	150	11	12,000	0.9	—7½	—	—	5/6
	K30D	2.0	0.1	150	18	12,000	1.5	—4½	4.0	—	5/6
	K30E	2.0	0.1	150	18	12,000	1.5	—4½	4.0	—	5/6
	*A30B	4.0	0.65	200	75	34,000	2.2	—2	1.8	1,000	13/6
	*A30D	4.0	0.65	200	40	12,500	3.2	—3	5.0	800	13/6
	*C30B	13.0	0.2	200	40	12,500	3.2	—3	5.0	800	13/6
Ferranti	L2	2.0	0.1	150	10.9	6,800	1.6	—4½	9.0	—	7/-
	*D4	4.0	1.0	200	40	12,500	3.3	—3	4.0	750	13/6
	*DA	13.0	0.2	200	51	14,600	3.5	—	—	—	13/6
Hivac	XD	2.0	0.06	100	16	23,000	0.75	0	1.25	—	10/6
	XL	2.0	0.06	100	12	14,000	0.85	—1½	3.0	—	10/6
	H210	2.0	0.1	150	25	22,000	1.15	—3	1.0	—	3/9
	D210	2.0	0.1	150	16	12,000	1.35	—4½	3.5	—	3/9
	L210	2.0	0.1	150	12	7,500	1.6	—6	4.0	—	3/9
Lissen	*AC/HL	4.0	1.0	200	35	10,000	3.5	—3	7.0	600	9/6
	H2	2.0	0.1	150	50	45,000	1.1	—1½	1.0	—	5/6
	HL2	2.0	0.1	150	35	22,000	1.5	—3	1.8	—	5/6
	L2	2.0	0.1	150	20	10,000	2.0	—4½	2.0	—	5/6
Marconi	*AC/HL	4.0	1.0	200	40	10,000	4.0	—4	3.0	1,000	13/6
	HL2	2.0	0.1	150	27	18,000	1.5	—3	2.0	—	5/6
	HL2/K	2.0	0.1	150	27	18,000	1.5	—3	2.0	—	5/6
	L21	2.0	0.1	150	16	8,900	1.8	—6	2.2	—	5/6
	HL210	2.0	0.1	150	24	20,000	1.2	—3	1.5	—	5/6
	H2	2.0	0.1	150	35	35,000	1.0	—1½	1.5	—	5/6
	*MH4	4.0	1.0	200	40	11,100	3.6	—3	4.5	660	13/6
	*MH41	4.0	1.0	200	80	13,300	6.0	—2	5.0	400	13/6
	*MHL4	4.0	1.0	200	20	8,000	2.5	—6	8.0	850	13/6
	*H30	13.0	0.3	250	80	13,300	6.0	—2	5.5	350	13/6
	†DH	16.0	0.25	200	40	10,800	3.7	—3	6.0	500	13/6
Mazda	HL2	2.0	0.1	150	32	21,000	1.5	—1½	2.7	—	5/6
	L2	2.0	0.1	150	19	10,000	1.9	—3	5.0	—	5/6
	H2	2.0	0.1	150	50	45,000	1.1	—1½	2.5	—	5/6
	*AC/HL	4.0	1.0	200	35	11,700	3.0	—3½	5.0	700	13/6
	*AC2/HL	4.0	1.0	200	75	11,500	6.5	—1½	6.2	250	13/6
	*HL1320	13.0	0.2	250	30	10,000	3.0	—4	6.0	650	13/6
	†DC8HL	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	—	5/6
	PM1HF	2.0	0.1	150	18	22,500	0.8	—4½	1.5	—	5/6
	PM1HL	2.0	0.1	150	28	20,000	1.4	—3	2.0	—	5/6
	PM2DX	2.0	0.1	150	18	12,000	1.5	—4½	4.0	—	5/6
	PM2DL	2.0	0.1	150	18	12,000	1.5	—4½	4.0	—	5/6
	PM1LF	2.0	0.1	150	11	12,000	0.9	—7½	4.0	—	5/6
	*994V	4.0	0.65	200	125	35,000	3.6	—1½	1.35	1,000	13/6
	*904V	4.0	0.65	200	75	34,000	2.2	—2	1.8	1,000	13/6
	*484V	4.0	1.0	200	48	21,800	2.2	—3	2.8	1,600	13/6
	*354V	4.0	0.65	200	40	12,500	3.2	—4	4.0	1,000	13/6
	*244V	4.0	0.65	200	25	9,000	2.8	—5½	5.5	1,000	13/6
	*154V	4.0	0.65	200	—	7,500	2.0	—7½	9.0	1,000	14/-
	*164V	4.0	0.65	200	—	4,850	3.3	—8½	8.5	1,000	14/-
(Side contact base)	*HL13	13.0	0.2	200	40	1,250	3.2	—4	4.0	800	13/6
	*HL13C	13.0	0.2	200	40	12,500	3.2	—4	4.0	800	13/6
	†H20	20.0	0.18	200	—	—	2.6	—14	1.0	1,500	13/6
	†HL20	20.0	0.18	200	35	14,000	2.5	—3½	3.5	1,000	13/6
Osram	H210	2.0	0.1	150	35	50,000	0.7	—1½	2.3	—	5/6
	HL210	2.0	0.1	150	24	20,000	1.2	—3	1.5	—	5/6
	HL2	2.0	0.1	150	27	18,000	1.5	—3	2.0	—	5/6
	L21	2.0	0.1	150	16	8,900	1.8	—6	2.0	—	5/6
	*MH41	4.0	1.0	200	80	13,300	6.0	—1½	5.2	400	13/6
	*MH4	4.0	1.0	200	40	11,000	3.6	—3	4.5	600	13/6
	*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	—1½	4.0	350	13/6
Ostar Ganz	*D130	250	.02	300	100	40,000	3.5	—1	2.0	500	15/9
	*A520	250	.02	300	22	8,800	2.5	—7	4.0	1,800	15/-
Philco	26	1.5	1.05	180	8.3	7,300	1.15	—14½	6.2	—	6/-
	30	2.0	0.06	180	9.3	10,300	0.9	—13½	3.1	—	7/-
	X99	3.3	0.063	90	6.6	15,500	0.04	—4½	2.5	—	11/-
	V99	3.3	0.063	90	6.6	15,500	0.04	—4½	2.5	—	16/3
	**27	2.5	1.75	250	9	9,250	0.97	—21	5.2	—	8/-
	**56	2.5	1.0	250	13.5	9,500	1.45	—13½	5.0	—	9/-
	**O1A	5.0	0.25	135	8.0	10,000	0.8	—9	3.0	—	7/-

Maker.	Type.	Fil. volts.	Fil. amp.	Anode volts.	Amp. factor.	Impedance.	Slope mA/v.	Grid bias.	Anode current.	Bias resistance.	Price.
	*76	6.3	0.3	250	13.5	9,500	1.45	—13½	5.0	—	9/-
	*37	6.3	0.3	250	9.2	8,400	1.1	—18	7.5	—	8/6
	†17	14.0	0.3	250	9.0	9,250	0.97	—21	5.2	—	12/-
Pix	4	2.0	0.1	150	33	37,000	0.9	—1½	1.9	—	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	1.7	—7½	3.4	—	2/6
	*90/AC	4.0	1.0	200	40	23,000	1.7	—11½	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	—3	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	14	10,000	1.4	—3	5.5	—	3/6
	TD2	2.0	0.08	150	9	10,000	1.2	—7	7.0	—	3/6
	*A440N	4.0	1.0	200	120	30,000	4.0	—11½	0.5	2,000	8/6
	*W415N	4.0	1.0	200	35	23,000	1.5	—3	2.5	1,000	8/6
	*A430N	4.0	1.0	200	30	8,300	3.0	—3½	6.0	600	8/6
	*A2040N	20.0	0.18	200	100	25,000	4.0	—1½	0.5	1,000	8/6
Tungsram	HR210	2.0	0.1	200	30	23,000	1.3	—1½	1.0	—	3/9
	LD210	2.0	0.1	150	18	14,000	1.3	—3	3.0	—	3/9
	*HL4	4.0	1.0	200	40	11,500	3.5	—4½	4.5	1,000	10/6
	*AR495	4.0	1.0	200	85	17,000	5.0	—1½	2.5	300	10/6
	°HL13	13.0	0.2	200	40	11,000	3.5	—4½	4.5	1,100	10/6
	°R3018	20.0	0.18	200	40	13,000	3.0	—2½	2.5	1,000	10/6
	56	2.5	1.0	250	13.8	9,500	1.45	—13½	5.0	2,500	8/-
	27	2.5	1.75	250	9	9,000	1.0	—21	6.0	3,500	7/6
342	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
	*UHL	6.5	0.3	250	32	16,000	2.0	—4	6.0	700	7/6

POWER OUTPUT TRIODES

Maker.	Type.	Fil. volts.	Fil. amps.	Anode volts.	Impedance.	Slope mA/v.	Grid bias.	Anode current.	Bias res.	Output m.w.	Price.
Brimar	*PA1	4.0	1.0	200	1,050	12.0	—9	40.0	260	1,250	16/6
Cossor	215P	2.0	0.15	150	4,000	2.25	—7½	10.0	—	150	7/-
	220P	2.0	0.2	150	4,000	2.25	—7½	11.0	—	170	7/-
	220PA	2.0	0.2	150	4,000	4.0	—4½	10.0	—	180	7/-
	230XP	2.0	0.3	150	1,500	3.0	—18	22.0	—	450	12/-
	*41MP	4.0	1.0	200	2,500	7.5	—7½	24.0	320	1,250	14/-
	*41MXP	4.0	1.0	200	1,500	7.5	—12½	40.0	300	2,000	16/6
	**4XP	4.0	1.0	250	900	7.0	—28½	48.0	600	—	16/6
	*402P	40.0	0.2	200	1,330	7.5	—9½	30.0	320	1,250	16/6
	†DP	16.0	0.25	200	2,800	6.0	—7½	25.0	300	1,250	14/-
Dario	TB052	2.0	0.15	150	4,200	1.2	—18	7.0	—	150	4/6
	TB122	2.0	0.2	150	3,600	3.5	—4½	6.0	—	350	4/6
	TB062	2.0	0.18	150	3,000	2.0	—10½	13.0	—	1,550	4/6
	TB032	2.0	0.19	150	2,000	1.5	—30	12.0	—	500	4/6
	*AC Hyper-power	4.0	1.0	200	3,000	3.0	—12	14.0	—	600	8/6
	*TE094	4.0	1.0	200	2,000	1.3	—16	12	—	350	8/6
	*DC Hyper-power	20.0	0.18	200	2,400	2.5	—18	15	—	600	8/6
Ever Ready	K30G	2.0	0.2	150	3,600	3.5	—7	6.0	—	150	7/-
	**S30C	4.0	1.0	250	950	6.8	—29	48.0	600	2,700	16/6
Ferranti	**LP4	4.0	1.0	250	870	5.4	—36	48.0	750	2,500	16/6
Hivac	XP	2.0	0.06	100	5,000	1.0	—9	5.0	—	—	12/6
	P220	2.0	0.2	150	4,700	3.0	—7½	6.0	—	175	5/6
	P215	2.0	0.15	120	3,600	2.25	—10½	7.0	—	150	4/9
	PP220	2.0	0.2	150	2,300	3.0	—12	12.5	—	250	6/6
	PX230	2.0	0.3	150	1,850	3.5	—15	17.5	—	450	7/6
	*AC/L	4.0	1.0	200	2,850	4.25	—13½	17.0	760	675	12/6
Lissen	LP2	2.0	0.2	150	3,500	3.5	—6	9.0	—	200	7/-
	P220	2.0	0.2	150	4,000	1.75	—13½	7.6	—	160	7/-
	PX240	2.0	0.4	200	1,500	3.0	—32	25.0	—	800	12/-
Marconi	LP2	2.0	0.2	150	3,900	3.85	—4½	6.0	—	150	7/-
	P215	2.0	0.15	150	5,000	1.4	—9	5.8	—	150	7/-
	P2	2.0	0.2	150	2,150	3.5	—10½	19.0	—	300	12/-
	*ML4	4.0	0.1	200	2,850	4.2	—9	20.0	400	650	14/-
	**PX4	4.0	1.0	250	825	6.0	—33	48.0	700	2,500	16/6
	**PX25	4.0	2.0	400	1,265	7.5	—30	62.5	530	5,500	25/-
	**PX25A	4.0	2.0	400	580	6.9	—103	62.5	1,600	8,000	25/-
	**DA60	6.0	4.0	500	835	3.0	—135	120.0	1,100	11,000	110/-
	**DA100	6.0	2.7	1,000	1,410	3.9	—146	100.0	1,500	30,000	210/-
	†DL	16.0	0.25	200	2,660	4.5	—8	25.0	350	600	14/-
Mazda	P220	2.0	0.2	150	3,700	3.4	—7	5.5	—	180	7/-
	P220A	2.0	0.2	150	1,850	3.5	—14	15.0	—	350	12/-
	*AC/P	4.0	1.0	200	2,650	3.75	—13	17.0	800	650	14/-
	*AC/P1	4.0	1.0	200	1,450	3.7	—28	24.0	1,200	1,000	16/6
	**PP3/250	4.0	1.0	250	1,000	6.5	—30	40.0	720	2,800	16/6
	**PP5/400	4.0	2.0	400	1,500	6.0	—32	62.5	510	5,900	25/-
	*PP3521	35.0	0.2	250	660	9.0	—25	70.0	360	—	16/6
	†DO2/P	35.0	0.1	200	2,650	3.8	—10	17.0	750	650	14/-

VALVE DATA CHART

Maker.	Type.	Fil. volts.	Fil. amps.	Anode volts.	Impedance	Slope mA/v.	Grid bias.	Anode current.	Bias res.	Output m.w.	Price.
Mullard	PM2	2.0	0.2	150	4,400	1.7	—12	6.6	—	150	7/-
	PM2A	2.0	0.2	150	3,600	3.5	—7	6.0	—	150	7/-
	PM202	2.0	0.2	150	2,000	3.5	—15	14.0	—	350	12/-
	PM252	2.0	0.4	150	1,900	3.7	—12	17.0	—	360	12/-
	*104V	4.0	1.0	200	3,000	4.0	—12	17.0	700	650	14/-
	*054V	4.0	1.0	200	1,250	4.0	—28	30.0	1,000	1,000	16/6
	**AC104	4.0	1.0	200	2,850	3.5	—14	11.0	800	400	16/-
	**AC064	4.0	1.0	200	2,000	3.0	—21	20.0	1,000	620	16/-
	**AC044	4.0	1.0	250	950	6.8	—29	48.0	600	2,700	16/6
	**DO10	6.0	0.85	400	2,850	0.85	—130	25.0	5,200	2,500	25/-
	**DO20	7.5	1.1	425	2,000	2.5	—66	40.0	1,650	5,000	30/-
	**DO24	4.0	2.0	400	1,390	6.5	—34	65.0	540	5,500	25/-
	**DO25	6.0	1.1	400	800	3.75	—112	63.0	1,800	4,000	30/-
	**DO26	4.0	2.0	400	600	6.3	—92	63.0	1,500	4,000	25/-
Osram	P215	2.0	0.15	150	5,000	1.4	—9	5.8	—	150	7/-
	P2	2.0	0.2	150	2,150	3.5	—10½	19.0	—	300	12/-
	*ML4	4.0	1.0	200	2,860	4.2	—9	20.0	400	400	14/-
	**PX4	4.0	1.0	250	830	6.0	—36	48.0	750	2,500	16/6
	**PX25	4.0	2.0	400	1,265	7.5	—33	62.5	530	5,500	25/-
	**PX25A	4.0	2.0	400	580	6.9	—102	62.5	1,630	8,400	25/-
	**DA30	4.0	2.0	500	580	6.9	—130	60.0	2,150	44,000	30/-
	**DA60	6.0	4.0	500	835	3.0	—138	120.0	1,150	10,000	110/-
	**DA100	6.0	2.7	1,000	1,410	3.9	—149	100.0	1,490	30,000	210/-
Ostar-Ganz	*U920	250	.02	300	3,700	3.0	—14	7.0	1,700	1,500	15/-
	*L1525	250	.02	300	1,850	3.0	—26	20.0	1,300	1,500	15/6
	*K2060	250	.02	300	1,000	5.0	—40	40.0	1,000	3,000	23/-
	*K3560	250	.044	220	500	6.0	—50	50.0	1,000	3,000	23/-
Philco	**45	2.5	1.5	275	1,700	2.05	—56	36.0	—	2,000	8/-
	**2A3	2.5	2.5	250	765	5.5	—45	60.0	—	3,500	18/-
	**12A	5.0	0.25	180	4,700	1.8	—13½	7.7	—	285	9/6
	**71A	5.0	0.25	180	1,750	1.7	—40½	20.0	—	750	6/-
	**10	7.5	1.25	425	5,000	1.6	—39	18.0	—	1,600	25/-
	**50	7.5	1.25	450	1,800	2.1	—84	55.0	—	4,600	25/-
	**6A3	6.3	1.0	250	765	5.5	—45	60.0	—	3,500	—
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	7,000	1.0	—15	10.0	—	150	4/6
	YD2	2.0	0.22	200	4,500	2.0	—11	16.0	—	250	4/6
	E235	2.0	0.33	200	3,000	3.0	—12	18.0	—	550	4/6
	UD2	2.0	0.22	150	2,000	2.0	—15	15.0	—	500	4/6
	SP2	2.0	0.33	150	1,500	2.0	—28	18.0	—	500	4/6
	*E430N	4.0	1.0	200	3,000	3.0	—15	15.0	1,000	350	8/6
	**E425	4.0	0.3	250	2,500	2.0	—32	20.0	1,600	1,000	7/-
	**K480	4.0	2.0	550	1,250	8.0	—36	45.0	800	5,000	22/6
	**K450/50	4.0	3.0	400	1,250	4.0	—50	120.0	500	12,000	45/-
	**K435/10	4.0	0.65	250	1,000	3.5	—40	40.0	1,000	2,500	12/6
Tungsram	P215	2.0	0.15	150	3,300	1.5	—9	10.0	—	280	4/9
	LP220	2.0	0.2	150	3,900	3.5	—4½	4.0	—	200	4/9
	SP220	2.0	0.2	150	2,200	3.0	—15	15.0	—	360	4/9
	*AP495	4.0	1.0	250	2,500	4.0	—18	20.0	900	900	11/3
	*P2018	20.0	0.18	200	2,500	4.0	—18	20.0	900	900	13/-
	PX2100	7.5	1.25	425	5,000	1.6	—39	18.0	2,000	1,600	22/6
	112	5.0	0.25	180	4,700	1.8	—13½	7.5	2,000	275	8/-
	50	7.5	1.25	450	1,800	2.1	—85	55.0	1,800	4,650	22/6
	45	2.5	1.5	275	1,750	2.0	—56	36.0	1,500	2,000	7/-
	171	5.0	0.25	180	1,750	1.8	—40	20.0	2,000	800	5/6
362	LP2	2.0	0.2	200	5,000	3.0	—9	8.0	—	500	4/-
	P2	2.0	0.2	200	3,000	3.0	—15	13.0	—	900	4/6
	*ACPX4	4.0	1.0	250	2,000	4.0	—18	30.0	600	2,500	9/-
	**ACPX4a	4.0	1.0	250	1,200	5.0	—25	50.0	500	3,000	9/-
	**PX25	4.0	2.0	400	1,000	6.0	—50	65.0	800	7,000	20/-
	**P625	6.0	0.25	250	2,000	2.3	—30	30.0	1,000	1,500	8/-
	**PX50	6.0	2.0	500	800	6.0	—70	100.0	700	13,000	50/-
	*CLP	6.5	0.6	250	2,000	4.0	—20	27.0	700	1,500	9/-
	*ULP	13.0	0.3	250	2,000	4.0	—20	27.0	700	1,500	9/-
	*UPX	26.0	0.3	250	800	7.0	—34	38.0	900	3,000	13/-

PENTODE OUTPUT VALVES

Maker.	Type.	Fil. volts.	Fil. amps.	Anode volts.	Screen volts.	Slope mA/v.	Grid bias.	Bias res. ohms.	Anode & screen current.	Output m.w.	Base pins.	Price.
Brimar	PenB1	2.0	0.2	150	150	2.5	—4½	—	9.8	500	5	13/6
	*7A2	4.0	1.2	250	250	3.2	—17½	330	40.0	3,000	7	18/6
	*7A3	4.0	2.0	250	250	10.0	—6	160	38.0	4,000	7	20/-
	**PenA1	4.0	1.0	250	250	3.0	—16½	450	39.0	2,850	5	18/6
	*7D8	13.0	0.6	250	250	10.0	—6	160	38.0	4,000	7	20/-
	*7D3	40.0	0.2	135	135	3.8	—20	500	48.0	2,500	7	18/6
	*7D6	40.0	0.2	250	250	10.0	—6	100	38.0	4,000	7	20/-
Cossor	220HPT	2.0	0.2	150	150	2.5	—4½	—	9.5	500	4 & 5	13/6
	220PT	2.0	0.2	150	150	2.5	—9	—	23.0	1,000	4 & 5	13/6
	230PT	2.0	0.3	150	150	2.0	—15	—	17.0	1,000	4 & 5	16/6
	*MP/Pen	4.0	1.0	250	250	3.5	—16	450	36.0	3,100	5 & 7	18/6
	*42MP/Pen	4.0	2.0	250	250	7.0	—5½	140	38.0	3,400	7	18/6
	**PT41	4.0	1.0	250	200	3.0	—12½	350	36.0	2,600	5	18/6

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.	Base pins.	Price.
	••PT41B ..	4.0	1.0	400	300	2.25	—40	1,200	36.0	3,600	5	22/6
	•40PPA ..	40.0	0.2	150	150	4.0	—25	600	42.0	2,250	7	18/6
	†DP/Pen ..	16.0	0.25	250	250	3.5	—10	300	36.0	3,000	7	18/6
Dario	TC432 ..	2.0	0.2	150	150	2.5	—4½	450	11.5	350	4 & 5	10/—
	•TE534 ..	4.0	1.1	250	250	2.5	—15	650	29.0	2,000	5 or 7	12/6
	•TE434 ..	4.0	1.35	250	250	2.7	—22	500	42.0	3,500	7	12/6
	•ACPolydon	4.0	1.0	250	250	3.5	—15	500	31.0	2,000	5	12/6
	••TE434 ..	4.0	1.1	250	250	3.5	—14	400	41.5	3,000	5	13/6
	•DC Polydon	20.0	0.18	200	200	2.5	—18	700	26.0	2,000	5	12/6
Ever Ready ..	K70B ..	2.0	0.2	150	150	2.5	—4½	—	11.5	425	5	13/6
	•A70C ..	4.0	1.95	250	250	10.0	—5.8	145	32.0	3,800	7	18/6
	•C70D ..	35.0	0.2	250	250	7.0	—5.8	165	32.0	3,200	7	18/6
Ferranti	•PTZ ..	40.0	0.2	250	250	7.5	—6	140	42.0	2,500	7	18/6
Hivac	XY	2.0	0.12	100	100	1.25	—4½	—	3.0	200	Midget	15/-
	Y220 ..	2.0	0.2	150	150	2.5	—4½	—	13.5	500	4 & 5	10/6
	Z220 ..	2.0	0.2	150	150	2.5	—9	—	22.5	750	4 & 5	10/6
	•ACY ..	4.0	1.0	250	250	2.65	—17½	500	37.0	3,400	5	15/6
	•ACZ ..	4.0	1.0	250	250	7.0	—5½	145	39.5	3,000	5	15/6
Lissen	PT225 ..	2.0	0.1	150	150	1.6	—6	—	10.0	300	4	12/6
	PT240 ..	2.0	0.4	200	150	2.3	—	—	—	1,000	4	13/6
	PT2A ..	2.0	0.2	150	150	2.5	—10	—	21.0	1,100	4	13/6
	•AC/PT ..	4.0	1.0	250	250	4.0	—8	230	35.0	2,500	5 & 7	18/6
	†PT611 ..	6.0	0.11	150	150	1.4	—7	500	15.0	300	4	16/—
Marconi	PT2 ..	2.0	0.2	150	150	2.5	—4½	—	8.5	500	5	13/6
	•N41 ..	4.0	2.0	250	250	10.0	—9½	90	40.0	3,500	7	18/6
	•MPT4 ..	4.0	1.0	250	200	3.0	—10½	280	37.5	2,900	5 & 7	18/6
	•MPT4/K ..	4.0	1.0	250	250	3.0	—13	335	39.0	3,200	5 & 7	18/6
	••PT4 ..	4.0	1.0	250	250	2.9	—16	400	40.0	2,500	5	18/6
	••PT25 ..	4.0	2.0	400	200	4.0	—22	350	62.0	10,000	5	45/—
	•N30K ..	13.0	0.3	250	250	3.9	—15	375	39.5	3,200	7	18/6
	•N30G ..	13.0	0.3	250	250	3.9	—15	375	39.5	3,200	7	18/6
	•N31	26.0	0.3	200	180	10.0	—4.4	90	50.6	2,500	7	18/6
	†DPT ..	16.0	0.25	200	200	3.0	—10	220	46.5	2,000	5	18/6
Mazda	Pen220 ..	2.0	0.2	150	150	2.5	—4½	—	10.6	600	5	13/6
	Pen220a ..	2.0	0.2	150	150	2.5	—9	—	21.0	1,100	5	13/6
	•AC/Pen ..	4.0	1.0	250	250	2.5	—13	400	37.0	3,400	5 & 7	18/6
	•AC2/Pen ..	4.0	1.75	250	250	8.0	—5.3	140	38.0	5,400	7	18/6
	•Pen3520 ..	35.0	0.2	250	250	7.0	—8	165	48.0	4,600	7	18/6
	Pen1340 ..	13.0	0.4	250	250	6.5	—8.6	175	49.0	4,600	7	18/6
	†DC2/Pen ..	35.0	0.1	250	250	2.5	—13	350	35.0	2,300	5	18/6
Mullard	PM22A ..	2.0	0.2	150	150	2.5	—4½	—	12.0	425	4 & 5	13/6
	PM22C ..	2.0	0.3	150	150	3.0	—20	—	—	1,450	5	13/6
	PM22 ..	2.0	0.3	150	150	1.3	—10	—	19.0	600	4 & 5	16/6
	•Pen4VA ..	4.0	1.5	250	250	3.5	—22	500	44.0	3,400	5 & 7	18/6
	•Pen4VB ..	4.0	1.95	250	250	10.0	—8	145	37.0	3,600	7	18/6
	••PM24 ..	4.0	0.15	150	150	1.75	—11	650	24.0	800	4 & 5	17/6
	••PM24A ..	4.0	0.275	300	200	2.0	—22½	950	22.0	1,900	5	18/6
	••PM24M ..	4.0	1.0	250	250	3.0	—18	500	37.0	3,000	5	18/6
	••PM24B ..	4.0	1.0	400	300	2.1	—40	1,000	37.5	4,000	5	22/6
	••PM24C ..	4.0	1.0	400	200	3.0	—28	800	37.0	4,000	5	22/6
	••PM24D ..	4.0	2.0	500	200	4.0	—35	750	59.0	10,000	5	45/—
	•Pen26 ..	24.0	0.2	200	100	8.0	—19	420	45.0	3,500	8sc	18/6
	•Pen13c ..	13.0	0.5	250	250	6.5	—12	185	37.0	3,600	7	18/6
	•Pen36c ..	35.0	0.2	250	250	7.0	—6	165	37.0	3,200	7	18/6
	†Pen20 ..	20.0	0.18	200	200	2.5	—15	450	34.0	1,500	5 & 7	18/6
Osram	PT2 ..	2.0	0.2	150	150	2.5	—4½	—	11.5	500	5	13/6
	•MPT4 ..	4.0	1.0	250	200	3.0	—11	300	37.0	2,200	5 & 7	18/6
	•MPT4K ..	4.0	1.0	250	250	3.0	—13	340	38.0	3,200	5 & 7	18/6
	•N41 ..	4.0	2.0	250	250	10.0	—5	120	40.0	3,500	7	18/6
	••PT25 ..	4.0	2.0	400	200	4.0	—22	330	73.0	10,000	5	45/—
	••PT25H ..	4.0	2.0	400	400	6.5	—18	288	75.0	10,000	5	45/—
	•N30	13.0	0.3	250	250	3.9	—15	375	40.0	3,200	7	18/6
	•M31	26.0	0.3	200	180	10.0	—4½	90	48.0	2,500	7	18/6
Ostar Ganz ..	•PT3	250	.02	250	250	3.5	—20	850	24.0	1,500	7	17/6
	•M43	250	.028	250	200	3.2	—24	350	46.0	3,500	7	18/6
Philco	2101E ..	2.0	0.12	135	135	1.7	—4½	—	10.6	450	5A	13/6
	33E	2.0	0.26	135	135	1.45	—13½	—	17.5	700	5A	15/3
	•47E	2.5	1.75	250	250	2.6	—16½	—	37.0	2,700	5A	13/6
	•59	2.5	2.0	250	250	2.5	—18	—	44.0	3,000	7A	18/—
	•41E	6.3	0.4	250	250	3.2	—18	—	37.5	2,400	6A	14/—
	•42E	6.3	0.65	250	250	2.2	—16½	—	40.5	3,000	6A	14/—
	•38E	6.3	0.3	250	250	1.2	—25	—	25.8	2,500	5A	14/—
	•18E	14.0	0.3	250	250	2.2	—16½	—	41.0	3,000	6A	18/6
	•43E	25.0	0.3	135	135	2.3	—20	490	41.0	2,000	6A	18/—
Pix	220	2.0	0.2	150	100	2.5	—7½	—	8.0	200	4 & 5	9/6
Triotron	P215 ..	2.0	0.25	150	150	1.5	—15	—	19.5	500	4 & 5	10/6
	P225 ..	2.0	0.2	150	150	2.0	—4½	—	10.0	500	4 & 5	10/6
	•P440N ..	4.0	1.1	250	250	3.3	—15	650	28.0	2,000	5 & 7	12/6
	•P441N ..	4.0	1.35	250	250	4.0	—22	500	37.0	3,800	7	13/6
	•P495 ..	4.0	1.5	250	250	10.0	—5½	160	38.5	3,500	7	13/6
	••P420 ..	4.0	0.15	200	150	2.0	—15	1,200	14.5	1,500	4 & 5	10/6

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.	Base pins.	Price.
	••P425 ..	4.0	0.25	300	200	2.0	—20	800	25.0	1,650	5	12/6
	••P433 ..	4.0	1.1	250	250	3.0	—15	400	42.0	2,800	5	13/6
	••P440 ..	4.0	2.0	550	200	3.0	—40	900	52.0	7,600	5	30/–
	••P460 ..	4.0	2.0	550	200	6.0	—40	800	52.0	8,000	5	30/–
	•P2460 ..	24.0	0.18	200	100	8.0	—19	400	40.0	3,000	5	13/6
	•P2020N ..	20.0	0.18	200	200	2.5	—18	1,000	19.0	1,350	5	12/6
	•P2060 ..	24.0	0.2	200	100	8.0	—19	400	40.0	3,550	7	13/6
Tungsram ..	P1222 ..	2.0	0.22	150	150	3.0	—6	—	10.6	600	5	10/–
	•APP4120 ..	4.0	1.2	350	250	3.5	—16.5	400	40.0	3,000	5 & 7	14/9
	•APP4B ..	4.0	1.9	250	250	10.0	—5½	140	38.0	3,600	7	14/9
	••APP4C ..	4.0	1.9	250	250	10.0	—6	150	38.0	3,600	7	14/9
	••PP4101 ..	4.0	1.1	250	250	3.5	—22	600	43.0	2,500	5	14/9
	•PP2018 ..	20.0	0.18	200	200	2.5	—18	750	25.0	1,400	5	14/9
	•PP4118 ..	40.0	0.18	180	180	6.5	—10	250	42.0	3,000	6C	14/9
	•PP36 ..	35.0	0.2	200	200	10.0	—6.5	165	45.0	3,000	7	14/9
	•PP35 ..	35.0	0.2	200	200	10.0	—6½	165	45.0	3,000	7	14/9
	2A5	2.5	1.75	250	250	2.2	—16½	400	40.5	3,000	6A	12/–
	47	2.5	1.75	250	250	2.5	—16½	450	37.0	2,700	5A	12/–
	42	6.3	0.7	250	250	2.2	—16½	400	40.5	3,000	6A	12/–
	43	25.0	0.3	135	135	2.3	—20	500	41.0	2,000	6A	12/–
362	ME2 ..	2.0	0.2	200	200	2.0	—12	—	10.0	1,000	5	10/–
	ME2a ..	2.0	0.2	200	200	2.0	—12	—	10.0	1,000	4	10/–
	•ACME4 ..	4.0	1.0	250	250	2.5	—16	200	44.0	3,500	5	13/–
	•ACME4c ..	4.0	2.0	250	250	4.5	—16	400	66.0	3,500	7	13/–
	••ACME4a ..	4.0	1.0	250	250	3.0	—22	400	44.0	3,500	4	13/–
	••ACME4b ..	4.0	1.0	250	250	3.0	—22	400	44.0	3,500	5	13/–
	••ME25 ..	4.0	2.0	400	400	4.0	—40	700	65.0	9,000	5	30/–
	•CME ..	6.5	0.6	250	250	3.0	—17	400	—	2,500	7	13/–
	•UME ..	13.0	0.3	250	250	3.0	—17	400	—	2,500	7	13/–

DOUBLE OUTPUT VALVES

Maker.	Type.	Circuit.	Fil. volts.	Fil. amp.	Anode volts.	Screen volts.	Average current.	Grid bias.	Power output m.w.	Base pins.	Price.
Cossor	220B	Class B ..	2.0	0.2	120	—	6.0	0	1,250	7	14/–
	240B	Class B ..	2.0	0.4	150	—	8.5	0	2,000	7	14/–
Dario	TR402 ..	Class B ..	2.0	0.2	150	—	7.0	0	1,200	7	9/6
Ever Ready ..	K33A ..	Class B ..	2.0	0.2	150	—	6.0	—	1,450	7	14/–
	K33B ..	Class B ..	2.0	0.2	150	—	6.0	—4½	1,500	7	14/–
	K77A ..	QPP	2.0	0.5	150	100	6.0	—13½	2,000	9	22/6
Hivac	B230	Class B ..	2.0	0.3	150	—	7.0	0	1,250	7	10/6
	DB240 ..	ClassB + driver	2.0	0.4	150	—	8.0	0	1,250	7	15/6
	QP240 ..	QPP	2.0	0.4	150	150	9.0	—18	1,400	7	19/6
	•AC/V ..	Volume expansion ..	4.0	2.0	150	—	—	—10	—	7	15/6
Lissen	BB240 ..	Class B ..	2.0	0.4	150	—	7.0	0	2,400	7	14/–
	BB220A ..	Class B ..	2.0	0.2	150	—	—	—4½	2,000	7	14/–
	B2	Class B ..	2.0	0.1	150	—	—	0	2,000	7	8/–
Marconi	B21	Class B ..	2.0	0.2	150	—	7.5	—6	1,500	7	14/–
	QP21	QPP	2.0	0.4	150	150	9.0	—9	1,500	7	22/6
Mazda	PD220 ..	Class B ..	2.0	0.2	150	—	7.5	—½	2,850	7	14/–
	PD220A ..	Class B ..	2.0	0.2	150	—	7.0	—6	2,900	7	14/–
	QP240 ..	QPP	2.0	0.4	150	150	6.0	—9	2,000	9	22/6
Mullard	PM2B ..	Class B ..	2.0	0.2	150	—	6.0	0	1,450	7	14/–
	PM2BA ..	Class B ..	2.0	0.2	150	—	6.0	—4½	1,450	7	14/–
	QP22A ..	QPP	2.0	0.5	150	150	—	—13½	2,000	9	22/6
Osram	B21	Class B ..	2.0	0.2	150	—	7.5	—6	2,000	7	14/–
	QP21	QPP	2.0	0.4	150	150	9.0	—9	1,200	7	22/6
Philco	19	Class B ..	2.0	0.26	135	—	2.7	0	2,100	6A	14/–
	2103	Class AB ..	2.0	0.12	135	—	—	—9	—	—	18/6
	•46	Class B .. two valves.	2.5	1.5	400	—	—	0	20,000	5A	12/–
	•79	Class B ..	6.3	0.6	250	—	10.5	0	8,000	6A	19/–
	•6A6	Class B ..	—	—	—	—	—	—	—	—	15/6
Triotron	E220B ..	Class B ..	2.0	0.3	150	—	6.0	0	1,350	7	9/6
362.	BA2	Class B ..	2.0	0.2	150	—	5.0	0	1,500	7	9/0
	BX2	Class B ..	2.0	0.4	200	—	7.0	0	3,000	7	9/–
	•DB	Class B ..	26.0	0.3	250	—	—	0	5,000	7	20/–

H.T. RECTIFYING VALVES

Maker.	Type.	Fil. volts.	Fil. amps.	Anode volts max. (RMS).	Output mA.	Price.
Brimar	•1A7	4.0	2.25	350+350	120	15/–
	••R1	4.0	1.0	250+250	60	12/6
	••R2	4.0	2.25	350+350	120	15/–
	••R3	4.0	2.5	500+500	120	20/–
	••4037A	4.0	2.0	260+260	500	22/6
	•1D5	40.0	0.2	250	75	12/6

Maker.	Type.	Fil. volts.	Fil. amps.	Anode volts max. (RMS).	Output mA.	Price.
Cossor	**506BU	4.0	1.0	250+250	60	12/6
	**442BU	4.0	2.5	350+350	120	15/-
	**460BU	4.0	2.5	500+500	120	20/-
	*40SUA	40.0	0.2	250	75	12/6
	**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/-
	**825BU	7.5	2.0	500+500	120	22/6
	**44SU	4.0	0.4	200	20	15/-
	**4128U	4.0	1.0	250	70	15/-
	**8608U	6.0	4.5	1,000	150	63/-
Dario	*1FW1	4.0	2.0	500+500	120	12/-
	**8W1	4.0	1.0	400	60	6/6
	**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	12/-
Ever-Ready	*A11B	4.0	2.4	350+350	120	15/-
	*C10B	20.0	0.2	250	75	12/6
Ferranti	**R4	4.0	2.5	350+350	120	15/-
	**R4A	4.0	2.5	500+500	120	20/-
	*RA	13.0	0.3	250+250	50	12/6
	*RZ	20.0	0.2	250	75	12/6
Hivac	*UU60/250	4.0	1.25	350+350	60	8/6
	*UU120/350	4.0	2.5	350+350	120	10/6
	*UU120/500	4.0	2.5	500+500	120	15/-
Lissen	**U650	6.0	0.5	300	40	12/6
	**UU41	4.0	1.0	300+300	80	12/6
Marconi	**U10	4.0	1.0	250+250	60	12/6
	**U12	4.0	2.5	350+350	120	15/-
	*MU12	4.0	2.5	350+350	120	15/-
	**U14	4.0	2.5	500+500	120	20/-
	*MU14	4.0	2.5	500+500	120	20/-
	**GU1	4.0	3.0	1,000	250	25/-
	**U16	2.0	0.25	5,000	2	20/-
	*U30	26.0	0.3	250	120	15/-
Mazda	*UU3	4.0	2.0	250+250	60	12/6
	**UU120/350	4.0	2.5	350+350	120	15/-
	**UU120/500	4.0	2.5	500+500	120	20/-
	*U4020	40.0	0.2	250	75	12/6
	**MU1	4.0	2.5	1,500	250	25/-
	**MU2	2.0	1.0	4,000	25	20/-
Mullard	**DW2	4.0	1.0	250+250	60	12/6
	**DW3	4.0	2.0	350+350	120	15/-
	**DW4	4.0	2.0	500+500	120	20/-
	*IW2	4.0	1.2	250+250	60	12/6
	*IW3	4.0	2.4	350+350	120	15/-
	*IW4	4.0	2.4	500+500	120	20/-
	*UB1C	20.0	0.2	250	75	12/6
(Side contact base)	*UR1	20.0	0.2	250	75	12/6
(Side contact base)	*UR3	30.0	0.2	250+250	120	15/-
Osram	**U10	4.0	1.0	250+250	60	12/6
	**U12	4.0	2.5	350+350	120	15/-
	**U14	4.0	2.5	500+500	120	20/-
	*MU12	4.0	2.5	350+350	120	15/-
	*MU14	4.0	2.5	500+500	120	20/-
	*U30	26.0	0.3	250 (VD)	120	15/-
	**GU1	4.0	3.0	1,000	250	25/-
	**U16	2.0	0.25	5,000	2	20/-
Ostar Ganz	*EG50	250	0.02	250	50	10/9
	*EG100	250	0.02	250	120	13/6
	*NG50	100–150	0.044	150 (VD)	50	20/6
	*NG100	100–150	0.044	150 (VD)	100	21/9
Philco	**82 (Mercury)	2.5	3.0	500+500	125	11/-
	**866 (Mercury)	2.5	5.0	7,500	600	35/-
	**80	5.0	2.0	350+350	125	8/-
	**83 (Mercury)	5.0	3.0	500+500	250	12/-
	**5Z3	5.0	3.0	500+500	500	11/-
	*84	6.3	0.5	350+350	50	12/9
	**81	7.5	1.25	700	85	20/-
	*12Z3	12.6	0.3	250	60	12/-
	*25Z5	25.0	0.3	125 (VD)	100	14/6
	*25RE	25.0	0.3	275 (VD)	100	14/6
Philips	*1831	4.0	1.2	250+250	60	12/6
	*1831a	4.0	2.4	250+250	60	12/6
	*1867	4.0	2.4	350+350	120	15/-
	*1861	4.0	2.4	500+500	120	20/-
	**1821	4.0	1.0	250+250	60	12/6
	**1807	4.0	2.0	350+350	120	15/-
	**1561	4.0	2.0	500+500	120	20/-
	**373	4.0	1.0	220	40	15/-
	**505	4.0	1.0	400	60	15/-
	**1801	4.0	0.6	250+250	30	12/6
	**1560	5.0	2.0	300+300	125	22/6
	**1817	4.0	4.0	350+350	300	45/-
	*CY1	20.0	0.2	250	75	12/6
	*CY2	30.0	0.2	250+250	120	15/-
Pix	**500	4.0	1.0	350+350	60	6/6

VALVE DATA CHART

Maker.	Type.	Fil. volts.	Fil. amp.	Anode volts max. (RMS).	Output mA.	Price.
Triotron	*G4120N	4.0	2.0	500+500	120	12/6
	**G429	4.0	0.3	250	30	6/–
	**G431	4.0	0.6	250+250	30	6/6
	**G470	4.0	1.0	350+350	70	7/6
	**G4120	4.0	2.0	500+500	120	12/6
	**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
	*G3070	30.0	0.18	250	70	9/6
	*G3412	33.0	0.18	125+125	120	10/6
Tungsram	*APV4200	4.0	2.0	350+350	120	10/–
	**PV495	4.0	1.0	300+300	70	10/–
	**PV4201	4.0	2.0	600+600	180	15/–
	*V2118	20.0	0.18	250	70	10/–
	*PV3018	30.0	0.18	250	100	10/–
	*V30	30.0	0.2	275	120	10/–
	81	7.5	1.25	750	110	17/6
	80	5.0	2.0	350+350	125	7/–
	25Z5	25.0	0.3	125 (VD)	100	13/–
	25Y5	25.0	0.3	250	100	13/–
362	RB41	4.0	1.0	300+300	60	7/6
	RB42	4.0	2.0	500+500	120	10/–

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.		Capacity of each (volt doubler).	Working voltage, D.C.	
		Volts.	mA.		Volts.	mA.	Volts.	mA.			
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
	H10	40	5	10	35	—	—	—	10 mfd.	50	4/6
	H50	205	5	10	175	—	—	—	2 mfd.	250	7/10
	H100	410	5	10	350	—	—	—	1 mfd.	500	12/4
	H120	500	5	10	410	—	—	—	1 mfd.	750	14/–
	H176	750	5	10	620	—	—	—	0.5 mfd.	1,100	20/–

WESTECTORS

Maker.	Type.	Class.	Max. safe input voltage.	Max. current output.	Price.
Westinghouse	W4	Half-wave	24v. peak carrier	0.25 mA	7/6
	W6	Half-wave	36v. peak carrier	0.28 mA	7/6
	Wx6	Half-wave	36v. peak carrier	0.12 mA	7/6
	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.	Base.	Price.
Marconiphone	301	0.3	138-221	E.S.	12/6
	302	0.3	112-195	E.S.	12/6
	251	0.25	100-180	4-pin	12/6
Osram	251	0.25	100-180	4-pin	12/6
	301	0.3	138-221	E.S.	12/6
	302	0.3	112-195	E.S.	12/6
	303	0.3	86-129	E.S.	12/6
	304	0.3	95-165	E.S.	12/6
	202	0.2	114-195	E.S. or 4-pin	12/6
Philips	C1	0.2	90-230	8 S.C.	10/–
	1904	0.1	40-70	4-pin.	12/6
	1920	0.25	40-70	4-pin.	12/6
	1927	0.18	60-120	4-pin.	12/6
	1928	0.18	100-210	4-pin	15/–
	1934	0.25	85-195	4-pin	15/–
	1933	0.1	50-160	4-pin	15/–
	1941	0.3	100-240	4-pin	15/–

SERVICE ACCOUNTS AND RECORDS

If you have a service department, you should instal some simple system for the control of your service records and accounts.

This will enable you :

(1) To render the best possible service at the lowest possible price consistent with reasonable profit, and

(2) To ensure that you make that profit.

It is not a bit of good looking at the sales turnover at the end of the year and wondering where the money has gone. You should know, and know every week, the exact financial position of your service department. A simple system of control will enable you to do this so that you can take the necessary steps to check losses and increase the profit-earning output of the department.

A considerable amount of money is often lost in the service department through such things as :—

Incorrect charges due to haphazard methods of compiling costs.

Damaged stock or spares.

Insufficient stock of spares.

Waste of engineer's time.

This latter item should be checked very carefully, as untrained service engineers can cause heavy losses through unnecessary length of time taken on the job, or repeat work due to their having done the job inefficiently in the first place.

The amount of money a trained service engineer can save you will very soon make the cost of that training a very profitable investment.

To set up a complete system for the control of service accounts, etc., is, of course, a job for a skilled accountant, and although in all businesses the principles involved are the same, they may vary considerably in their application. Here it is only proposed to discuss a simple method whereby from week to week you can readily ascertain how your service department is progressing.

One most important rule to bear in mind is that *all work done and all materials used must be charged to something.*

Most dealers charge so-called free service to the general service accounts. Consequently the sales account looks extremely healthy, and the service account, which has to carry this *free* service, which is given as an aid to sales, is often made to look as though the department were being run at a loss.

To give service a really fair chance, allocate a definite percentage of your sales turnover to cover this free service. This will allow you to get a clear picture of your service department.

Then, when you have fully developed your service so that it can stand on its own feet and show a profit, gradually reduce the percentage allotted from sales until you have managed to make your paid service cover the losses on your *free* service. From then onwards you can show all your profit in the sales account.

Before you can say that your service department is making a profit or not, you must *find out exactly how much that service department is costing you.* The total cost of your service department is the sum of your direct charges and your indirect charges.

Your indirect charges are such items as :—

Interest on capital invested in the service department.

Depreciation of your service premises equipment.

Rent, rates, taxes and insurance (a proportion of which should be charged to the service department).

Maintenance—lighting, heating, etc.

Clerical work and correspondence.

Handling, packing and transport.

Your direct charges are wages paid on productive work, and materials used on productive work. (Materials which you cannot charge to the individual jobs, such as cleaning materials, solder, wire and other small items, are included in your indirect charges.)

From the above you can readily calculate your overheads for a period. The proportion of your overheads to your direct cost of productive labour over the same period will be the percentage which you must add to wages cost on productive work, in order to cover overheads. When charging the customer, add a percentage which will allow you to make a reasonable profit.

Adjust your percentage for overheads periodically and do not try to make profit on your overheads or you will find that your charges will not be competitive with those of other dealers.

Finally, aim to provide your service department with as much productive labour as possible to keep your engineers working to capacity and so automatically reduce the percentage of overheads.

SERVICE ACCOUNTS

A perfectly satisfactory system of control for service records, charges, etc., can be readily developed from the use of a few simple forms. These forms are :—

Job cards.
Engineers' time-sheets.
Record of materials used.
Weekly service analysis.

The correct use of job cards will enable you to keep a permanent record of all work done for any customer or to any instrument.

You should not wait until such time as a customer has a service complaint to make out one of these job cards. You should make out a job card for every instrument when it is sold, and that card should give such details as name, address and 'phone number of buyer, the date on which the instrument was purchased, the make, model and serial number, the mains voltage and frequency (if alternating current), and sufficient space for any further information which you may care to use.

This card is then filed in your service filing cabinet so that when, at a later date, a customer's instrument requires servicing, you can turn up the card and have all the necessary information before you.

On the other side of the job card you can enter up the details of the service complaint, and such information as date, engineer's report, working time, fares or mileage, miscellaneous expenses, materials supplied, name of engineer, etc., and the charge to the customer.

The card can then be filed away until such time as there is another service call, when you immediately take the card out again and you have before you a record of the work done during the previous service call.

Some firms improve on this system, making use of a service requisition form, the same size and shape of the job card, which is filled up by the assistant who attends to the customer's request for service. In addition to the obvious advantages of the use of this form—if it is filed with the job card—the job card can be taken out by the engineer, who can fill in all the details while he is actually on the job, and in the event of the job card being lost (which in practice is extremely rare), a new one can be made out from the service requisition.

Some job cards have ample space for filling in complete details of three service calls. When further service is necessary a fresh job card can be attached to the one in use for a further three calls.

Incidentally, these job cards can also be used as a follow-up system for further sales.

The use of engineers' daily time-sheets will enable you to keep an accurate check on your engineers' activities and show you the actual working time, cost of travelling, outside purchases, etc., to be charged to each job. Where two or more engineers are employed, you can obtain an accurate comparison of the productive efforts of each engineer.

The records of materials used need only be a simple form which will record the materials used, quantity, date, cost and number of the job to which charged. This form, if used in duplicate, will also act as a credit on stores for material issued.

Your weekly service analysis form, which can be drawn up to suit your own requirements, when used in conjunction with the other forms mentioned, should give you a weekly record of your overheads, wages paid to each engineer, materials used on each job, and the proportion of productive as against unproductive labour.

It should also show you approximately your net profit for the week, or if a loss, show you exactly where that loss occurred so that you can take the necessary steps to obviate a similar loss in future.

As previously mentioned, the exact application of these methods will vary with different firms, and the above is only intended as a guide for you to set up some simple system that will at least help you to ensure that your service department is run as economically as possible.

OFFICE USE

No.	Job No.	Working Time	Fares or Mileage @			Outside Service Purchases				Details	Cost				Recovery				Allocation
1.																			
2.																			
3.																			

How an engineer's daily time-sheet is ruled up. There should, of course, be space for more job entries than shown here, and the form must bear the engineer's name and the date, together with the totals in each of the columns.

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 particular the copyright of all broadcast commentaries and all news supplied by the News Agencies, is strictly reserved," they state.

In the case of such broadcasts as the Royal Wedding in November, 1934, 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 by direct application to the B.B.C.

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.

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 7306).

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. ; the 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.

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	11,336,376	5,035,977	1,037,729	5,262,670
England	9,453,270	4,427,693	887,643	4,137,934
Wales (and Monmouth) ...	649,927	257,478	48,198	344,251
Scotland	1,233,179	350,806	101,888	780,485

Possible customers for mains radio are increasing at the rate of 588,000 annually. This market is almost entirely confined to A.C. sets. The number of prospects on D.C. mains has hardly changed at all since 1932.

These facts are revealed by the national market survey of wired homes made by THE BROADCASTER's sister journal, *Electrical Trading*. A detailed analysis showing the market district by district throughout Great Britain is published on the following pages.

The survey shows that over six million homes can now have mains sets—more than half the number of homes in the country.

Of that total, 5,035,977 have A.C. supply and 1,037,729 have D.C. supply.

Since 1932, when the first of these surveys was published, 1,763,985 homes have been wired. Last year's increase was 680,906.

Another important point is that the market for battery sets, though steadily decreasing in size, is still immense. There are 5,262,670 homes without any supply of electricity, and which can therefore only have battery-driven radio.

Key to References

The figures, in every case, refer to the supply areas of the local electricity undertakings.

All figures are official except those marked with an asterisk (*).

Homes with time-controlled A.C. supply are marked thus †.

Data for a few unauthorised electricity undertakings is included. These undertakings are marked §

A brace (⌒) over a figure in the 3rd and 4th columns indicates that no separate figures for A.C and D.C. are available.

Wales and Scotland

The figures for Wales and Scotland are given on pages 141 and 142 respectively. Britain's various small islands come at the end of English Counties.

Name of Supply Authority	Total No. of House-holders in Area	Number of Households on A.C.	on D.C.	Without Supply.
LONDON.				
Battersea Cpn... ..	44,600	14,511†	12,942	17,147
Bermondsey Cpn. ..	—	17,770		—
Bethnal Green Cpn. ..	—	7,525	—	—
Brompton and Kensington E. S. Co. ..	11,425*	10,500*†	—	925
Charing Cross E.S. Co., Ltd.	Figures not available. Very small residential area.			
Chelsea E.S. Co., Ltd...	12,413	5,550	3,547	3,316
Chiswick Cpn.	10,500	500*†	6,000*	4,000
County of London E. S. Co.	425,000*	211,913†		213,087
[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.]				
City of London E.L. Co.	(Very small residential area.)			
East Ham Cpn. ..	30,000*	10,788†	16,500	2,712
Fulham Cpn.	32,500	29,250†	—	3,250
Hackney Cpn.	60,000	600†	39,400	20,000
Hammersmith Cpn. ..	—	—	—	—
Hampstead Cpn. ..	18,991	18,041†	—	950
Hornsey Cpn.	31,450	—	17,000	14,450

Name of Supply Authority	Total No. of House-holders in Area	Number of Households on A.C.	on D.C.	Without Supply.
Islington Cpn.	45,000*	36,000*†	—	9,000
Kensington and Knightsbridge Co. ..	7,713	2,319†	5,191	203
Notting Hill E. L. Co.,	27,500*	3,944†	11,512	12,044
Poplar Cpn.	23,000*	—	21,000*	2,000
St. James and Pall Mall E. L. Co. Ltd. ..	(Not a residential area.)			
St. Marylebone Cpn. ..	18,000	6,330†	9,645	2,025
Shoreditch Cpn. ..	25,000	—	18,130	6,870
South London E. S. Cpn.	—	24,000†	—	—
South Met. E. L. and P. Co.	—	41,000*†	—	—
Southwark Cpn. ..	20,246	—	6,869	13,377
Stepney Cpn.	54,657	—	25,472	29,185
Stoke Newington Cpn.	13,600	1,030†	11,225	1,345
Westminster E. S. Cpn.,	21,000*	12,211†	3,887	4,902
Woolwich Cpn. ..	30,000	19,556†	—	10,444
BEDFORDSHIRE.				
Bedford Cpn.	21,887	16,263†	—	5,624
Beds. Cambs. & Hunts. E. Co.	15,500	8,000†	—	7,500
First Garden City, Ltd.	(See Hertfordshire).			
Luton Cpn.	30,000	13,000†	7,000	10,000

SET MARKET SURVEY

Name of Supply Authority	Total No. of House-holders in Area	Number of Households on A.C.	on D.C.	Without Supply.
BERKSHIRE.				
Abingdon E. S. Co., Ltd.	5,250*	1,650*†	—	3,600
Ascot Gas & E. Co.	(See Surrey).			
Cookham and Dist. E. Cpn., Ltd.	(See Buckinghamshire).			
Maidenhead Cpn.	6,001	2,992†	1,183	1,826
Reading Cpn.	29,796	4,500†	2,200	23,096
Thames Valley E. S. Co.,	9,478	2,087†	—	7,391
Wantage E. S. Co., Ltd.	1,840*	400†*	—	1,440
Windsor E. Installation Co.	5,050*	2,200*†	—	2,850
BUCKINGHAMSHIRE.				
Aylesbury Cpn.	14,610	10,893	750	2,967
Chesham E. L. and P. Co.	9,500*	5,000*†	—	4,500
Cookham and Dist. E. Cpn., Ltd.	5,200	2,100†	—	3,100
Luton Cpn.	(See Beds.).			
Slough and Datchet E.S. Co.	13,000*	6,000*†	—	7,000
Wycombe E. L. and P. Co., Ltd.	11·000*	2,025†	7,140	1,835
CAMBRIDGESHIRE.				
Beds, Cambs and Hunts E. Co.	(See Beds.).			
Cambridge E. S. Co.,	20,000*	12,500*†	—	7,500
Newmarket E. L. Co., Ltd.	2,574	850†	—	1,724
Peterborough Cpn.	(See Northamptonshire).			
Wisbech E. L. and P. Co., Ltd.	4,499	—	825	3,674
CHESHIRE.				
Alderley Edge and Wilmslow E. Bd.	4,383	2,550†	402	1,431
Altrincham E. S. Co.,	17,469	10,190	—	7,279
Birkenhead Cpn.	49,700	14,544†	22,067	13,089
Bredbury and Romilly U.D.C.	4,000	3,500†	—	500
Cheadle and Gatley U.D.C.	7,300	5,812†	—	1,488
Chester Cpn.	15,500	11,697†	—	3,803
Congleton Cpn.	5,379	2,480†	—	2,899
Crewe Cpn.	12,647	6,623†	3,405	2,619
Hazel Grove and Bramhall U.D.C.	4,550	3,500†	—	1,050
Hoylake U.D.C.	6,507	5,617†	—	890
Marple U.D.C.	2,787	1,123†	—	1,664
Mersey Power Co	(See Lancashire).			
Mid-Cheshire E. S. Co.,	20,154	5,246†	2,011	12,897
Sale U.D.C.	10,000	6,500†	—	3,500
Stalybridge, Hyde, Mossley and Dukinfield Tramways and E. Bd.	(See Lancashire).			
Stockport Cpn.	41,500	15,769†	3,500	22,231
Wallasey Cpn.	25,980	23,800†	—	2,180
Warrington Cpn.	(See Lancashire).			
CORNWALL.				
Bodmin E. L. and S. Co.	1,050	—	500	550
Bude E. S. Co., Ltd.	1,450*	300*	900*	250
Callington and D. E. S. Co., Ltd. Urban E. S. Co., Ltd.	680	398†	—	282
Camborne E. S. Co., Ltd.	4,056*	850*†	—	3,206
Cornwall E. P. Co.	(Power supply only)			
Delabole E. L. and S. Co., Ltd.	300	—	250	50
East Cornwall E. S. Co., Ltd.	15,700*	3,028†	—	12,672
Launceston and D. E. S. Co., Ltd.	1,443	—	857	586
Looe E. Co., Ltd.	850*	—	560*	290
Newquay E. L. and P. Co., Ltd.	2,016	1,557†	—	459
Penzance and Dist. E S. Co.	3,200*	1,220*	—	1,980
St. Austell and Dist. E. L. & P. Co.	7,241	2,748†	249	4,244
Truro E. S. Co., Ltd.	3,400	800	—	2,600
West Cornwall E. S. Co., Ltd.	20,000*	8,631†	—	11,369
CUMBERLAND.				
Carlisle Cpn.	24,013	10,213†	1,200	12,600
Keswick E. L. Co., Ltd.	1,020	850	—	170
Mid-Cumberland E. Co., Ltd.	18,000	3,600†	—	14,400
Millom R. D. C.	2,000	914	—	1,086
Penrith E. S. Co., Ltd.	2,038	411†	—	1,627
South Cumberland E. S. Co., Ltd.	6,129	2,037†	—	4,092
Whitehaven Cpn.	5,680	700†	3,640	1,340
Workington Cpn.	6,298	2,491†	—	3,807
DERBYSHIRE.				
Barlborough E. S. Co., Ltd.	433	376	—	57
Bolsover U.D.C.	2,696	1,671†	—	1,025
Buxton Cpn.	4,316	120	2,653	1,543
Chesterfield Cpn.	15,250	8,391†	5,460	1,399
Clowne E. S. Co., Ltd.	1,500	592	—	908
Derby Cpn.	45,710	36,893†	200	8,617
Derbyshire and Nottinghamshire E. P. Co.	125,000	30,000†	1,600	93,400
Killamarsh and Dist. E. S. Co., Ltd.	1,240	650	—	590
Leicestershire and Warwickshire E. P. Co.	(See Leicestershire).			
Long Eaton U.D.C.	6,900	1,750†	4,100	1,050
Mansfield Cpn.	15,400	3,587†	4,784	7,029
Sheffield Cpn.	(See Yorkshire).			
Staveley E. S. Co. Ltd.	1,600	1,400	—	200
Trent Valley and High Peak E. Co., Ltd.	12,862	3,786†	—	9,076
Urban E. S. Co., Ltd.	5,922	—	1,076	4,846
Worksop Cpn.	(See Nottingham)			
DEVONSHIRE.				
Barnstaple Cpn.	4,219	—	2,523	1,696
Bideford and Dist. E. S. Co., Ltd.	8,994	2,320	—	6,674
Bradworthy E. S.	80	—	40	40
Braunton E. L. and P. Co., Ltd.	1,500*	—	750*	750
Brixham Gas and E. Co.	2,350*	—	700*	1650
Chudleigh E. L. and P. Co., Ltd.	500	248†	—	252
Culm Valley E. S. Co., Ltd.	3,376	921†	—	2,455
Dartmouth and Kingswear E. (U. E. S. Co.)	2,170	849†	—	1321
Dawlish E. L. and P. Co. Ltd.	1,500*	1,210*†	—	290
East Devon E. Co., Ltd.	13,309	5,106	—	8,203
Exe Valley E. C., Ltd.	11,806	1,756	58	9,992
Exeter Cpn.	23,100	17,235†	—	5,865
Holsworthy E. S. Co., Ltd.	350	250	—	100
Ilfracombe E. L. and P. Co.	5,019	321	735	3,963
Lynton and Lynmouth E. L. Co., Ltd.	430	421	—	9
Paignton E. L. and P. Co., Ltd.	6,542	4,690†	—	1,852
Plymouth Cpn.	32,550	26,790†	980	4,780
Plympton St. Mary R.D.C.	7,600	4,247†	—	3,353
Salcombe Gas and E. Co., Ltd.	2,343	469†	—	1,874
Teignmouth E. L. Co., Ltd.	6,880	3,103†	—	3,777
Tiverton Cpn.	2,400	—	886	1,514
Torquay Cpn.	52,000	14,500†	370	17,130
West Devon E. S. Co., Ltd.	10,500	2,900†	70	7,530
DORSETSHIRE				
Blandford Forum and Dist E. S. Co., Ltd.	1,100*	500*	—	600
Bridport Cpn.	5,000	1,574	—	3,426
Dorchester Cpn.	2,632	800†	200	1,632
Lyme Regis Cpn.	900	—	700	200
Swanage Gas and E. Co., Ltd.	(See Bournemouth E. Co., Ltd., Hants.)			
Weymouth and Melcombe Regis Cpn.	42,676	4,104†	2,010	36,562
DURHAM.				
Annfield Plain U.D.C.	4,000	3,000†	—	1,000
Crook U.D.C.	1,700	1,628	—	72
Darlington Cpn.	21,231	11,619†	998	8,614
North-Eastern E. S. Co., Ltd.	(See Northumberland).			
Seaham Harbour U.D.C.	5,500	3,600†	—	1,900
South Shields Cpn.	34,000	29,000†	—	5,000
Stockton-on-Tees Cpn.	17,000	9,041†	100	7,859
Sunderland Cpn.	25,500	12,159†	—	13,341
Tanfield U.D.C.	2,250	2,000	—	250
West Hartlepool Cpn.	19,000	8,048†	4,505	6,447

Name of Supply Authority	Total No. of House-holders in Area	Number of Households on A.C.	on D.C.	Without Supply.
ESSEX.				
Barking Cpn.	16,246	10,597†	4,000	1,649
Brentwood Dist. E. Co., Ltd.	5,000	4,000†	—	1,000
Clacton U.D.C. ..	8,000	4,105†	3,466	427
Colchester Cpn. ..	29,000	22,745		6,255
County of London E. S. Co.	(See London).			
Frinton-on-Sea and Dist. E. L. and P. Co. ..	1,352	735†	—	617
Grays Thurrock U.D.C.	4,499	3,215	1,146	138
Harwich Cpn.	3,634	3,182†	—	452
Ilford Cpn.	36,826	14,072†	19,949	2,805
Leyton Cpn.	33,000	21,211	2,950	8,839
North Metropolitan E. P. S. Co.	(See Hertfordshire).			
Saffron Walden Cpn. ..	1,850*	450*†	270	1,130
Southend-on-Sea ..	39,200	23,960†	7,360	7,880
Tilbury U.D.C. ..	3,000	2,205†	—	795
Walthamstow Cpn. ..	34,000	20,281†	6,700	7,019
West Ham Cpn. ..	72,000	40,348†	—	31,652
Wickford and Dist. E. S. Co.	2,250*	1,090*†	—	1,160
GLOUCESTERSHIRE.				
Bourton-on-the-Water L. and P. Co. ..	300*	—	250*	50
Bristol Cpn.	(See Somerset).			
Cheltenham Cpn. ..	18,303	10,228†	—	8,075
Chepstow E. L. and P. Co., Ltd.	(See Wales).			
Cirencester E. S. Co., Ltd.	1,800*	650*	—	1,150
Gloucester Cpn. ..	16,700	6,900†	300	9,500
Northleach E. S. Co., Ltd.	247	—	175	72
Stroud E. S. Co., Ltd...	2,336	722†	—	1,614
Tewkesbury E. L. Co., Ltd.	1,200	510†	—	690
Thornbury and Dist. E. Co., Ltd.	—	310†	—	—
Warmley R.D.C. ..	2,010	1,665†	—	345
West Gloucestershire P. Co.	37,442	6,081†	—	31,361
HAMPSHIRE.				
Aldershot Cpn. ..	4,841	1,320†	809	2,712
Basingstoke Cpn ..	9,815	3,726		6,089
Bournemouth and Poole E. S. Co., Ltd. ..	46,000	21,000*	1,000*	24,000
Fareham U.D.C. ..	3,495	2,482	—	1,013
Gosport and Alverstoke E. L. Co.	10,300	—	5,115	5,185
Lymington E. L. and P. Co.	3,400	1,238†	—	2,162
Milton and Barton-on-Sea E. S. Co. ..	2,000*	950*†	—	1,050
Portsmouth Cpn. ..	85,006	58,425†	—	26,581
Southampton Cpn. ..	56,602	35,444†	2,800	18,358
West Hants E. Co., Ltd.				
Ringwood E. S. Co., Ltd.	33,000	6,000†	—	27,000
Whitchurch Gas and E. Co., Ltd.	650	250†	—	400
Winchester Cpn. ..	7,945	3,085†	848	4,012
HEREFORDSHIRE.				
Ledbury E. S. Co., Ltd. (S.W. and S.E. P. Co.)	1,014	247†	—	767
Leominster E. S. Co., Ltd.	1,450*	500*†	—	950
Shropshire W. and S. Co.	(See Shropshire).			
HERTFORDSHIRE.				
Aylesbury Cpn. ..	(See Bucks).			
Colne Valley E. S. Co., Ltd.	(See Middlesex).			
First Garden City, Ltd.	9,318	4,300†	900	4,118
Luton Cpn.	(See Beds).			
North Met. E. P. S. Co.	231,186	151,616†	2,765	76,805
Northwood E. L. and P. Co.	10,000	6,900†	—	3,100
Watford Cpn.	27,370	18,331	—	9,039
Welwyn Garden City E. S. Co., Ltd. ..	2,848	2,788†	—	60
HUNTINGDONSHIRE.				
Beds, Cambs and Hunts E. Co.	(See Bedfordshire).			
Peterborough Cpn. ..	(See Northamptonshire).			

Name of Supply Authority	Total No. of House-holders in Area	Number of Households on A.C.	on D.C.	Without Supply.
KENT.				
Ashford U.D.C. ..	9,000	6,800†	—	2,200
Beckenham U.D.C. ..	15,606	14,393†	—	1,213
Bexley U.D.C. ..	22,300	21,277†	—	1,023
Bromley Cpn.	14,042	8,399†	—	5,643
Canterbury Cpn. ..	7,418	1,142†	3,923	2,353
Chislehurst E. S. Co. ..	2,500*	1,200*†	—	1,300
Dartford Cpn.	7,300	1,119†	4,455	1,726
Dover Cpn.	10,300	6,548†	—	3,752
Erith U.D.C.	7,890	7,500†	—	390
Foots Cray E. S. Co. (Sidcup)	3,331	2,049†	—	1,282
Gillingham Cpn. ..	15,000*	10,350*†	—	4,650
Gravesend Cpn. ..	15,000	7,500†	2,500	5,000
Herne Bay and Dist. E. S. Co.	5,960	2,310†	—	3,650
Isle of Thanet E.S. Co.	14,130	679	6,369	7,082
Kent Electric Power Co.	—	13,500*†	—	—
Maidstone Cpn. ..	15,000	8,000†	2,000	5,000
Ramsgate and Dist. E. S. Co.	9,000*	—	3,720*	5,280
Sevenoaks and Dist. E. Co.	13,185	8,250†	—	4,935
South East Kent E. P. Co.	20,599	2,989†	—	17,610
Tonbridge U.D.C. ..	6,606	3,200†	300	3,106
Tunbridge Wells Cpn...	12,500	8,800†	—	3,700
Weald E. S. Co. ..	26,154	8,301†	—	17,853
West Kent E. Co. ..	—	19,500*†	—	—
Whitstable E. Co. ..	5,000	4,066†	—	934
LANCASHIRE.				
Accrington Cpn. ..	18,400*	11,819†	—	6,581
Ashton-in-Makerfield U.D.C.	4,400	850†	—	3,550
Ashton-under-Lyne Cpn.	18,000	6,500†	2,500	9,000
Atherton U.D.C. ..	4,700*	2,400*	—	2,300
Bacup Cpn.	5,612	2,795†	—	2,817
Barrow-in-Furness Cpn.	21,200	4,070	5,711	11,419
Birkdale Dist E. S. Co.	4,750*	550*	3,050*	1,150
Blackburn Cpn. ..	39,923	14,453†	1,400	23,370
Blackpool Cpn. ..	41,230*	27,000*	—	14,230
Bolton Cpn.	49,944	22,438†	2,534	24,972
Brierfield U.D.C. ..	1,498	1,115†	—	383
Burnley Cpn.	27,000	12,200†	7,000	7,800
Bury Cpn.	16,316	7,000†	—	9,316
Cark and Dist. E. Co. ..	1,420	475†	—	945
Clitheroe Cpn.	5,856	1,957	—	3,899
Colne Cpn.	8,738	2,924†	1,042	4,772
Darwen Cpn.	13,866	1,498	5,046	7,322
Eccles Cpn.	11,336	6,300†	—	5,056
Farnworth Cpn. ..	8,307	5,343†	1,130	1,834
Fleetwood Cpn. ..	—	5,236	618	—
Formby U.D.C. ..	2,064	1,800†	—	264
Grange U.D.C. ..	700	600†	—	100
Haslingden Cpn. ..	5,500	3,600†	—	1,900
Heywood Cpn. ..	9,100	2,248†	755	6,097
Hindley U.D.C. ..	5,200	1,407†	—	3,793
Horwich U.D.C. ..	4,587	1,850†	—	2,737
Lancashire E. P. Co. ..	71,255	35,415†	—	35,840
Lancaster Cpn. ..	16,748	6,993†	—	9,755
Leigh Cpn.	11,840	4,881†	691	6,268
Littleborough U.D.C. ..	3,500	1,299†	—	2,201
Liverpool Cpn... ..	253,906	70,000*†	23,000*	160,906
Lytham St. Annes Cpn.	7,868	5,437†	823	1,608
Manchester Cpn. ..	198,700	83,997†	3,027	111,676
Mersey Power Co. ..	26,000	17,275†	—	8,725
Middleton Cpn. ..	7,900	4,100†	800	3,000
Morecambe and Heysham Cpn. ..	8,502	7,319†	—	1,183
Nelson Cpn.	11,863	8,650†	—	3,213
Newton-in-Makerfield U.D.C.	5,250	3,240†	—	2,010
Oldham Cpn.	55,000	39,000†	1,600	14,400
Ormskirk E. S. Co. ..	2,635	988†	—	1,647
Padiham U.D.C. ..	3,000	1,200†	—	1,800
Prescot E. Undertaking	2,500*	1,130*†	—	1,370
Preston Cpn.	42,935	22,412†	—	20,523
Radcliffe U.D.C. ..	7,775	2,831†	875	4,069
Rawtenstall Cpn. ..	8,179	4,625†	—	3,554
Rochdale Cpn.	32,200	16,400†	—	15,800
St. Helens Cpn. ..	26,987	11,399†	3,027	12,561
Salford Cpn.	55,403	27,286†	129	27,988
Southport Cpn.	16,247	11,906†	—	4,341
Stalybridge, Hyde, Mossley and Dukinfield Tramways and E. B.	30,000	14,104†	—	15,896
Stretford and Dist E. B.	28,114	19,635†	4,096	8,383
Swinton and Pendlebury U.D.C.	10,431	5,590†	450	4,391
Thornton Cleveleys U.D.C.	3,600	3,272†	—	328
Turton U.D.C. ..	3,350	1,850†	—	1,500
Ulverston U.D.C. ..	2,500	1,050†	—	1,450
Warrington Cpn. ..	30,154	16,132†	60	13,962

SET MARKET SURVEY

Name of Supply Authority	Total No. of House-holders in Area	Number of Households on A.C.	on D.C.	Without Supply.
West Lancashire R.D.C.	2,600*	1,400*†	—	1,200
Westmorland and Dist. E. S. Co.	(See Westmorland)			
Whiston E. S. Authority	2,476*..	1,800*	—	676
Whitworth U.D.C.	3,000	2,000†	—	1,000
Wigan Cpn.	34,900	10,232†	—	24,668
Windermere and Dist. E. S. Co.	(See Westmorland).			
LEICESTERSHIRE.				
Kettering U.D.C.	(See Northamptonshire)			
Leicester Cpn.	70,000	57,500*†	—	12,500
Leicestershire and Warwickshire E. P.	69,600	36,835†	—	32,765
Loughborough Cpn.	7,830	3,837†	3,400	593
Melton Mowbray E. L. Co.	3,226	—	1,729	1,497
Mid-Lincolnshire E. S. Co.	(See Lincolnshire).			
Oakham Gas and E. Co.	1,816	373	—	1,443
Tamworth Dist. E. S. Co.	(See Staffordshire).			
LINCOLNSHIRE.				
Barton-on-Humber E. S. Co.	1,773*	—	550*	1,223
Boston & Dist. E.S. Co.	—	4,150	—	—
Cleethorpes U.D.C.	7,600	4,944†	—	2,656
Gainsborough U.D.C.	4,934	1,620†	—	3,314
Grimsby Cpn.	31,628	13,133†	6,700	11,795
Lincoln Cpn.	19,000	7,624†	200	11,176
Louth Cpn.	3,169	904†	—	2,265
Mid-Lincolnshire E. S. Co.	45,000	10,000†	—	35,000
Scunthorpe and Frodingham U.D.C.	8,568	6,354	—	2,214
Sleaford U.D.C.	1,850	350†	650	850
Spalding U.D.C.	7,771	2,067†	—	5,704
Stamford Urban E. S. Co.	2,482	—	666	1,816
MIDDLESEX.				
Colne Valley E. S. Co.	15,376	12,766†	—	2,610
Ealing Cpn.	21,458	17,305	—	4,153
Finchley Cpn.	19,500	—	13,600	5,900
Harrow E. L. and P. Co.	9,900	500†	7,950	1,450
Hendon E. S. Co.	33,098	30,090†	—	3,008
Heston and Isleworth Cpn.	24,000	20,657		3,343
London and Home Counties J. E. A.	(See Surrey).			
North Metropolitan E. P. S. Co.	(See Hertfordshire).			
Northwood E. L. and P. Co.	10,000	6,900†	—	3,100
Twickenham (J.E.A.)	34,128	20,173†	9,240	4,715
Willesden Cpn.	40,000	35,000†	1,500	3,500
Woking E. S. Co.	(See Surrey).			
NORFOLK.				
East Anglian Co.	104,729*	16,800*†		87,929
East Dereham U.D.C.	1,089	790†	—	899
Great Yarmouth Cpn.	31,779	18,466†	—	13,313
Kings Lynn Cpn.	6,847	1,378†	3,779	1,690
Norwich Cpn.	61,307	38,436†	3,500	19,371
NORTHAMPTONSHIRE.				
Kettering U.D.C.	19,292	11,383†	2,298	5,611
Mid-Lincolnshire E. S. Co.	(See Lincolnshire).			
Northampton E. L. and P. Co.	56,941	29,900†	1,200	25,841
Peterborough Cpn.	16,000	9,500†	500	6,000
Rushden and Dist E. S.	11,000*	3,600*†	700*	6,700
Stamford (Urban E. S. Co.)	(See Lincolnshire).			
Wellingborough E. S. Co.	8,537	3,367†	300	4,870
NORTHUMBERLAND.				
Amble U.D.C.	1,300	1,100†	—	200
Berwick-on-Tweed (Urban E. S. Co.)	4,073	—	1,281	2,792
North Eastern E. S. Co.	389,332	162,500†	2,500	224,332
Tynemouth Cpn.	16,000	11,900†	—	4,100
NOTTINGHAMSHIRE.				
Derbyshire and Nottinghamshire E. P. Co.	(See Derbyshire).			
East Retford Cpn.	8,600	4,500†	—	4,100
Long Eaton U.D.C.	(See Derbyshire).			
Mansfield Cpn.	15,334*	3,300*†	4,040*	7,994
Newark-on-Trent Cpn.	5,613	3,552†	—	2,061
Nottingham Cpn.	96,000	40,000†	40,000	16,000
Worksop Cpn.	6,800	2,301†	3,066	1,433
OXFORDSHIRE.				
Aylesbury Cpn.	(See Bucks).			
Banbury and Dist. E. S. Co. (S.W.S. and S. Co.)	3,704	1,262†	926	1,516
Burford E. L. and P Co.	466	212†	70	184
Chipping Norton E. S. Co., Ltd.	—	—	—	—
Oxford Cpn.	15,900	12,033†	20	3,847
Reading Cpn.	(See Berkshire).			
Thames Valley E. S. Co., Ltd.	(See Berkshire).			
Witney U.D.C.	1,050*	320*†	520*	210
Woodstock and Dist. E. Distribution Co., Ltd.	525	385†	—	140
SHROPSHIRE.				
Market Drayton E. L. and P. Co.	1,225	—	936	289
Midland E. Corporation for P. Dist., Ltd.	(See Staffordshire).			
North West Midlands J.E.A.	(See Staffordshire).			
Oswestry Cpn.	6,337	2,174†	—	4,163
Shrewsbury Cpn.	9,390	—	4,375	5,015
Shropshire, Worcestershire and Staffordshire E. P. Co.	156,629	46,200†	9,320	101,109
SOMERSETSHIRE.				
Bath Cpn.	23,011	8,852†	1,011	13,148
Bristol Cpn.	94,100*	57,700†	—	36,400
Burnham and Dist. E. S. Co.	1,200	1,016†	—	184
Mid-Somerset E. S. Co.	1,140	912†	—	228
Minehead E. S. Co.	5,871	2,633†	—	3,238
North Somerset E. S. Co.	37,052	14,252†	—	22,800
Taunton Cpn.	12,814	6,018	—	6,796
Wellington Dist. E. Co.	3,500	1,022†	—	2,778
Wessex E. Co.	11,480	3,050	—	8,430
Weston-super-Mare and Dist. E. Co.	8,522	5,719		2,803
Yeovil E. L. and P. Co.	4,000	120	1,930	1,950
STAFFORDSHIRE.				
Burton-on-Trent Cpn.	26,000	17,900†‡	—	8,100
Cannock U.D.C.	10,167	5,457†	—	4,710
Chasetown and Dist. E. Co.	7,292	4,569	—	2,723
Leek U.D.C.	5,555	256†	3,388	1,911
Lichfield Cpn.	4,035	2,486†	—	1,549
Midland E. Corp for Power Distribution	74,083	26,878†	1,500	45,705
Newcastle-under-Lyme Cpn.	11,250*	1,200	2,950	7,100
N.W. Midlands J.E.A.	24,353	4,322†	—	20,031
Shropshire, Worcestershire and Staffordshire E. P. Co.	(See Shropshire).			
Stafford Cpn.	7,589	—	—	7,589
Stoke-on-Trent Cpn.	67,802	18,550†	2,200	47,052
Stone U.D.C.	2,700	1,587†	—	1,113
Tamworth Cpn.	7,815	6,430	—	1,385
Trent Valley and High Peak E. Co.	(See Derbyshire).			
Uttoxeter U.D.C.	2,409	1,223†	—	1,186
Walsall Cpn.	28,000	16,000†	—	12,000
West Bromwich Cpn.	18,875	6,875†	2,178	9,822
Wolverhampton Cpn.	40,000	29,800†	—	10,200
SUFFOLK.				
Aldeburgh E. S. Co.	760	—	499	261
Bungay Gas and E. Co.	800	601†	—	199
Bury St. Edmund's Cpn.	4,800	2,686†	—	2,114
East Anglian E. S. Co.	(See Norfolk).			
East Suffolk E. Dist. Co. Ltd.	4,128	1,700†	—	2,428
Felixstowe U.D.C.	3,929	3,260†	570	99
Ipswich Cpn.	29,550	11,650†	6,600	11,300
Lowestoft Cpn.	13,725	2,934	6,656	4,135
Nayland E. L. and P. Co.	400	—	200	200
Parker Bars (Mildenhall), Ltd.	600	—	265	335
Woodbridge and Dist. E. L. Co.	1,820*	700*†	—	1,120
SURREY.				
Ascot Dist. Gas and E. Co.	9,463	2,642		6,821

Name of Supply Authority	Total No. of House-holders in Area	Number of Households on A.C.	on D.C.	Without Supply.
Barnes Cpn.	11,500	—	10,500	1,000
County of London E. S. Co.	(See London).			
Dorking (J.E.A.) ..	7,498	2,700†	2,100	2,698
East Grinstead U.D.C.	(See Sussex).			
Epsom and Ewell U.D.C.	5,504	1,599†	2,984	921
Farnham Gas and E. Co.	6,500*	2,700*†	—	3,800
Guildford Cpn... ..	15,800	11,871†	300	3,629
Horley and Dist. E. S. Co.	4,800	2,300†	—	2,500
Kingston - on - Thames Cpn.	10,450	7,447†	—	3,003
Leatherhead and Dist. (J.E.A.)	8,801	4,626†	1,475	2,700
London and Home Counties J.E.A. ..	113,068	83,682†	12,815	16,571
Reigate Cpn.	—	7,601†	—	—
Richmond E. L. and P. Co.	9,874	7,065†	—	2,809
Sevenoaks and D. E. Co.	(See Kent).			
Surbiton E. Authority (J.E.A.)	12,188	12,120†	—	68
Sussex E. S. Co. ..	(See Sussex).			
Sutton (J.E.A.) ..	43,451	42,463†	—	5,988
Walton and Weybridge U.D.C.	5,810	3,776†	—	2,034
Weybridge (J.E.A.) ..	2,002	1,600†	—	402
Wimbledon Cpn. ..	33,142	32,897†	—	245
Woking E. S. Co. ..	18,083	12,646†	—	5,437
Yorktown (Camberley) and Dist. Gas and E. Co.	7,233	2,123	—	5,110
SUSSEX.				
Bexhill Cpn.	5,705	420†	4,926	359
Bognor Gas and E. Co.	7,750	5,790†	—	1,960
Brighton Cpn.	50,000	8,000†	32,000	10,000
Burgess Hill and Dist. E. S. Co.	2,227	1,050†	—	1,177
Central Sussex E. Co. and Assoc. Companies	21,000*	5,000*†	1,000*	15,000
East Grinstead U.D.C.	2,900	972†	957	971
Eastbourne Cpn. ..	19,704	16,620†	—	3,084
Hastings Cpn.	25,298	19,722†	—	5,576
Horley and Dist. E. S. Co.	(See Surrey).			
Lewes and Dist. E. S. Co.	3,361	—	1,699	1,692
Peacehaven E. L. and P. Co.	1,400*	700*	—	700
Shoreham and Dist. E. L. and P. Co. ..	6,000	2,973†	—	3,027
Steyning E. L. Co. ..	6,208	1,750†	—	4,458
Sussex E. S. Co. ..	2,455	1,042†	—	1,413
Worthing Cpn... ..	23,000	7,594†	8,939	6,467
WARWICKSHIRE.				
Birmingham Cpn. ..	290,000	122,000†	28,000	140,000
Coventry Cpn. ..	66,628	44,676†	—	21,952
Leamington and Warwick E. Co.	5,060*	600*†	650*	3,810
Leicestershire and Warwickshire E. P. Co...	(See Leicestershire).			
Midland E. L. and P. Co.	9,350*	1,650*†	800*	6,900
Nuneaton Cpn. ..	12,972	6,500†	3,700	2,772
Rugby Cpn.	6,100	3,900*†	—	2,200
Stratford-on-Avon E. Co. (S.W. & S. Co.) ..	3,158	710†	850	1,598
Sutton Coldfield Cpn...	10,632	2,100†	5,604	2,928
Tamworth Dist. E. S. Co.	(See Staffordshire).			
WESTMORLAND.				
Barrow-in-Furness Cpn.	(See Lancashire).			
Brough E. L. Co. § ..	200	—	112	88
Kendal Cpn.	4,625	1,535†	—	3,090
Westmorland and Dist. E. S. Ltd.	13,000	3,439†	—	9,561
Windermere and Dist. E. S. Co.	3,600	1,851†	—	1,749
WILTSHIRE.				
Amesbury E. L. and Gen. S. Co.	500*	—	300*	200
Calne Cpn.	970*	—	300*	670
Durrington E. L. Co. § ..	500	3*0	—	120
Marlborough Cpn. ..	1,250	—	626	624
Salisbury E. L. and S. Co.	7,924	900	3,314	3,710
Swindon Cpn.	18,919	6,378†	6,886	5,655
Tisbury E. S. Co. ..	628	—	168	460
West Wilts E. L. and P. Co.	20,000	10,485†	—	9,515
Wilton E. S. Co., Ltd. ..	500	156†	—	344
WORCESTERSHIRE.				
Kidderminster and Dist. E. S. Co (S.W. and S. Co.)	10,972	2,139†	1,900	6,933
Malvern U.D.C. ..	3,275	2,461	—	814
Midland E. Corp. for Power Distribution..	(See Staffordshire).			
Shropshire, Worcestershire and Staffordshire E. P. Co.	(See Shropshire).			
Worcester Cpn. ..	18,000	12,300†	—	5,700
YORKSHIRE.				
Adwick-le-Street U.D.C.	4,249	3,289†	—	960
Askrigg and Reeth E. S. Co.	550	280	—	270
Barnoldswick U.D.C. ..	3,127	969†	—	2,158
Barnsley Cpn.	16,634	10,600†	34	6,000
Batley Cpn.	10,103	4,790	1,200	4,113
Bingley U.D.C. ..	7,216	4,352†	—	2,864
Bradford Cpn. ..	83,895	33,936†	2,329	47,630
Bridlington Cpn. ..	5,706	3,950†	—	1,756
Brighouse Cpn. ..	6,548	1,974†	—	4,574
Buckrose L. and P. Co.	—	2,100†	—	—
Clitheroe Corporation.	(See Lancashire).			
Craven Hydro E. S. Co.	361*	—	337*	24
Dearne Dist. E. B. ..	9,200	3,700†	—	5,500
Dewsbury Cpn. ..	15,806	6,539†	1,000	8,267
Doncaster Cpn. ..	20,317	12,100†	333	7,884
Electrical Distribution of Yorks	206,000	76,000†	—	130,000
Earby U.D.C.	1,661	950†	—	711
Elland U.D.C.	3,457	1,446†	950	1,061
Eston U.D.C.	6,850	5,835	—	1,015
Guisborough U.D.C. ..	1,400*	1,150*	—	250
Halifax Cpn.	29,118	13,469		15,649
Harrogate Cpn. ..	21,000	12,965†	—	8,035
Hawes E. L. Co. ..	—	207	—	—
Haworth U.D.C. ..	2,000	400†	—	1,600
Hebden Bridge Cpn. ..	2,100	1,103†	—	997
Heckmondwike U.D.C.	2,500*	—	2,000*	500
Holmfirth U.D.C. ..	3,601	2,500†	—	1,101
Huddersfield Cpn. ..	40,897	30,404†	—	10,493
Hull Cpn.	92,804	31,831†	25,110	35,863
Ilkley U.D.C.	2,734	2,265†	—	469
Keighley Cpn.	14,564	3,826†	2,468	8,270
Kettlewell E. S. Co. ..	—	—	70	—
Leeds Corporation ..	135,200	107,792†	—	27,408
Leyburn E. S. Co. ..	—	—	250	—
Mexborough U.D.C. ..	3,929	—	3,040	889
Middlesbrough Cpn. ..	32,000*	30,000†	300	1,700
Mirfield U.D.C. ..	4,500	2,300†	—	2,200
Morley Cpn.	6,645*	4,340*†	—	2,305
Newmill U.D.C. ..	1,220	1,024†	—	196
Normanton U.D.C. ..	3,600	1,441†	—	2,159
North-Eastern E. S. Co.	(See Northumberland).			
Pudsey Cpn.	4,882	3,700†	—	1,182
Redcar Cpn.	6,176	5,370†	—	806
Richmond Cpn. ..	—	1,278†	—	—
Rochdale Cpn. ..	31,000*	15,000*†	—	16,000
Rotherham Cpn. ..	29,400	17,500†	—	11,900
Scarborough Cpn. ..	18,850	10,829†	—	8,021
Sedburgh E. S. Auth...	800	220	—	580
Settle and Dist. E. Co...	3,710	1,220†	—	2,490
Sheffield Cpn.	150,355	113,087	—	37,268
Shipley U.D.C.	9,457	5,725†	680	3,052
Skelton and Brotton U.D.C.	3,204	2,643†	—	561
Skipton U.D.C. ..	4,500	2,300†	—	2,200
Slaithwaite U.D.C. ..	1,510*	800*	—	710
Spenborough U.D.C. ..	3,700	1,800†	—	1,900
Tadcaster E. Co. ..	1,102	—	549	553
Wakefield Cpn. ..	14,600	13,324†	—	1,276
West Riding Automobile Co.	4,428	852†	—	3,576
Whitby U.D.C. ..	3,700	1,200†	1,547	953
Whitwood U.D.C. ..	1,690	995†	—	695
York Cpn.	30,082	24,000†	3,024	3,058
Yorkshire E. P. Co. ..	—	—	—	—
ISLANDS.				
Douglas Cpn. (I.O.M.)..	6,010	1,470†	3,030	1,510
Guernsey States E. B...	8,000	897†	2,691	4,412
Isle of Man E. B. ..	7,000	1,800†	—	5,200
Isle of Wight E. L. and P. Co.	29,000	10,500†	—	18,500
Jersey E. Co., Ltd. ..	—	4,292	—	—
Lerwick Cpn. (Shetland)	1,405	—	788	617
St. Mary (Scilly) E. S. Co.	250	108	—	142

Wales and Monmouth

Aberaugell E. S. ..	—	—	130	—
Aberayron and Dist. E. S. Co.	400	—	260	140
Aberdare U.D.C. ..	12,263	10,186	1,000	1,076
Abertillery U.D.C. ..	6,574	1,605	1,680	3,289

SET MARKET SURVEY

Name of Supply Authority	Total No. of Householders in Area	Number of Households on A.C.	on D.C.	Without Supply.
Ammanford U.D.C.	1,750	1,460†	—	290
Bangor Cpn.	2,700	2,540†	—	160
Barry U.D.C.	8,470*	300*	—	8,170
Bedwas and Machen U.D.C.	2,000*	1,300*	—	700
Bedwellty U.D.C.	6,079	5,434†	—	645
Bethesda U.D.C.	1,500	900†	—	600
Bettws-y-Coed U.D.C.	218	196	—	22
Borth and Ynyslas E. S. Co.	450	—	227	223
Brecon Cpn.	1,440	—	1,154	286
Bridgend U.D.C.	5,944	4,013	—	1,931
Brynamman and Dist. E. S. Co.	4,747	2,764	—	1,983
Caernarvon Cpn.	2,300	2,050†	—	250
Caerphilly U.D.C.	9,350*	1,100*	—	8,250
Caerswa E. S. Co.	—	115	—	—
Cardiff Cpn.	44,000	40,542†	1,700	1,458
Cardiff R.D.C.	8,379	3,960†	—	4,419
Carmarthen E. S. Co.	2,740*	400*	1,800*	540
Chepstow E. L. and P. Co.	1,520	540	—	980
Colwyn Bay U.D.C.	7,000	5,692†	700	608
Connah's Quay U.D.C.	1,200	950†	—	250
Conway Cpn.	3,000	2,505†	—	495
Cwmbran U.D.C.	1,975	1,300	—	675
Ebbw Vale U.D.C.	6,231	—	5,42	807
Ely Valley L. Co.	4,000	2,500	—	1,500
Gellygaer U.D.C.	8,877	7,200†	—	1,677
Glantawe E. S. Co.	—	—	1,540	—
Gorseinon E. L. Co.	5,120	2,400†	700	2,020
Hawarden R.D.C.	7,000	4,500†	—	2,500
Llandrindod Wells U.D.C.	800	—	720	80
Llandudno U.D.C.	4,500*	1,500*	2,200*	800
Llanelly and Dist. E. S. Co.	25,096	6,044†	3,000	16,052
Llanfairfechan U.D.C.	800	595†	—	205
Llangollen and Dist. E. L. and P. Co.	933	—	430	503
Llanidloes E. L. Co.	700	—	386	314
Llanrwst E. S. Co.	1,108	220†	300	588
Llantarnam U.D.C.	1,600*	1,350*	—	250
Machynlleth E. S. Co.	552	326	—	226
Maesteg U.D.C.	5,500	5,400	—	100
Menai Bridge U.D.C.	681*	300*	—	381
Merthyr E. Traction and L. Co.	17,112	1,888	3,728	11,496
Milford Haven U.D.C.	2,393	—	1,626	767
Monmouth E. Co.	1,120	548†	—	572
Mountain Ash U.D.C.	8,120	8,100	—	20
Mynyddislwyn U.D.C.	3,500	3,200	—	300
Neath Cpn.	8,000	2,094	—	5,906
Newport Cpn.	22,806	13,454†	7,701	1,651
Ogmore and Garw U.D.C.	2,600	2,451	—	149
Ogmore Valley E. L. and P. S. Co.	3,000	2,800†	—	200
Oswestry Cpn.		(See Shropshire)		
Penarth E. L. Co.	4,750	116†	1,850	2,785
Penmaenmawr U.D.C.	1,300	1,250†	—	50
Penybont R. D. C.	2,000	1,922†	—	78
Pontardawe R.D.C.	6,800	4,200	—	2,600
Pontypool E. L. & P. Co.	8,236	2,000	—	6,236
Pontypridd U.D.C.	9,020	1,750	2,788	4,482
Port Talbot Cpn.	9,903	1,550	—	8,353
Porthcawl E. Co.	1,500*	700*	—	800
Prestatyn U.D.C.	1,640*	1,220*†	—	420
Rhondda U.D.C.	28,880	15,147	—	13,733
Risca U.D.C.	4,035	1,781†	—	2,254
Ruthin E. S. Co.	920	—	730	190
South Wales E. P. Co.	36,250	22,777†	—	13,473
Swansea Cpn.	38,772	21,403†	500	16,869
Tredegar U.D.C.	4,100	217	—	3,883
West Cambrian P. Co.	500*	—	400*	100
Wrexham Cpn.	5,606	3,052†	948	1,666
Yale E. P. Co.	2,000	—	1,450	550

SCOTLAND

Aberdeen Cpn.	47,000	19,000	?	28,000
Arbroath E. L. and P. Co.	4,000	210†	1,364	2,426
Ayrshire, E.B.	74,793	21 57†	2,344	51,392
Berwick-on-Tweed. (Urban E.S.Co.	3,360*	—	1,250*	2,050
Blair-Atholl	—	—	60	—
Bo'ness Cpn.	2,234	—	841	1,393
Buckie Cpn.	1,975	—	683	1,292
Clyde Valley E. P. Co.	—	89,159†	—	—
Coatbridge and Airdrie E.S.Co.	15,000*	—	1,250*	13,750
Crieff Electric S. Co., Ltd.	1,400	—	235	1,165
Denny and Dunipace Cpn.	1,136	687	—	449
Dumfries Cpn.	5,845	2,018	2,045	1,782
Dumfriesshire C.C.	14,176	5,100†	—	9,076
Duncan's E. S. Co.	777	—	464	313
Dundee Cpn.	47,836	11,830	—	36,006
Dunoon and Dist. E. S. Co.	4,300	2,480	—	1,820
Edinburgh Cpn.	111,233*	38,000*†	9,500*	63,733
Elgin E. S. Co.	2,000	—	300	1,700
Falkirk Cpn.	9,650	4,422†	—	5,228
Fife E. P. Co.	2,519	—	1,010	1,509
Fochabers E. Und.	273	—	267	6
Fort Augustus E. S.	—	—	44	—
Fort William E. L. Co.	580	—	400	580
Glasgow Cpn.	456,455	73,692	35,901	146,862
Grantown-on-Spey E. S. Co.	560	—	290	270
Greenock Cpn.	23,795	4,001†	4,830	14,964
Hamilton Cpn.	9,530	4,200†	500	4,830
Hawick E. S. Und. (Urban E. S. Co.)	5,509	—	1,394	4,115
Inverness Cpn.	6,939	—	3,461	3,478
Kirkcaldy Cpn.	10,200*	2,400*	700*	7,100
Kirkcudbright C.C.	9,500	2,100†	—	7,400
Lairg E. S. Co.	—	64	81	—
Lothians E. P. Co.	35,417	8,459†	—	26,958
Motherwell and Wishaw Cpn.	14,933	—	8,439	6,494
Musselburgh and Dist. E. L. and Traction Co.	5 286	22	1,502	3,762
North Berwick Cpn.	1,260	419†	—	841
North of Scotland E. L. and P. Co.	3,399	—	639	2,760
Paisley Cpn.	20,000	15,000*†	—	5,000
Perth Cpn.	9,384	—	4,300	5,084
Peterhead E. S. Co.	3,000*	350*	—	2,650
Rothesay Cpn.	2,713	—	1,000	1,713
St. Andrews E. S. Auth.	2,425*	—	950*	1,475
Scottish Midlands E. S. Co.	36,800*	5,500*†	—	31,300
Skelmorlie E.S. Co. Ltd.	2,000	500†	—	1,500
Stirling Cpn.	5,371	—	3,083	2,288
Stornoway E. S. Co.	974	—	119	855
Tobermory Cpn.	224	—	127	97
Wick Cpn.	2,085	—	1,396	689
Wigtownshire E. Co.	6,306	1,250†	—	5,056

P.M.G. 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."

Camel Accumulators Ltd., 9, Newington Causeway, S.E.1. HOP 3404

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 included 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 ja 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 Willans 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

CAMEL ACCUMULATOR goes for Weeks without a Charge.

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-diodo-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

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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 climinate 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

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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 ¼ 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 that it 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.

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THE INDUSTRY AT LAW

Summary of the Year's Actions

Patents

Pentode Valve : Mullard Appeal.—In the Court of Appeal, before the Master of the Rolls and Lords Justices Romer and Maugham, the Mullard Radio Valve Co., Ltd., appealed against the judgment of Mr. Justice Farwell in the Chancery Division dismissing an action against the Philco Radio and Television Corporation of Great Britain, Ltd., and others.

The Mullard Company originally claimed an injunction restraining infringement of their patent No. 287,958 of December 24, 1926, relating to "improvements in or relating to circuit arrangements and discharge tubes for amplifying electric oscillations."

CASE FOR PATENTEES :—Sir Stafford Cripps, K.C., for the Mullard Company, said that Mr. Justice Farwell found that the patent was invalid so far as the second claim was concerned. The first claim dealt with a circuit in which a certain type of valve was used, and the second claim with the valve itself. It was alleged that the second claim had been infringed by certain valves manufactured by the Philco Company. Notice of their intention to challenge the validity of the first claim had been given by the Philco Company.

Sir Stafford Cripps explained that it had been said that the second claim was not valid because it was too wide, and also that there was no difficulty in constructing the valve. Although the judge said that it was a surprising idea that a valve could be made which operated in this way, he took the claim to refer merely to the mechanical construction of the valve, and he said there was nothing surprising or difficult in making this valve, and there was no invention.

Evidence as to the characteristics of the pentode was then given, and Counsel mentioned that the utility of the patented valve was not disputed.

Replying to Lord Hanworth, Sir Stafford said that the second claim was wholly independent of the first claim. The valve was not only useful in the patent sense, but was being widely used in the commercial sense.

Sir Stafford Cripps further explained that the second claim was for a valve having at least three auxiliary electrodes between the cathode and the anode.

Referring to Capt. Round's specification, which was alleged to anticipate the pentode, counsel said it showed a valve with five or more electrodes in it, and the valve was indicated by the description to be a multiplication of triodes in its operation. In no case was the grid nearest to the anode directly connected to the cathode, and counsel submitted that the specification could not be an anticipation of the plaintiff's patent.

As long ago as 1914, said Sir Stafford, the fact that secondary emission might affect the various currents in a valve was known, but nobody discovered how to remedy the admitted defects in the triode amplifier prior to the date of the plaintiff's patent.

CASE FOR THE RESPONDENTS :—Mr. J. Whitehead, K.C., for the respondents said that Mr. Justice Farwell held that the claim was too wide, having regard to its want of limitations, to have any conceivable subject matter, and to have required any inventive step at all.

"It is enough for me to say that it is wide enough to negative the possibility of an inventive step," added Mr. Whitehead. "The claim may include an inventive step, but it has gone far beyond that. An invention might be required for the solution of a particular problem, and if the claim had been limited to that there would have been a possibility of it being valid, but the claim includes not only that, but much beyond it."

It sets out to cover a certain kind of valve, as an article of commerce, entirely without regard to its particular use. The claim is not even limited to an amplifier nor confined to a pentode. There is no explanation of the utility in using multigrid valves, or in picking out the potential on one particular grid, apart from the circuit arrangement covered by the first claim.

Mr. Trevor Watson, K.C., followed : Taking electrical facts known at the time, there is no particular reason shown by the Patentees—on whom the onus lies—why the obvious method of limiting the effects of secondary emission should not at least, already have been tried, seeing that the operation of the screen grid valve had been completely described by Hull and Williams. An invention may be wider than the particular solution described, but not wider than the problem the patentee sets out to solve. A claim which covers more than has been invented is generally inconvenient and hurtful to trade and is therefore barred by the Statute of Monopolies.

JUDGMENT :—The appeal was dismissed with costs on the ground that claim 2 (which covers the pentode valve by itself, apart from any circuit in which it is used) was too wide, and was wanting in subject-matter. Claim 1 was not invalid, and costs were given to the appellants on this particular issue.

In his judgment the Master of the Rolls (Lord Hanworth) said : Claim 2 is not limited to any particular circuit or to the solution of any particular problem. It covers a multitude of valves with no necessary relation to the inventive step set out in the first claim. It has already been laid down that an invention must be novel and useful, and the specification intelligible. Also the specification must not attempt to cover more than the inventor has actually discovered. If it does the patent fails. For these reasons I agree with Mr. Justice Farwell that claims 2 and 5 cannot be sustained.

Lord Justice Romer in agreeing with the Master of the Rolls, pointed out that claim 2 would be good if it had been confined to an amplifier in which the screen-grid current was prevented from increasing at the expense of the anode current by the use of a fourth electrode inserted near the anode and connected to the cathode. But as it stands the claim covers a wide and unexplored field in which other workers might continually find themselves embarrassed and hindered by the existence of the claim, without having received from the patentee any adequate consideration.

Lord Justice Maugham also concurred that the appeal must be dismissed.

A further appeal in this matter is now pending in the House of Lords.

Price-Cutting

"Ultra" Injunction.—In the Chancery Division, Mr. Justice Bennett, heard a motion by Hochohm G.m.b.H. and Ultra Electric, Ltd., for an interim injunction restraining M. C. Ellison, trading as Coates and Co., at Albert Street, Harrogate, from selling plaintiffs' sets at prices

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lower than the minimum retail prices fixed by the plaintiffs was mentioned.

Sir Stafford Cripps, K.C., for the plaintiffs, stated that the parties had arrived at a settlement. The defendants consented to the motion being treated as the trial of the action, submitted to an injunction during the life of the patent, and agreed to pay the costs as between solicitor and client and one guinea by way of nominal damages.

His lordship said there would be judgment for plaintiffs, by consent, in the terms agreed.

Mullard Action to Maintain Prices.—An action by the Mullard Radio Valve Co., Ltd., *v.* H. A. Epton was heard before Mr. Justice Clauson in the Chancery Division.

Mr. R. Burrell, for the company, stated that the action was for infringement of patent by the selling of their valves below the stipulated price.

The defendant appeared in person and consented to judgment being entered against him in the terms specified in the motion for judgment.

A SECOND ACTION:—In a similar action by the M.O. Valve Co., Ltd., against Mr. Epton, Mr. P. Bevan, counsel for the company, asked for an injunction to prevent the infringement of certain letters patent by the selling of valves under the stipulated price.

Mr. Epton, who appeared in person, consented to judgment being entered against him in the terms specified in the motion for judgment.

Miscellaneous

Use of Trading Name.—In the Chancery Division after a two-day hearing, Mr. Justice Clauson granted Radio Rentals, Ltd., Regent Street, London, W., an injunction restraining Rentals, Ltd., Balham Road, Lower Edmonton, from trading under the style of Rentals, Ltd., or any other style resembling Radio Rentals, Ltd.

Damages were fixed at 30 gns.

T. N. Cole v. "Ever Ready": Disputed Agreement.—Procedure summonses in an action by Mr. T. N. Cole against the Ever Ready Co. (Great Britain), Ltd., Sir James Hamet Dunn, the Dean Finance Co., Ltd., and Mr. John S. E. Todd, came before Mr. Justice Crossman in the Chancery Division.

Mr. Cyril Radcliffe, for Mr. Cole, said that four separate defences to the action had been put in, and his application now was for certain particulars in connection with the defences.

Mr. Justice Crossman made an order that some of the particulars should be given.

The question in the action, said Mr. Radcliffe, was whether an undertaking contained in a letter was enforceable or not. Mr. Cole was asking in the action for a declaration that the undertaking was void.

It was pleaded by Mr. Cole, continued Mr. Radcliffe, that he was the owner of 200,000 fully paid £1 ordinary shares in Lissen, Ltd., a company of which he was managing director. He was introduced to Mr. Todd, a partner in a firm of stock and share brokers, who, it was pleaded, told Mr. Cole that he was acting for Sir James Dunn, who offered to purchase Mr. Cole's Lissen shares at 40s. a share.

IN RESTRAINT OF TRADE:—The offer was subject to a stipulation that Mr. Cole should not take part in any form of competitive activity for five years after leaving Lissen, Ltd. A letter was signed by Mr. Cole containing such an undertaking.

Sir James Dunn acquired 190,000 shares and subsequently, according to the pleading, the Ever Ready Co., Ltd., agreed to purchase 170,000 of his 190,000 shares at 50s. a share.

The Ever Ready Co., Ltd., said Mr. Radcliffe, came into the matter as assignees of the benefit of the undertaking. Mr. Cole contended that the undertaking was a contract in restraint of trade, and in the circumstances it could not be shown to be a reasonable restraint.

It was also contended that Mr. Cole only made the contract with Sir James Dunn, and that he never intended to make it with anybody else, and that it was not capable of being assigned by Sir James Dunn to the Dean Finance Co., Ltd., or the Ever Ready Co., Ltd.

Subsequently, after consultation between the parties, it was announced that they had come to an accommodation which was satisfactory to all of them.

Mr. Justice Eve made an order staying all further proceedings upon terms endorsed on counsels' briefs.

"Avometer" Libel Action.—The Automatic Coil Winder and Electrical Equipment Co., Ltd., of Winder House, Douglas Street, Westminster, claimed damages for alleged libel arising out of statements which appeared in the "Ekco Service Bulletin," published by E. K. Cole, Ltd., of Southend-on-Sea, and in "Newnes' Complete Wireless," published by George Newnes, Ltd., of Southampton Street, Strand, London.

E. K. Cole, Ltd., pleaded that the words complained of were published in good faith and without malice, in the belief that they were true, and were, therefore, privileged; or, alternatively, that they constituted fair comment upon a matter of public interest. Messrs. Newnes' defence was that the words were incapable of defamatory meaning, and that they were true in substance and in fact.

Mr. Roland Thomas, K.C., for the plaintiffs, said that an issue of the "Ekco Service Bulletin," published in December, 1931, contained an article in which appeared: "If an Avometer is obtained, it must not be used for reading H.T. batteries, as it has a resistance of only 200 ohms per volt, and the reading will not, therefore, be entirely accurate."

The article, he submitted, contained a suggestion that the plaintiffs' claim that the Avometer was serviceable and accurate was wrong.

"The defendants overlooked," said Mr. Thomas, "that it has a range, not only of 120 volts, but of 1,200 volts, and when that range is used the resistance is then multiplied by another 100."

In June, 1932, Newnes decided to publish "Nownes' Complete Wireless." Contributions were invited, and E. K. Cole, Ltd., supplied an article which appeared on September 13, and contained the same statement as that to which exception had been taken in the Ekco "Bulletin."

On the third day of the hearing, Mr. Justice Macnaghten dismissed the action with costs.

Dealer Loses "Static" Case.—An Ipswich woman who said she would buy a receiver if it would cut out all interference, succeeded at Ipswich County Court against Avis, Cook and Co., who sued for 17 guineas, the cost of a set. It was stated bus interference was bad in the town.

Evidence was given that the defendant ordered the set the previous December, and several were sent to her house on trial. She complained of interference, but finally purchased a set. A witness for Avis, Cook and Co., said no condition about there being no interference was made, and added this was a matter no radio dealer could guarantee. Complaints regarding interference were subsequently made, and finally the set was returned. A P.O. official who investigated the complaints said the set gave perfect reception, and added that he heard no interference.

For the defence it was stated that at first fairly good reception was obtained, but on Christmas Day the noise of the interference was like machine-gun effects at a cinema.

The customer told a representative of Avis, Cook and Co., who was called in, that unless the interference was cut out she would not make a purchase.

Judge A. Hildesley, K.C., gave judgment in defendant's favour. She only said she would have a set that would cut out all interference, and he did not think the set could be said to have overcome that difficulty.

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MERCHANDISE MARKS ACT

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 any marking order.

The execution of the Acts of 1926 is in the hands of any local authority authorised to appoint analysts under the Sale of Food and Drugs Act.

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.

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FACTORY AND WORKSHOPS ACTS

1901—1920

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

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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;

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(*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.

MILLET FOR ELECTRICAL ACCESSORIES

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.

MILLET FOR EVERYTHING ELECTRICAL

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.

MILLET FOR RADIO FLEX & WIRES

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.

Shops Act, 1934.

The provisions of this new Act are principally concerned with the conditions of employment of persons under the age of 18, but minor alterations are made, in addition, with regard to the arrangements for the health and comfort of shop workers generally.

MILLET FOR METERS

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

"SELECTA" MEANS SERVICE

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.

Should he decide to abandon the application, he can do so without further expense.

It should, however, be clearly understood that the filing of a Provisional application 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.

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 typographical printing. Fictitious names should not be used under this heading, nor names in the possessive sense.

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," "Mazawattee," "Magnavox," "Gecophone."

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 fulfil the sole condition of being 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.

TRUPHONIC RADIO

A mark which is not new as applied to the particular goods for which it is proposed to use it, cannot be registered.

Representations of the Royal Arms or Crests, or of the Red Cross or Geneva Cross, are not allowed; nor are such words or phrases as "Patent," "Registered," or "Entered at Stationers Hall."

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.

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.

CATHEDRAL TONED

MOTOR VAN RECORDS

Traffic Act Requirements

The Road and Rail Traffic Act imposes definite obligations on all who use self-propelled vehicles for business purposes.

The manner in which records must be kept does not entail much work, but retailers, having regard to the amount of other detail work that has to be undertaken in connection with their shops, do find it somewhat onerous to adjust themselves to the code's requirements.

There is no difficulty about arranging the duties of the driver in such a manner that he is not at the driving wheel more than 5½ hours at a stretch or more than 11 hours per working day. Even with a battery-charging service the hours of work are concentrated within a comparatively short period, allowing an ample margin on the right side.

Some retailers do not appreciate the importance and the motive of the legislature in stipulating that on the record form there must be stated the hour of beginning work—work in this instance being taken to include any form of duty that is undertaken by the driver of the vehicle. It is the duty of the licence-holder—in other words, the driver's employer—to see that the hour of beginning work is entered on the record sheet. Obviously if that is not done there can be no check on the number of hours worked. Hence, if only as a matter of self-protection, the owner should see that this time is entered.

Every record must be carried by the driver until he has finished his work and must be signed by him. The holder of the licence must keep these records for at least six months.

There is imposed on the dealer the obligation to maintain his vehicle in fit condition, and examiners are authorised to inspect vehicles and, if necessary, order repairs to be carried out. When an examiner discovers a van or lorry in what he considers not to be efficient roadworthy condition, the usual procedure is to issue a prohibition order and give the owner a number of days' grace in which to have the repairs effected, in the meantime permitting the use of the vehicle.

But it cannot be used after the days of grace have expired until it has been inspected by an examiner. It is a serious matter for the van to be forced off the road. Owners of one or two vehicles might find it will pay them to enter into a service contract with the local garage.

Most radio dealers operate under what are known as "C" licences. This is the simplest form of authorisation. The following statutory conditions must be observed in every case:—(a) The motor must be maintained in a fit and serviceable condition; (b) the law with respect to speed limits and weight must be complied with; (c) the requirements of the law regarding the limits of time for which drivers may remain continuously on duty must be observed; (d) records must be kept.

References have been made to the setting up of a Joint Conciliation Board for the Road Transport Industry and a schedule of proposals determining the rates of pay for motor drivers.

"How do these apply to 'C' licence-holders?" dealers ask. There is no need for retail motor users to concern themselves on this point, although the National Conciliation Board has expressed the hope that "C" licence-holders will recognise similar wages and working conditions to "A" and "B" licence-holders. (The "A" licence is held by the motor haulage contractor, and the "B" licence by the limited carrier.)

Inquiries have been received from dealers who want to know if they may teach junior employees how to drive a car, provided that when so used the vehicle shows the letter "L" on the rear of the car.

The procedure to be adopted is: A person wishing to learn to drive must, first of all, take out a provisional licence (cost 5s.). Then he can learn how to drive if he is under the supervision of an experienced person, is always accompanied by a person who has held a licence for two years, and provided, further, that a red letter "L" is shown both at the front and at the rear of the car. Having learned to drive, the driver must undergo a test.

Retailers may teach their junior assistants how to drive, provided they comply with these general conditions.

The fee for the driving test in the presence of the official examiner is 7s. 6d. As soon as the driving test has been passed, an ordinary licence costing 5s. can then be obtained. In the event of the learner not passing the test, a statement to that effect is issued, but after a month has elapsed application can be made for another test.

Just one other point—the owner-driver need not keep any record when he himself is driving an authorised vehicle on a journey that is in no way connected with his trade or business. It is important to note that this exemption only applies when the owner-driver himself is driving. A record must be kept if a paid driver is employed.

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TRUPHONIC RADIO

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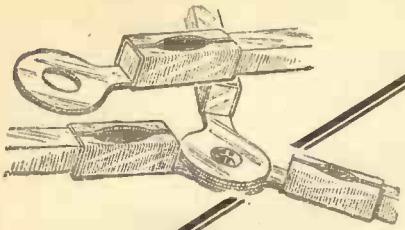

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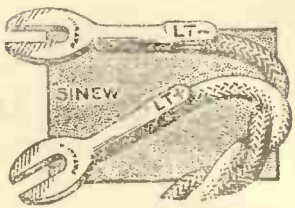

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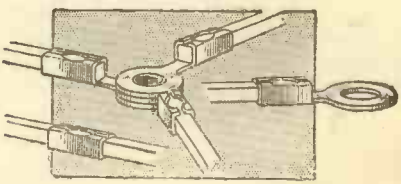

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DIRECTORY SECTION

MANUFACTURERS' DIRECTORY

Makers of radio and gramophone instruments, parts and accessories with addresses and telephone numbers are listed in this section.

Abbey Engineering Works, Watton, Norfolk. Watton 2.

Ace Radio, 2-5, Dingley Place, E.C.1. Clerkenwell 7874.

Accumulator Construction Co., 40, Pudding Chase, Newcastle-on-Tyne.

Accumulator Makers' Association, 66, Victoria Street, S.W.1. Victoria 2853. Acmakas, Sowest, London.

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 1030.

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. Handysides Arcade, Newcastle-on-Tyne.

Aerodyne Radio, Ltd., Aerodyne Works, Tottenham, London, N.17. Tottenham 4500. Aerodyne, Phone, London.

Aladdin Gramophone and Accessories Co., 93, Tabernacle Street, E.C.2. Clerkenwell 3852.

Allen and Co., Ltd., E., Imperial Steel Works, Sheffield 9. Attercliffe 41055. 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.

Allwave International Radio and Television, Ltd., 242, High Street, Bromley, Kent. Ravensbourne 4046. Albands, Bromley.

Allwood, Blackband and Co., Alexander Works, Alcester.

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.

Amalgamated Manufacturers, 431, Coventry Road, Birmingham. Victoria 1662.

Ambassador Radio-Gramophones, Ambassador Works, Bramston Street, Brighouse, Yorks. Brighouse 283. 14, Oxford Road, Manchester 1. Central 6089. 42, Bridge End, Leeds Bridge, Leeds.

Amerad (Great Britain), Ltd., Aldwych House, Aldwych, W.C.2. Holborn 9111.

American Radio Repair Service, 12, Shepherd's Bush Green, W.12. Shepherd's Bush 4798.

Amplifiers Ltd., Billet Works, Billet Road, Walthamstow, E.17. Larkswood 2244.

Amplion (1932), Ltd., 82-4, Rosoman Street, Rosebery Avenue, London, E.C.1. Clerkenwell 5440. Nuamplion, Smith, London.

Andrews and Co., A. E., 31, Tollington Park, Finsbury Park, N.4. Archway 1948.

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.

Anglo-Swiss Electrical Co., Ltd., 15, Victoria Street, S.W.1. Abbey 4213.

Anson & Hopwood, Ltd., 11, Berkeley Square, W.1. Mayfair 5855. 41, Cheval Place, S.W.7. Kensington 5855. Autotrope Works, Harlequin Avenue, W.5. Ealing 1203.

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.

Arvin Electric, Ltd., Shropshire House, 179, Tottenham Court Road, W.1.

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.

Attwater and Sons, Hopwood Street Mills, Preston. Preston 4045. Attwaters, Preston.

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.

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Automobile Accessories (Bristol), Ltd., Clifton Terrace, Sion Road, Bedminster, Bristol 3. Bristol 64067.

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., 58, Victoria Street, S.W.1. Victoria 7238. Televisor, Sowest, London.

Bakelite, Ltd., 68, Victoria Street, S.W.1. Works: Birmingham. Victoria 5441. Bakelite, London.

Baker and Finnemore, Ltd., Bakfin Works, Newhall Street, Birmingham, 3. Central 2838. Bakfin, Birmingham.

Baker, G. F., and Co., Ltd., Xaltona House, Leeke Street Corner, King's Cross Road, London, W.C.1. Terminus 4302. Ocrekab, Kincross, 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.

Bastock, E., 135, Showell Green Lane, Sparkhill, Birmingham.

Batteries, Ltd., Redditch. Astwood Bank 4, Batteries, Redditch.

Baty, E. J., 157, Dunstable Road, Luton. Luton 229. Baty, Luton.

Battery Maintenance, Ltd., 9, Newton Road, Torquay.

Becker, G., Ltd., Ampere Works, Wembley Park, Middlesex. Wembley 3737. Switches Wembley.

Beddoes, Ltd., J. G., 11, Great Hampton Street, Birmingham, 18. Central 4340. 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.

Beresford and Co., W., Dominion House, Bartholomew Close, E.C.1. National 9668.

Berk and Co., Ltd., F. W., 106, Fenchurch Street, E.C.3. Monument 3874. Berk, Phone, 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.

Bligh, S. W., 1 and 2, North Lane, and St. Dunstan's Street, Canterbury. Canterbury 289. Bligh, Canterbury.

Block Batteries, Ltd., By Pass, Barking, London, E. Grangewood 3346.

Bond and Sons, Ltd., V.C., Parkfield Works, Church Road, Leyton, E.10. Leytonstone 1066. Veeceebee, Leystone, London.

Bonson, E. W., 2, Tichborne Court, Holborn, London, W.C.1. Holborn 0664.

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.

Boxfoldia, Ltd., Bournbrook, Birmingham. Selly Oak 1164. Boxfoldia, Birmingham.

Boyes Radio, Ltd., 2, Bradshaw Street, Manchester, 4. Blackfriars 9128.

Boynton and Co., Ltd., 65-8, Stafford Street, Birmingham. Central 1525. Portables, Birmingham ; 139, Corporation Street, 3 & 5, Hill Street, and 23, Smallbrook Street, Birmingham. Portables, Birmingham.

Bradnam and Co., 15, Heywood Street, Moss Side, Manchester.

Bramley, J. W., Radio House, Corporation Street, Halifax. Halifax 3394.

Bridger and Co., R. O. No. 4 Factory, Shelford Place, Church Street, Stoke Newington, N.16. Clissold 6077.

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 5561-3 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 ; 66, Kirkstall Road, Leeds.

British Belmont Radio, Ltd., Balfour House, 119-125, Finsbury Pavement, E.C.2. National 6828. Belrad Phone, London.

British Blue Spot Co., Ltd., Sterling Works, Dagenham, Essex. Seven Kings 3466.

British Capehart Corpn., Ltd., 62, Glengall Road, S.E.15. Bermondsey 2022.

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 Ebonite Co., Ltd., Hanwell, London, W.7. Ealing 0125. Ebonitical, Ealux, London.

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., 6, Fountayne Road, Tottenham, N.15. Stamford Hill 3911. Loewerad, Southtot.

British Needle Co., Ltd., Argosy Works, Redditch. Redditch 119. Argosy, Redditch, 9, Falcon Avenue, Aldersgate Street, London E.C.1. 52, Spencer Street, Birmingham.

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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. Hop 1001.
British Radio Corporation, Ltd., 40, Grosvenor Gardens, London, S.W.1.
British Radio Gramophone Co., Ltd., Pilot House, Church Street, Stoke Newington, London, N.16. Clissold 6287.
British Radio Valve Manufacturers' Association, 59, Russell Square W.C.1. Museum 1206. Bradval, Westcent, London.
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., Vernon Place, Bath Road, Cheltenham.
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. Ordsall, Retford, Notts. Retford 249. Sankey Mills, Warrington. Warrington 418. 18, Ludgate Hill, Birmingham. Central 5585.
British Television Supplies, Ltd., Bush House, Aldwych, W.C.2. Temple Bar 0134. Teleview Bush, 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.
Brown Radio, Ltd., W.F., Ossillo Radio Works, Brierley Hill, Staffs. Brierley Hill 7062.
Browning Wireless Manufacturers, 18, Shellgrave Road, N.16. Clissold 0853.
Brunswick, Ltd., 1-3, Brixton Road, London, S.W.9. Reliance 3311.
Bryce and Co., W. Andrew, 3-4, Ashland Place, Baker Street, W.1. Welbeck 1521. Woodfield Works, Tile Street, Bury, Lancs.
Bulgin and Co., Ltd., A. F., Abbey Road, Barking, Essex. Grangewood 3266-7. 64, Holborn Viaduct, E.C.1. Central 2751.
Bulle Co., Ltd., Bulle Clock House, 187, Tottenham Court Road, London, W.1. Museum 6336.
Bullers, Ltd., 6, Laurence Pountney Hill, E.C.4. Mansion House 9971. Bullers, Cannon, London. Bullers, London.
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Havenhand, Lewis and Co., Kingsley Works, Young Street, Sheffield. Sheffield 23788.

Haynes Radio, Queensway, Enfield, Middlesex. Enfield 2726.

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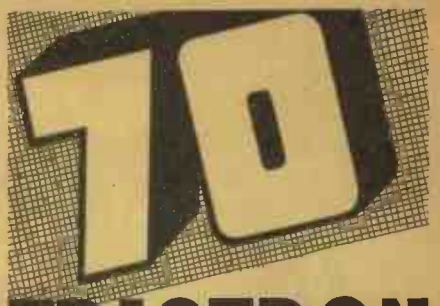

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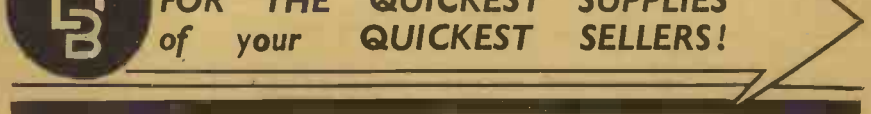

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Smith and Cookson, 22, Paradise Street, Liverpool, 1. Bank 3525/6.

Solway Factoring Co., 128, Queensberry Street, Dumfries. Dumfries 903. Solway.

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.

Storey, F. M., 367, Hylton Road, Sunderland.

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. 45/50, 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. 25, Sussex Street, Rhyl. Rhyl 646.

Superlamp, Ltd., 6, Paul Street, London, E.C.2. Bishopsgate 4868. 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. 92, Tabernacle Street, E.C.2. Clerkenwell 0234. 82, Queen's Road, Watford. Watford 5383.

Taylor, H. S., Roper Street, Whitehaven, Whitehaven 390. Taylor, Factor, Whitehaven. 108, Stricklandgate, Kendal.

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. Factory at 22-23, Clerkenwell Close, London, E.C.1. 104, Bath Street, Glasgow, C.2. Douglas 1223. Thomdibu, Glasgow.

Thomson and Brown Brothers, Ltd. See Brown Bros., Ltd.

Trentstreet Factors, Ltd., Trent Street, Nottingham. Nottingham 43521. Springbuck. 36, Wide Bargate, Boston, Lincs. Boston 659.

Trix Electrical Co., Ltd., 8-9, Clerkenwell Green, London, E.C.1. Clerkenwell 3014. Trixadio, Smith, London. 50, Wellington Street, Glasgow. 5, Evans Terrace, Trealaw, Glam.

Wall and Attwooll, Ltd., 47/49, Craswell Street, Portsmouth. Portsmouth 2031. Wanda, Portsmouth.

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 and 7021. Weblite Finsquare, London. Weblite House, Pancras Lane, Waterbeer Street, Exeter. Exeter 5220. Weblite, Exeter. 116½, High Street West, Sunderland.

Weston and Co., Ltd., A. W., Universal House, Christchurch, Hants. Christchurch 505. Universal, Christchurch.

Whiteford and Co., J., 5, Oswald Street, Glasgow, C.1.

Wildbores Radio, Ltd., 68, Yorkshire Street, Oldham, Lancs. Oldham Main 4939.

Wilkes and Co., S. J. H., Station Road, Stechford, Birmingham. Stechford 2105.

Wilkinson, L., 8, City Road, Finsbury Square, London, E.C.1. Metropolitan 7359.

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 21511. Wood, Leicester 21511. 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., 165, Trongate, Glasgow, C.1. Bell 3460. Clocks, Glasgow. 33, Cadogan Street, Glasgow, C.2. Central 3620. Radivest, Glasgow. 24, Ellison Place, Newcastle-on-Tyne. Newcastle-on-Tyne 20410.

Wrights Midland Electrical Co., Ltd., 113, Coleshill Street, Birmingham 4. Central 1096.

Yevrah Electric Co. (Y.E.C.), 37, Union Street, London, S.E.1. Hop 6708/9.

Young and Wildsmith, Ltd., 35, Little Russell Street, W.C.1. Museum 7057 (4 lines). 17, The Oracle, Minster Street, Reading. Reading 2072.

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.

MILLET FOR RADIO FLEX & WIRES

TRADE NAMES DIRECTORY

Inclusion of a trade name in this section of the directory does not necessarily mean the name is registered.

Abbey.—Abbey Engineering Works. Steel tubular masts and aerial accessories.
Ace.—John E. Dallas and Sons, Ltd. Gramophone.
Acfil.—E. M. Francis, Ltd. Acid pump for accumulators.
Acme.—Acme Album Service. Record album and carrying case.
Acme.—McLeod and McLeod. Instrument wire, insulating cloth and paper.
Aconemeter.—Leslie Dixon Switchgear Co. A.C. voltmeter.
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.
Airflo.—Radio Instruments, Ltd. All-mains receivers and radiograms.
Airmax.—J. Dyson and Co. (Wks.), Ltd. Plug-in and 6-pin coils.
Airtune.—Varley. L.F. transformers with air di-electric trimmers.
Airweight.—J. H. Taylor and Co. Headphones.
Akoostex.—Ashton and Co. (Est. 1787), Ltd. Silk gauze.
Akrite.—Ward and Goldstone, Ltd. Aerial wire.
Akros.—Ward and Goldstone, Ltd. Circular flex and black adhesive tape.
Aladdin.—Aladdin Gramophone and Accessories Co. Sound boxes, automatic brakes, valves, portable gramophone, turntables and cabinets.
Alba.—A. J. Balcombe, Ltd. General trade mark.
Albemarle.—H. B. Hicking. General trade mark.
Aldergate.—P. H. Lawrence. Receivers.
Alembic.—J. Millet. Crystal, meter, switch, headphones and speaker.
Alert.—K. E. Beswick, Ltd. Fuses.
Alligator.—Guillaume and Sons, Ltd. Gramophone needles.
Allscott.—James Scott and Co. Receivers and radio-gramophones.
Allvalve.—Radiometers, Ltd. Valve tester.
Allwave.—Allwave International Radio and Television, Ltd. General trade mark.
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.
Alton.—Alton Battery Co., Ltd. Accumulators and accessories.
Always.—Abingdon Wireless Supplies. Grid leaks, anode resistances, spaghetti resistances, potential dividers.
Amachron.—Amalgamated Mfrs. Electric clock.
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.
Antinodal.—Radio Instruments, Ltd. Short wave adaptor.
Antisulf.—Wilon's. Solvent for accumulators.
Antoria.—James T. Coppock. Gramophones.
Ardente.—Ardente Acoustic Laboratories. Sound amplification equipment and group hearing aids.
Ardwick.—Runbaken Magneto Co., Ltd. Battery chargers.
Arega Radio.—Precision Electric, Ltd. Receivers.
Aresco.—Radio Service Co. Receivers, eliminators, radio-gramophones and loudspeakers.
Arrow.—Claude Lyons, Ltd. QMB mains switches.
Artic.—Artic Fuse and Electrical Manufacturing Co., Ltd. Valve holder and fuses.
Artiste.—Pohlmann and Son, Ltd. Gramophone record cabinets, etc.
Arvin.—Arvin Electric, Ltd. General trade mark.
Ashton.—Ashton's Wireless Depot. General trade mark.
Athco.—A. T. Harrison & Co. Bakelite tools and mouldings.
Atlantis.—John E. Dallas & Sons, Ltd. P.A. equipment.
Atlas.—Electric Lamp Service Co., Ltd. Lamps.
Atlas.—Atlas Carbon and Battery Co. Batteries.
Atlas.—H. Clarke and Co. (Manchester), Ltd. General trade mark.
Atlas.—O. Ruhl (1922), Ltd.—Gramophones and accessories.
Atonic.—Alton Battery Co., Ltd. Accumulators.
Atwater, Kent.—Portland Radio Co., Ltd. Receivers.
Audak.—Claude Lyons, Ltd. Electromagnetic pick-ups.
Audiola.—Amplion (1932), Ltd. Moving coil speaker.
Audion.—Graham-Farish, Ltd. Resistance capacity unit.
Audirad.—Radio Instruments, Ltd. L.F. output choke.
Auditorium.—Goodman's (Clerkenwell), Ltd. Speakers.
Austin.—City Accumulator Co., Ltd. A.C. and battery superhets and radiograms.
Auto-Bat.—Climax Radio Electric, Ltd. Mains supply units.
Auto Parafeed.—Radio Instruments, Ltd. L.F. transformer.
Autocel.—Primus Manufacturing Co., Ltd. H.T. batteries.
Autocontrolla.—Benjamin Electric, Ltd. Automatic battery economy unit.
Autocrat.—Itonia, Ltd. Portable receiver.
Autokoil.—A. W. Hambling and Co. Tuner.
Automatic Tension.—J. G. Beddoes, Ltd. Automatic safety lock.
Automobile.—Goodman's (Clerkenwell), Ltd. Speakers.
Autotrope.—Anson and Hopwood, Ltd. Auto-changers, auto-changer radio gram. amplifiers, etc.
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.
Avon.—Avon India Rubber Co., Ltd. Battery accessories and insulating material, acid, resisting rubber washers, etc., gasket tubing for sound boxes and sponge rubber.
Axiom.—Goodman's (Clerkenwell), Ltd. Speakers.
A.A.—Linolite, Ltd. Earth clip.
A.B.C.—Allwood Blackband and Co. Gramophone needles.

TRADE NAMES

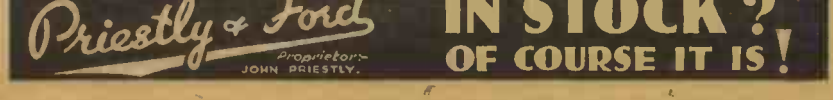
A.D.—Le Carbone, Ltd. Batteries and cells.
A.E.F.—A.E.F. Manufacturing Co. Accumulators.
A.R.G.—Ambassador Radio Gramophones. General trade mark.
A.J.D.—A. J. Dew and Co., Ltd. Products.
A 56 A.G.—Charlton Higgs (Radio), Ltd. Autoradiogram.
A 56 G.—Charlton Higgs (Radio), Ltd. Radiograms.
A 56 R.—Charlton Higgs (Radio), Ltd. Receivers.

Bakelite.—Bakelite, Ltd. Insulating materials.
Bakelized.—R. O. Bridger and Co., Ltd. Paper cones.
Bakfin.—Baker and Finnemore, Ltd. Pressings.
Ballsok.—Lionel Robinson and Co., Ltd. Insulators.
Bandmaster.—Lugton and Co., Ltd. Accumulators and sound boxes.
Barto.—J. G. Coates, Ltd. Relay apparatus and components.
Baty.—E. J. Baty. Receivers, speakers, and mains units.
Beanco.—Baxendale and Co., Ltd. Gramophones.
Bear Brand.—G. Bowerman, Ltd. H.T. batteries.
Beasal.—Beardsall and Co., Ltd.—Batteries.
Bebe.—Sydney S. Bird and Sons, Ltd. Variable condensers.
Becker.—G. Becker, Ltd. Switches.
Becol.—British Ebonite Co., Ltd. Ebonite.
Becolate.—British Ebonite Co., Ltd. Composite material.
Bedford.—Reproducers and Amplifiers, Ltd. P.M. cabinet speakers for relay operation.
Beethoven.—Beethoven Radio, Ltd. General trade mark.
Belco.—Nobel Chemical Finishes, Ltd. Cellulose wood finishes for cabinets.
Bell.—J. and J. Laker Co., Ltd. Insulators.
Belling Lee.—Belling and Lee, Ltd. General trade mark.
Belmont.—British Belmont Radio, Ltd. Receivers.
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.
Berkeley.—Halford Distributors, Ltd. Receivers, radiograms and s.w. converters.
Bettaflex.—Saxonia Elec. Wire Co., Ltd. Flexible wires and cables.
Betterset.—Betterset Radio, Ltd. Receiver.
Bi-Duplex.—Varley. Resistances.
Bi-Ferrous.—Radio Instruments, Ltd. High fidelity L.F. transformer.
Biflecca.—Aladdin Gramophone and Accessories Co. Amplifier.
Biflo.—Osdur Manufacturing Co. Static cut-out and interference eliminator.
Big Ben.—Stockall, Marples and Co., Ltd. Gramophones and sound boxes.
Bijou.—Wharfedale Wireless Works. Loudspeakers.
Binode.—Mullard Wireless Service Co., Ltd. Valves.
Biscolac.—Bakelite, Ltd. Lacquer.
Blackfriars.—Spicers, Ltd. Black adhesive tape.
Blackley.—Connollys (Blackley), Ltd. Insulating tape.
Bligh.—S. W. Bligh. Set and accessories.
Bliley. Claude Lyons, Ltd. Quartz crystals.
Blue Spot.—British Blue Spot Co., Ltd. General trade mark.
Boley.—S. Wolf and Co., Ltd. Precision tools.
Booster.—Graham Farish Ltd. H.T. unit.
Bowerman's.—George Bowerman, Ltd. Headphones, speakers and cone units.
Bowl.—Kingsway Radio, Ltd. Speaker.
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.
Britannic.—Ever Ready Co. (Great Britain), Ltd. Dry cell.
British Radiogram.—British Radio Gramophone Co., Ltd. Kit factors.
British Wolf.—S. Wolf & Co., Ltd. Portable electric tools.
Broadcaster.—J. and A. Margolin. Gramophones.
Broadway.—Rose, Morris and Co. General trade mark.
Bronzian.—Wharfedale Wireless Works. Loudspeakers.
Brownie.—Radio Electric Products Co. Crystal sets.
Browning.—Browning Wireless Mfgs. General trade mark.
Brunpoint.—Brunswick Ltd. Semi-permanent needles.
Brunswick.—Brunswick, Ltd. General trade mark.
Bryce Products.—W. Andrew Bryce & Co. General trade mark.
Buckingham.—Reproducers and Amplifiers, Ltd. P.M. cabinet speakers for relay operation.
Bulgin.—A. F. Bulgin and Co., Ltd. Registered trade mark.
Bull.—British Ropes, Ltd. Wire.
Bull-Dog.—Pomona Rubber Co. Insulating tapes.
Bull-Dog.—Ward and Goldstone, Ltd. Spring connectors.
Bulle.—Bulle Co., Ltd. Electric clocks.
Bulwark.—Redfern's Rubber Works, Ltd. Ebonite, panels, sheets and coil formers.
Bur-Bri.—Fred Burris and Sons, Ltd. General trade mark.
Burgess.—Burgess Products Co. Batteries.
Burgess Keelite.—Burgess Products Co. Leather contained flashlamps.
Burgess Snaplite.—Burgess Products Co. Flashlamps.
Burgoyne.—Burgoyne Wireless (1930), Ltd. Receivers.
Burndept.—Burndept, Ltd. Receivers, radiograms and batteries.
Bur-Ton.—C. F. and H. Burton. General trade mark.
Busco.—Busby and Co., Ltd. Lightning arrester, terminal tags and push-pull switches.
Bush.—Bush Radio, Ltd. General trade mark.
Bush Ranger.—Bush Radio, Ltd. Sets.
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.B.—George Bowerman, Ltd. Duralumin headbands.
B.B.B.—H. E. Kettle, Ltd. H.T. batteries.
B.C.N.—B.C.N. Co. Non-metallic gramophone needles.
B.E.M.—British Electric Meters, Ltd. General trade mark.
B.I.—British Insulated Cables Ltd. General trade mark.
B. and O.—F. W. Lechner and Co., Ltd.
B.S.R.—Bakers' Selhurst Radio Ltd. Speaker.
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.W.—L. R. Wood. Aerial wire.
B 56 R.—Charlton Higgs (Radio), Ltd. Receivers.

Caddie.—Acme Album Service. Record Cases.
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.

P&F. IN STOCK? OF COURSE IT IS! BIRMINGHAM NOTTINGHAM MANCHESTER

Cambridge.—Cambridge Instrument Co., Ltd. Instruments.
Cambridge.—G. J. Pooley. General trade mark.
Cambridge.—Midland Auto Components. Batteries.
Cameo.—Carrington Manufacturing Co., Ltd. Cabinets, panels and brackets.
Capehart.—Giffens (London), Ltd. Automatic record changer.
Capitol.—Hobday Bros., Ltd. Components and accessories.
Carborundum.—Caradio Services, Ltd. Crystal detectors.
Carfax.—British Rectifiers Eng. Co. A.C. battery charging plant with valve or metal rectification.
Carl Lindstrom.—Parlophone Co., Ltd. Gramophones, motors, etc.
Carlton.—Fred Bulmer. General trade mark.
Carryset.—Electrico.
Castaphone.—G. Castagnoli. Public address outfits, valve sets, amplifiers and components.
Castle.—Castle Fuse and Engineering Co., Ltd. General trade mark.
Castle.—Watson, Saville and Co., Ltd. High-speed steels.
Celastoid.—British Celanese, Ltd. Non-flam. celluloid sheets.
Celec.—Curtis Manufacturing Co., Ltd. Resistances.
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.—R. A. Rothermel, Ltd. Volume controls and resistances.
Centrex.—Goodmans (Clerkenwell), Ltd. Moving coil speaker.
Centurion.—L. Heys. Aerial wire.
Centuron.—Saxon Radio Co. Insulated aerial wire.
Ceolian.—L. R. Wood. Receivers, radiograms, amplifiers, gramophones and gramophone accessories.
Chakophone.—Eagle Engineering Co., Ltd. Sets and components.
Chakotrope.—Eagle Engineering Co., Ltd. Amplifiers.
Chalgrove and Chalkley.—C. G. Chalkley. Sets, components, speakers and accessories.
Challenger.—Riddiough and Son. Dry batteries.
Champion.—Hobday Bros., Ltd. Portable receiver.
Chaslyn.—J. H. Collie and Co. Hydrometers and gravity balls.
Chippendale.—Halford Distributors, Ltd. Receivers and radiograms.
Choice of Critics.—A. F. Bulgin and Co., Ltd. General trade mark.
Chorister.—H. J. Fletcher and Co., Ltd. Needles, soundboxes, pick-ups and arms.
Chrome.—E. A. Wood. Accumulators.
Clarion.—Octron, Ltd. Radio valves.
Clarion.—Clarion Radio Valve Co. Valves.
Claristal.—Ward and Goldstone, Ltd. Aerial set.
Clarostat.—Claude Lyons, Ltd. Volume controls.
Classic.—A. E. Shearing. 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.
Clirtun.—British Ropes, Ltd. Piano wire.
Clix.—Lectro Linx, Ltd. Terminals.
Clutch Brand.—Hellesens, Ltd. Insulating tape.
Coaguline.—Kay Bros., Ltd. Transparent adhesive for china, glass, etc.
Collaro.—Collaro, Ltd. General trade mark.
Collett.—S. H. Collett Manufacturing Co. Aerial pulley and components.
Colpak.—Colvern, Ltd. Radio frequency and super-het tuning units.
Coltags.—S. H. Collett Manufacturing Co. Battery cord tags.
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. Variable condensers.
Compet.—J Moores and Co. Electrical goods.
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.
Connode.—C. E. Needham and Bro., Ltd. Condensers and coil holders.
Connoisseur.—A. F. Bulgin and Co., Ltd. Transformer.
Constant.—Varley. Inductance chokes.
Constantan.—Concordia Electric Wire Co., Ltd. Resistance wire.
Contra Resonant.—R. O. Bridger and Co., Ltd. Dual cones.
Controlatone.—A. F. Bulgin and Co., Ltd. Variable tone control.
Convertogram.—Thompson Diamond and Butcher. Combined cabinet gramophone and conversion unit.
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. Loudspeakers.
Coronet.—Faudels, Ltd. Receivers.
Cortabs.—Money Hicks, Ltd. Tags for marking connecting wires.
Cortabs-de-Luxe.—Money Hicks, Ltd. Tabs for marking connecting wires.
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.
Crisptone.—R. O. Bridger and Co., Ltd. Super-paper cones.
Cromaloy.—A. C. Scott and Co., Ltd. Nickel chromium resistance wires.
Crown.—J. Leibovici. Accessories.
Crypto.—Crypto Equipment Co. Rotary and valve rectifiers for L.T. and H.T. charging.
Crystacel.—Siemens Electric Lamps and Supplies, Ltd. L.T. accumulators.
Crystalate.—Crystalate Gramophone Record Manufacturing Co., Ltd. Mouldings.
Curry.—Currys Ltd. Receivers and L.F. transformer.
Cylda.—H. C. Daly. Aerial eliminator.
Cyldon.—Sydney S. Bird and Sons, Ltd. Variable condensers.
Cymosite.—North Eastern Instrument Co. Crystals and detectors.
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.



TRADE NAMES

D'accord.—Burwood's Wireless. General trade mark.
Dagenite.—Peto and Radford. Accumulator.
Dagenite Tell Tale.—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.
Davent.—Wright's Midland Electrical Co., Ltd. Receivers, H.T. batteries, and accumulators.
Daventry.—Carrington Mfg. Co., Ltd. Cabinet.
Davey Radio.—E.M.G. Hand Made Gramophones, Ltd. General trade mark.
Decca-Polydor.—Decca Record Co., Ltd. Records.
Decko.—A. F. Bulgin and Co., Ltd. Accessories.
Deckorem.—A. F. Bulgin and Co., Ltd. General trade mark.
Decpoint.—Decca Record Co., Ltd. Semi-permanent needles.
De-Luxe.—Accumulator Construction Co. Lead acid L.T. accumulators.
De Luxe Label.—Columbia Graphophone Co., Ltd. Needles.
Dialite.—A. F. Bulgin and Co., Ltd. Panel mounting light.
Dido.—Kay Bros., Ltd. Adhesive for celluloid.
Difeed.—Radio Instruments, Ltd. L.F. transformer.
Disc.—Graham Farish, Ltd. H.F. choke.
Disque.—Disque Cabinet Co., Ltd. Cabinets.
Dix-Mipanta.—Leslie Dixon & Co. A.C. multimeter.
Dix-Onemeter.—Leslie Dixon & Co. Resistance meter.
Doelcam.—McLeod and McLeod. Sleeving (Varnished insulating).
Domino.—Radio Development Co. Speakers.
Dorchester.—Halford Distributors, Ltd. All-wave radio-gram. (writing desk model).
Dot.—T. M. Tod. General trade mark.
Double Pentagon.—Woodhams, Dade and Co. Shellacs.
Douglas.—Automatic Coil Winder and Electrical Equipment Co., Ltd. Automatic coil winders, both hand and power.
Draco.—Drury Radio Co., Ltd. H.T. batteries.
Dreadnaut.—R. O. Bridger and Co., Ltd. Paper cones.
Dreadnought.—Goodman's (Clerkenwell), Ltd. Moving coil speakers, chassis and cabinet models.
Drivermu.—Radio Instruments, Ltd. Class B. transformer.
Drummer.—Edge Radio, Ltd. General trade mark.
Drydex.—Chloride Electrical Storage Co., Ltd. Dry Battery.
Drymac.—Metal Agencies Co., Ltd. H.T. batteries.
Dual.—Dual Motors, Ltd. Electric motors.
Dual Astatic.—Radio Instruments, Ltd. H.F. chokes.
Dual Plug.—T.X. Products Co., Ltd.
Duco.—Brown Brothers, Ltd. Components.
Dulcetto.—Dulcetto Polyphon, Ltd. General trade mark.
Dulux.—Nobel Chemical Finishes Ltd. Air drying and stoving synthetic enamels.
Dumolite.—Dew and Co., Ltd., A. J. Accumulators and battery tester.
Dumont.—R. A. Rothermel, Ltd. Cathode ray tubes and oscillographs.
Duonicore.—Varley. Coils.
Duplex.—McMichael Radio, Ltd. Receivers.
Duragold.—Columbia Graphophone Co., Ltd. Needles.
Duratex.—Ioco Rubber and Waterpoofing Co., Ltd. Leather cloth.
Duray.—Duray. H.T. eliminators, tone purifiers, H.T. economisers and acrials.
Duropic.—Woodhams, Dade & Co. Everlasting gramophone needles.
Dux.—Radio Instruments Ltd. L.F. transformer.
Dwarf.—Everett, Edgcumbe and Co., Ltd. Ammeters and voltmeters.
Dynamotone.—Murdoch Trading Co. Talkie needles.
Dynatone.—Scientific Supply Stores (Wirelcss), Ltd. Air cored auto S.W. inductance.
Dynatron.—H. Hacker and Sons. Sound amplifiers, 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.
Eagle.—Eagle Transfer, Ltd. Transfers.
Eagle.—John Riley and Sons, Ltd. Accumulator acid.
Eagle.—Static Condenser Co. Condensers.
Eagtranco—Eagle Transfer, Ltd. Transfers.
Easifil.—S. Guiterman and Co. Distilled water carrier.
Easiflx.—Ward and Goldstone, Ltd. Combined H.T. and L.T. battery cords.
Easistrip.—Ward and Goldstone, Ltd. Connecting wire.
Ebonart.—Redfern's Rubber Works, Ltd. Ebonite panels, sheets and coil formers.
Ebonex.—Money Hicks, Ltd. Engraved labels.
Eby.—Claude Lyons, Ltd. Valve holders.
Eccoradio.—Ecco Radio, Ltd. Receivers.
Eclipse.—James Neill and Co. (Sheffield), Ltd. Permanent magnets.
Economic.—Salisbury Transformer and Electrical Co., Ltd.—Accumulator chargers.
Eddystone.—Stratton and Co., Ltd. Short wave sets and components, and transmitting coils.
Edison.—Edison Storage Battery Dist., Ltd. L.T. accumulators.
Ediswan.—Edison Swan Electric Co., Ltd. General trade mark.
Editor.—Peto Scott Co., Ltd. Kits.
Edna.—J. W. Bramley. Receiver and water motors.
Eedee.—Edward Doherty and Sons. Radio cabinets in wood and leather.
Eelex.—J. J. Eastick and Sons. Components and accessories.
Eisler.—McLeod and McLeod, Ltd.
Ekco.—E. K. Cole, Ltd. General trade mark.
Ekcozene.—E. K. Cole, Ltd. Mouldings.
Electone.—F. J. Gordon and Co., Ltd. Automatic programme selector.
Electra.—Vce Cee Dry Cell Co. (1927), Ltd.
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 aerial.
Electronic.—Varley. Resistances.
Elity.—British Ropes, Ltd. Box strapping wire.
Ella.—Lionel Robinson and Co., Ltd. Converter, voltmeter and ammeter.
Ella Flex.—Lionel Robinson and Co., Ltd. Insulating sleeving.
Ellancee.—Ellancee Radio, Ltd. Valve receiving sets and tuners.
Ella-Varic.—Lionel Robinson and Co., Ltd. Components.
Elliott.—Elliotts. Sets and components.
Elrad.—Elliott Radio Mfg. Co., Ltd. Components and speakers.
Eltic.—E. A. Wood. Components.
Embassy.—British Needle Co., Ltd. Gramophone needles.
Emicol.—Electrical Measuring Instruments Co. Meters and Servicing apparatus.
Emitta.—Barnard Accumulator Co. Accumulators.

Priestly & Ford
Proprietor:—JOHN PRIESTLY.
IN STOCK? OF COURSE IT IS!
THE NATIONAL RADIO DISTRIBUTORS
BIRMINGHAM • NOTTINGHAM • MANCHESTER

Emkabe.—Emkabe Radio Co., Ltd. General trade mark.
Emo.—George Emmott (Pawsons), Ltd. Mainsprings for gramophone motors.
Empire.—Micanite and Insulators Co., Ltd. Insulating material.
Empire.—Manufacturers' Accessories Co. (1928), Ltd. Battery.
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.
Energex.—L. Heys. Batteries and accumulators.
Enfield.—Enfield Cable Works, Ltd. Wires and cables.
Enhansa.—Ward and Goldstone, Ltd. Indoor aerial.
Enke Products.—F. W. Lechner and Co., Ltd.
Enox.—Frys (London), Ltd. Metal and ebonite cutting saws, lathes, grinding and drilling machines.
Ento.—J. Hyatt and Co., Ltd. Cabinet and battery box.
Eon.—Eon Vacuum Wireless Co. General trade mark.
Epoch.—Radio Development Co. Speakers and microphones.
Equilode.—Whiteley Electrical Radio Co., Ltd. Extension speakers.
Ericsson.—Ericsson Telephones, Ltd. Head phones.
Erie.—Radio Resistor Co.
Erie.—Erie Resistor, Ltd. General trade mark.
Erinoid.—Erinold, Ltd. Insulating material.
Erka.—F. W. Lechner & Co., Ltd.
Erl.—Ecco itadio, Ltd. Coils.
Erlite.—Ecco Radio, Ltd. Condensers.
Eros.—Vee Cee Dry Cell Co. (1927), Ltd.
Essell.—Spicers, Ltd. Fibre and leatheroid.
Essex.—Essex Accumulator Co., Ltd. Accumulators.
Essex.—Reproducers and Amplifiers, Ltd. P.M. cabinet speakers for relay operation.
Estrella.—Thompson, Diamond and Butcher. Piano accordians.
Eta.—Eta Tool Co. Tools and coil winding machines.
Ethatrope.—British Radio Corpn., Ltd. Amplifiers and P.A. equipment.
Ether Master.—A. E. Andrews and Co. Coils and sets.
Ethovernier.—Burndept, Ltd. Slow motion dials.
Eureka.—London Electric Wire Co. and Smiths, Ltd. Resistance wire.
Eureka.—L. Person and Son. General trade mark.
Everlock.—McLeod and McLeod, Ltd. Washers.
Ever Ready.—Ever Ready Co. (Gt. Britain), Ltd. Primary and secondary batteries, H.T., L.T. and G.B.
Evrizone.—Evrizone Radio Co. General trade mark.
Ewebec.—Evington Electrical Mfg. Co. Coil former.
Excel.—S. H. Collett Manufacturing Co. Terminal tags and fuses.
Excelsior.—Ward and Goldstone, Ltd. Resistance wire.
Exide.—Chloride Electrical Storage Co., Ltd. Accumulator.
Exponential Five.—Charlton Higgs (Radio), Ltd. Receivers.
Extralife.—Edison Swan Electric Co., Ltd. L.T. accumulators.
Eze-tite.—S. H. Collett Manufacturing Co. Phone adaptors.
Eze-Way.—S. H. Collett Manufacturing Co. Pulleys.
E.A.W.—E. A. Wood. Components and accessories.
E.D.L.—Electric Depot, Ltd. Accumulator charging equipment.
E.S.C.—English Steel Corporation, Ltd. Permanent magnets.
E.85.—Reproducers and Amplifiers, Ltd. Speakers.

Facile.—Ross Courtney and Co., Ltd. Terminals.
Fairchild.—Claude Lyons, Ltd. Ariel cameras, etc.
Falco.—George Bowerman, Ltd.
Faneeka.—Michael Black, Ltd. H.T. batteries and accumulators.
Feet o' Felt.—McLeod and McLeod. Felt feet for cabinets.
Ferranti.—Ferranti, Ltd. General trade mark.
Ferrocart.—British Ferrocart Co., Ltd.
Ferrocart.—Colvern, Ltd. Iron core tuning coils and intermediates.
Fiberite.—Thames Board Mills, Ltd. Packing cases.
Fitzall.—Peto Scott Co., Ltd. Cabinets.
Filt.—Graham Farish, Ltd. Percolative earth.
Flag.—Ever Ready Co. (Great Britain), Ltd. Dry cell.
Flex.—Daws, Clarke and Co. Sound box diaphragms.
Fluxite.—Fluxite, Ltd. Soldering paste and soldering set.
Fonatex.—Ashton and Co. (Est. 1787), Ltd. Gauze for speakers and gramophones.
Formapex.—Ioco Rubber and Waterproofing Co., Ltd. Bakelite type miocarta and varnish.
Formite.—Bakelite, Ltd. Insulating materials.
Formo.—Formo Products, Ltd. Components.
Formo Densor.—Formo Products, Ltd. Pre-set condenser.
Formowatt.—Formo Products, Ltd. Resistors.
Fotos.—Concerton Radio and Electrical Co., Ltd. General trade mark.
Fototune.—Kolster-Brandes, Ltd. Tuning devices.
Four in One.—British Homophone Co., Ltd. Records.
Franklin.—Franklin Electric Co, Ltd. General trade mark.
Frequentite.—Steatite and Porcelain Products, Ltd. Low dielectric loss ceramic insulating material.
Froitzheim.—F. Whitelegg. Coil winding machines.
Fulgor.—J. Toubkin. Batteries.
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.
Fydelitone.—Bakers Selhurst Radio, Ltd. Speakers.
F. and R.—F. Whitelegg. Coil winding machines.
F.M.C.—Fairfield Mfg. Co. Receiver.

Gabriel.—Halford Distributors, Ltd. Receivers and radio-grams.
Galloy.—Climax Radio Electric, Ltd. Earth tubes.
Galvanic.—Gresley Radio, Ltd. Earth tube.
Gambrell.—Halford Distributors, Ltd. Receivers and radiograms.
Gard.—Graham Farish, Ltd. Lightning arrester.
Garrard.—Garrard Engineering and Mfg. Co., Ltd. Gramophone motors.
Garrard.—J. Moores and Co. Gramophone motors.
Gas-ohm.—Rotor Electric, Ltd. Grid leaks and resistances.
G. Burri.—McLeod and McLeod, Ltd. Instrument wire.
Gecalloy.—General Electric Co., Ltd. Iron cores for H.F. coils.
Gee-Gee.—G. Green and Co. Electric soldering irons and distilling apparatus.
Geisha.—C. Gilbert and Co., Ltd. Pedestal and portable gramophones, sound boxes and needles.
Gel-Cel.—Chloride Electrical Storage Co., Ltd. Jelly acid accumulator.
Genalex.—General Electric Co., Ltd. Components.
General Instruments.—R. A. Rothermel, Ltd. Variable condensers.
Georgian.—Halford Distributors, Ltd. Receivers.
Giplex.—General Inductance Co. Pressboard sheet and tubes.

Priestly & Ford Proprietor:- JOHN PRIESTLY. THE NATIONAL RADIO DISTRIBUTORS —Get it from P.&F.

TRADE NAMES

Givrite.—Le Carbone, Ltd. Carbon resistances.
Glasorwood.—Eagle Transfer, Ltd. Transfers.
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.
Godwinex.—J. Dyson and Co. (Wks.), Ltd. Eliminators and components.
Golden Arrow.—J. Toubkin. Accumulators.
Golden Domes.—J. and A. Margolin. Gramophones.
Golden Pyramid.—British Needle Co., Ltd. Gramophone needles.
Golden Pyramid Radiogram.—British Needle Co., Ltd. Needles for radiograms.
Golden Series.—S. Lilley and Son, Ltd. Switches, terminals and wander plugs.
Goldring.—British Goldring Products, Ltd. General trade mark.
Goltone.—Ward and Goldstone, Ltd. General trade mark.
Gordometer.—F. J. Gordon and Co., Ltd. Hydrometer.
Gordon.—F. J. Gordon and Co., Ltd. General trade mark.
Grafonola.—Columbia Graphophone Co., Ltd. Gramophones.
Gramochassis.—Cosmocord, Ltd. Induction motor unit with pick-up, etc.
Gramotube.—British Needle Co., Ltd.—Gramophone and radio-gram. needles.
Grantona.—R. O. Bridger and Co., Ltd. Cones.
Grawor.—H. Joseph. Speakers.
Grayson.—Grayson and Co. Drills for bakelite and glass.
Greatrex.—R. G. Greatrex and Co. Receivers.
Greatrex, R.G.—R. G. Greatrex and Co. Speaker.
Greenman Automatic Lidstay.—S. Greenman, Ltd. Radiogram.
Grelco.—Grafton Electric Co. Components.
Grey and Sons, John.—Rose, Morris, and Co., Ltd. General trade mark.
Griffin faturan.—Maul and Murphy, Ltd. Bakelite sheet.
Grille.—Goodmans (Clerkenwell), Ltd. Speakers.
Grippleshell.—Partridge, Wilson and Co., Ltd. Aerial insulator and bracket.
Gripso.—Gripso Co. 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 apparatus.
G.W.Z.—British G.W.Z. Battery Co., Ltd. Dry Batteries.

Hall.—Daws Clarke & Co. Fibre needles.
Halawax.—Bakelite Ltd. Insulating materials.
Halson.—Halson Radio Co., Ltd. Midget and car receivers.
Hammarlund.—R. A. Rothermel, Ltd. Short wave coils and condensers.
Hammond.—R. A. Rothermel, Ltd. Electric clocks.
Handel.—James T. Coppock. Gramophones.
Handy.—Lehmann, Archer and Lane, Ltd. Carded tools.
Harbros.—Hart Bros. Electrical Mfg. Co., Ltd. General trade mark.
Hardale.—Hardman & 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.
Haynes.—Haynes Radio. General trade mark.
Heayberd.—F. C. Heayberd and Co. General trade mark.
Hegra.—J. Millet. Cone unit, speakers, lightning arresters and grid-leak clips.
Hellesen.—Hellesens, Ltd. General Trade Mark.
Henlog.—Baldwin Instrument Co. Inductance bridges.
Heroulacker.—Concordia Elec. Wire Co., Ltd. Lacquered wires and cables.
Hercules.—Boynton and Co., Ltd. General trade mark.
Hercules.—Ever Ready Co. (Gt. Britain), Ltd. Low tension battery.
Hesco.—Octron Ltd. Valves.
Hi-Life.—Hellesens, Ltd. H.T. batteries.
Hickok.—Claude Lyons, Ltd. Set testers.
His Master's Voice.—Gramophone Co., Ltd. General trade mark.
Hivac.—High Vacuum Valve Co., Ltd. Valves.
Hobart.—F. J. Gordon and Co., Ltd. Battery charger.
Hoetanic.—L.P.S. Electrical Co., Ltd. Resistance wire.
Holbro.—Holmes Bros. (London), Ltd. Cabinets.
Holdtite.—S. H. Collett Mfg. Co. Battery clips.
Holmer.—Holliday and Hemmerdinger. P.A. equipment.
Hoyt.—F. J. Gordon and Co., Ltd. Testing instruments.
Huber.—McLeod and McLeod, Ltd. Wire (silk-covered.)
Hum-dinger.—Claude Lyons, Ltd. Variable-resistances for mains apparatus.
Hymax.—E. Allen and Co., Ltd. Magnet.
Hymeg.—Edison Swan Electric Co., Ltd. H.T. accumulator.
Hypercore.—Radio Instruments, Ltd. L.F. smoothing and filter output choke.
Hypermite.—Radio Instruments, Ltd. L.F. transformer.
Hypermu.—Radio Instruments, Ltd. L.F. transformer.
Hypernik.—Lissen, Ltd. Transformer.
Hyvoltstar.—Universal High Voltage Radio, Ltd. Universal all-wave radiograms and receivers.
H.B.—Cookson and Co. Syphon hydrometers.
H.B.—Hobday Bros., Ltd. Components and accessories.
H.E.K.—H. E. Kettle, Ltd. Valve set.
H.L.C.—Havenhand, Lewis and Co. Accumulator.
H.M.S.—Graham Farish, Ltd. H.F. choke.
H.M.V.—Gramophone Co., Ltd. General trade mark.
H.S.—Adam Hilger, Ltd. Trade mark for spectroscopically standardised substances.
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. General trade mark.
Imp Super.—Imp Radio Co. General trade mark.
Impedance Matching.—Varley. Output transformers.
Imperi.—Hobday Bros., Ltd. Components and accessories.
Imperial.—E. Allen and Co., Ltd. Magnet.
Imperial.—Imp Radio Co. General trade mark.
Imperial-Broadcast.—Crystalate Gramophone Record Mfg. Co., Ltd. Gramophone records.
Imperial.—Ward and Goldstone, Ltd. Dry battery.
Imperial.—Watmel Wireless Co., Ltd. Components.
Indigraph.—Igranic Electric Co., Ltd. Recording tuning dial.
Indispenso.—Ward and Goldstone, Ltd. Charging set.
Inkwell.—Everett, Edgcumbe and Co., Ltd. Recording ammeters, voltmeters and wattmeters.
Insta.—Adam Hilger, Ltd. Trade mark for special spectroscopic accessories.

Invincible.—Goodmans (Clerkenwell), Ltd. Moving coil speaker.
Invicta.—Orr Radio, Ltd. Receivers.
Ionic.—Ionic Alkaline Batteries, Ltd. Battery.
Itonia.—Itonia Ltd. Gramophone products.
Ivalek.—Ivory Electric. General trade mark.
Ivorex.—Money Hicks, Ltd. Engraved labels.

Jacelite.—J. A. Crabtree and Co., Ltd. Moulded B.S. gauge, plugs and sockets, tumbler switches.
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.
Junilog.—Sydney S. Bird and Sons, Ltd. Baby logarithmetic condensers.
Junior Automatic Lidstay.—S. Greenman, Ltd. Portable wireless and gramophones sets.
Jussrite.—Murdoch Trading Co. Record filing cabinets.
Justone.—Bakers Selhurst Radio, Ltd. Speakers.
J. and A.—Claude Lyons, Ltd. Laboratory apparatus.
J.B.—Jackson Brothers (London), Ltd. Variable condensers.
J.D.—J. Dyson Co., Ltd. Batteries.
J.L.—Walter Balmford, Ltd. Wiring clips.
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.
Kalanite.—Callender's Cable and Construction Co., Ltd. Insulating material.
Kaleeco.—Callender's Cable and Construction Co., Ltd. Electric cable.
Kalibond.—Callender's Cable and Construction Co., Ltd. Electric cable.
Karna.—Appletons (Leeds), Ltd. Gramophones and speakers.
Kayvee.—Kemps Vulcanizing Co., Ltd. Accumulators.
Kelsey.—Peto Scott Co., Ltd. Shortwave adaptor.
Kenwell.—Kenwell Radio, Ltd. Receivers and radiograms.
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.
Klinx.—Kay Bros., Ltd. Heat-proof cement for china insulators, etc.
Klock.—Baker's Selhurst Radio, Ltd. Moving-coil speaker incorporating synchronous clock.
Kniffy.—Kniveton Cable Works, Ltd. General trade mark.
Knightsbridge.—Betterset Radio, Ltd. Receivers.
Koh-i-Noor.—Primus Manufacturing Co. H.T. batteries.
Konekap.—Graham-Farish, Ltd. Grid leak.
Konductite.—City Accumulator Co. Metallic screening paper.
Kurz-Kasch.—R. A. Rothermel, Ltd. Knobs and dials.
K.-B.—Kolster-Brandes, Ltd. Receivers, speakers and other radio apparatus.
K.G. Chromotone.—Radio Reconstruction Co., Ltd., and Arthur Kingston and Co. Recording apparatus.
K.V.—Kemps Vulcanizing Co., Ltd. Accumulators, ebonite, etc.

Lacoline.—Ward and Goldstone, Ltd. Coloured connecting wire.
Laker.—J. and J. Laker Co., Ltd. Masts and aerial equipment.
Laminic.—Magnetic and Electrical Alloys, Ltd. Nickel iron cores.
Lampex.—Lampex Radio and Electric Co. General trade mark.
Lassophone.—East Ham Wireless Supplies. Sets, components and accessories.
Lebakite.—Spicers, Ltd. Bakelite sheets, panels, tubes, formers and rods.
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. Waterproof insulated aerial wire.
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.
Limpet.—Connollys (Blackley), Ltd. Adhesive tape.
Linapex.—Ioco Rubber and Waterproofing Co., Ltd. Insulating cloth, silk and tapes.
Linco.—F. Line and Co. Tools.
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.
Logobm.—Baldwin Instrument Co. Resistance bridges.
Lohys.—J. Sankey and Sons, Ltd. Transformer laminations.
London.—London Electric Clock Co. Electric clock.
Londona.—Londona, Ltd. P.M.-M.C. speakers.
Longlife.—Runwell Cycle Co. (Birmingham), Ltd. Batteries, accumulators, gramophone needles, and motor springs and insulating tape.
Lotus.—Lotus Radio (1933), Ltd. General trade mark.
Lowrah.—Harwol Specialities Co. Slow motion dials and H.T. batteries.
Lucas.—J. Lucas, Ltd. L.T. accumulators and mouldings.
Luminex.—Steatite and Porcelain Products, Ltd. Ceramic material for resistance formers.
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.
L.P.S.—L.P.S. Electrical Co., Ltd. Wire.

Macadie.—Automatic Coil Winder and Electrical Equipment Co., Ltd. Coil winder.
Maco.—Manufacturers Accessories Co. (1928), Ltd. Accumulators.
Maconite.—Macintosh Cable Co., Ltd. Insulated cables.
Magna.—E. A. Wood. Products and gramophone springs.
Magna.—Benjamin Electric, Ltd., Speakers.
Magna-flux.—Watson, Saville and Co., Ltd. Magnet steel, cobalt and tungsten magnets.

TRADE NAMES

Magnafilter.—Burne-Jones and Co., Ltd. Wave trap.
Magnagram.—Burne-Jones and Co., Ltd. Radio-gramophones.
Magnavox.—Benjamin Electric, Ltd. Speakers.
Magnet.—General Electric Co., Ltd. Accumulators.
Magnetic.—J. and J. Laker Co., Ltd. Earth tube.
Magnex.—Charlton Higgs (Radio), Ltd. Receivers and radiograms.
Magnum.—Burne-Jones and Co., Ltd. Receivers, components and accessories.
Majestic.—Majestic Electric Co., Ltd. All-electric receivers and radio-gramophones.
Maklodone.—McLeod and McLeod. Bakelite mouldings and knobs.
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.
Marlborough.—Wildbores Radio, Ltd. Receivers.
Massicore.—W. Bryan Savage, Ltd. Transformers and mains components.
Mastertone.—John E. Dallas and Sons, Ltd. Gramophone.
Mastiff.—Ward and Goldstone, Ltd. Spring connectors.
Matched Tone.—Kolster-Brandes, Ltd. Headphones.
Mavox.—National Radio Service Co. Receivers.
Maxitone.—Lugton and Co., Ltd. General trade mark.
Max.—Graham-Farish, Ltd. Parallel feed transformer.
Mayfair.—Halford Distributors, Ltd. Cocktail set all-wave radio-gram.
Mazda.—Edison Swan Electric Co., Ltd. Valves.
Medium Resistance.—J. Sankey and Sons, Ltd. Transformer laminations.
Megger.—Eversheds and Vignoles, Ltd. Testing instruments.
Megohmax.—J. Moores and Co. Synthetic resin products.
Megohmior.—J. Moores and Co. Insulating materials.
Mellow Tone.—The Mellow Tone Co., Ltd. Needles.
Melodee.—Carrington Manufacturing Co., Ltd. Cabinet.
Melody Maker.—A. C. Cossor, Ltd. Melody Maker kits, battery and all-electric.
Meraco.—Mervyn Sound and Vision Co., Ltd. Radio television apparatus.
Mercury.—Grosvenor Electric Batteries, Ltd. H.T. battery.
Meritone.—Thompson, Diamond and Butcher. Gramophones. batteries and accumulators.
Meritus.—Meritus (Barnet), Ltd. General trade mark.
Merrybright.—J. and A. Margolin. Gramophones.
Mervyn.—Mervyn Sound and Vision Co., Ltd. General trade mark.
Mervyn-Faraday.—Faraday Allwave Wireless. Receivers.
Meshwood.—S. Greenman, Ltd. Wireless silks.
Metaplex.—Peto Scott Co., Ltd. Metallised baseboard.
Meteor.—Claude Lyons, Ltd. Plugs and sockets.
Metocel.—Ward and Goldstone, Ltd. Air spaced metal screened down lead.
Metrohm.—Everett, Edgcumbe and Co., Ltd. Insulation and resistance testing sets.
Meyer.—E. Oppenheim and Co., Ltd. Turntables.
Micaloid.—Mica Mfg. Co., Ltd. Mouldings for high frequency.
Micarta.—Westinghouse Electric International Co. Decorative sheet.
Micaylor.—Taylor and Petters, Ltd. Diaphragms for sound-boxes.
Micrion.—Radio Instruments, Ltd. Adjustable inductance coils, transformers and receivers.
Microdenser.—Stratton and Co., Ltd. S.W. condenser.
Micro Drive.—Wingrove and Rogers, Ltd. Slow motion drive.
Microfu.—Microfuses. Ltd. Fuses.
Micro-Henlog.—Baldwin Instrument Co. Inductance bridges.
Microlode.—Whiteley Elec. Radio Co., Ltd. Speakers.
Micromesh.—Standard Telephone and Cables, Ltd. Valves.
Microspec.—General Inductance Co. Bakelised paper coil formers, tubes and sheet.
Microtune.—J. Dyson and Co., Ltd. Radio instruments.
Midget.—Wingrove and Rogers, Ltd. Variable gang condensers.
Millgate.—Chorlton Metal Co., Ltd. General trade mark.
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.
Moderne.—Radio Instruments Ltd. All mains receivers and radiograms.
Modula.—British Pix Co., Ltd. Volume control.
Monix.—Money Hicks, Ltd. Components.
Monosonic.—Primus Manufacturing Co. Sets.
Moto Radio.—Philips Lamps, Ltd. Car radio equipment.
Mouldensite.—Bakelite, Ltd. Insulating materials
Mozart.—Bradnam and Co. Radio-gramophones.
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. Air spaced shell type metal screened down lead.
Multi-Volt.—Varley. Power transformers.
Multitone.—Multitone Electric Co., Ltd. Deaf aids and deaf aid receivers.
Mum.—Graham Farish, Ltd. Mains interference suppressor unit.
Mumax.—Climax Radio Electric Ltd. L.F. transformer.
M.A. Sound System.—Mobile Amplifiers, Ltd. Amplification apparatus.
M.A.C.—Manufacturers' Accessories Co. (1928), Ltd. General trade mark.
M.B.3.—Mullard Wireless Service Co., Ltd. Battery receivers.
M.C.22.—Amplion (1932) Ltd. Moving coil speaker.
M.H.—McMichael Radio, Ltd. Receivers.
M.L.—Rotax, Ltd. General trade mark.
M. and M.—McLeod and McLeod, Ltd. General trade mark.
M.P.R.—M.P.R. Electrical Co. General trade mark.
M.R.—Mains Radio Mfg. Co. General mark.

Nakvo.—R. O. Bridger and Co., Ltd. Waterproof compo. cones.
National.—R. A. Rothermel, Ltd. Vernier dials.
National Band.—Thompson. Diamond and Butcher. General trade mark.
Natrasco.—National Radio Service Co. General trade mark.
Necol.—Nobel Chemical Finishes, Ltd. Cellulose enamels, lacquers, cements, etc.
Needle Tension.—Dawes Clark & Co. Soundbox diaphragms.
Negrolac.—Ward and Goldstone, Ltd. Indoor and outdoor aerials.

Netaglass.—E. A. Wood. Valve holders.
Netavox.—E. A. Wood. Receivers and cone assemblies.
Netax.—E. A. Wood. Valve and coil holders
Neutron.—Neutron (1927), Ltd. Crystals and valves.
Neutron.—Wolsey (Radio and Allied Trades) Ltd.
New Empire.—Victor Battery Co. Dry Batteries.
New Mascot.—Churchmans, Ltd. General trade mark.
Nial.—E. Allen and Co., Ltd. Magnet.
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.
Nine Lives.—Boynton and Co., Ltd. Batteries.
Nivex.—Runbaken Magneto, Ltd. Meters.
Nodalizer.—Ward and Goldstone, Ltd. Potentiometers.
No-Mast.—Caradio Services, Ltd. Aerial.
No-Mast.—Central Equipment, Ltd. Aerial.
Non-Jam.—J. and J. Laker Co., Ltd. Aerial pulley.
Norfolk.—Reproducers and Amplifiers, Ltd. P.M. cabinet speakers for relay operation.
Norma.—Norma Technical Products, Ltd.—Soundbox.
Nosco.—Northern Steel and Hardware Co., Ltd. Batteries and accumulators.
Noshok.—E. W. Bonson. Sockets and couplers.
Nu-Glo.—Mervyn Sound and Vision Co., Ltd. Television lamps.
Nuvolion.—Nuvolion Electrics, Ltd. Speakers, P.A. equipment and relay apparatus.
Oak.—R. A. Rothermel, Ltd. Switches.
Obo.—A. E. Andrews and Co. General mark.
Octacros.—Synchrophone, Ltd. Records.
Octave.—Claude Lyons, Ltd. Tone controls.
Octopus.—Edmunds, Ltd., G. Grip terminals.
Octron.—Octron, Ltd. Valves.
Odeon.—Parlophone Co., Ltd. Records.
Ohmite.—Graham Farish, Ltd. Fixed resistances and volume control.
Oldham.—Oldham and Son, Ltd. Batteries.
Olympic.—Stadium, Ltd. Hydrometers.
Omega.—H. Joseph. Soldering irons.
Orchestrion.—Thompson, Diamond and Butcher. General trade mark.
Orgola.—Mullard Wireless Service Co., Ltd. General trade mark.
Original.—Lehmann, Archer and Lane, Ltd. Tools, taps and dies.
Oriole.—Levy's Sound Studios, Ltd. Records.
Ormond.—Ormond Engineering Co., Ltd. Components.
Orr.—Orr Radio, Ltd. General trade mark.
Orthotone.—Watmel Wireless Co., Ltd. Components.
Osram.—General Electric Co., Ltd. Valves.
Osram.—M.O. Valve Co., Ltd. Valves.
Ostar-Ganz.—Eugene Forbat. General trade mark.
Overnight.—F. C. Heaybord and Co. Battery charger.
Oxford.—Reproducers and Amplifiers, Ltd. P.M. cabinet speakers for relay operation.
O.K.—J. Toubkin. Chokes, batteries, speakers.
O.P. 58.—Reproducers and Amplifiers, Ltd. Transformers.
Pam.—Claude Lyons, Ltd. D.C. and A.C. operated amplifiers.
Panachord.—Brunswick, Ltd. Records.
Panatrope.—Brunswick, Ltd. Radio-gramophone.
Pantophone.—Parlophone Co., Ltd. Records, needles and pick-ups.
Parafeed.—Radio Instruments, Ltd. L.F. transformer.
Paragon.—Clarkes (Redditch) Ltd. Terminals.
Paragon.—H. J. Fletcher and Co., Ltd. Needles and record-filing cabinets.
Parex.—E. Paroussi. Components, accessories and metal cabinets.
Parlophone.—Parlophone Co., Ltd. Records and needles.
Parmeko.—Partridge and Mee, Ltd. General trade mark.
Paulette.—Paulls Wireless Stores. General trade mark.
Paxolin.—Micanite and Insulators Co., Ltd. General trade mark.
Peace Products.—Henry Peace, Ltd. General trade mark.
Peak.—W. Andrew, Bryce and Co. Paper and electrolytic condensers.
Peerlex.—Clarke Bros. (Leicester), Ltd. H.T. batteries.
Peero.—Brown Brothers, Ltd. Pocket lamp batteries.
Pegasus.—Pegasus, Ltd. Receivers.
Pentamu.—Radio Instruments, Ltd. Pentode output transformer.
Pentex.—Celluloid Printers, Ltd. Scales.
Pentomite.—Radio Instruments, Ltd. L.F. smoothing and filter output choke.
Pentone.—Mullard Wireless Service Co., Ltd. Valves.
Pentrovol.—Igranic Electric Co., Ltd. Microphone.
Percolite.—Aerialite, Ltd. Chemical percolative earth tubes, also H.T. dry batteries.
Perfect.—Octron, Ltd. Valves.
Perfecta.—E. W. Bonson. Plugs.
Peridulce.—Murdoch Trading Co. Gramophones.
Permadyne.—Goodmans (Clerkenwell), Ltd. Moving-coil speaker.
Permag.—Bakers Selhurst Radio, Ltd. Speakers.
Permalloy.—Standard Telephones and Cables, Ltd. High magnetic alloy for cores.
Permatector.—Radio Electric Products Co. Permanent detectors (crystal).
Permcol.—British Hard Rubber Co., Ltd. Non-discolouring ebonite.
Permeability Tuning.—Varley. Three- and four-gong tuners.
Perpetuum.—Aladdin Gramophone and Accessories Co. Gramophone motors, spring and electric.
Pertinax.—G. L. Scott and Co., Ltd. Insulation and wire.
Pertrix.—Britannia Batteries, Ltd. Dry batteries and accumulators.
Petmecky.—Murdoch Trading Co. Gramophone needles.
Phantom.—Lampex Radio and Electric Co. Receivers, etc.
Phenoid.—Mica Manufacturing Co., Ltd. Bakelite sheet, tubes and formers, stampings, etc
Philco.—Philco Radio and Television Corp. of G.B., Ltd. General trade mark.
Philco Car Radio.—Philco Radio and Television Co. of Great Britain, Ltd. Car radio.
Philips.—Philips Industrial Ltd. (Philips Lamps, Ltd.). General trade mark.
Philips.—Philips Lamps, Ltd. Sets, rectifying valves, components and accessories.
Philite.—Philips Lamps, Ltd. Synthetic resin moulding.
Pifco.—Provincial Incandescent Fittings Co., Ltd. General trade mark.
Pilot.—Peto-Scott Co., Ltd. Kits, sets.
Pilot Author.—Peto Scott Co., Ltd. Kits.
Pioneer.—Pioneer Manufacturing Co. General trade mark.
Pioneer.—R. A. Rothermel, Ltd. Auto-mobile generators.
Pip.—Graham Farish, Ltd. L.F. transformers.
Pirouette.—A. W. Chapman, Ltd. Turntables, for portables, transportables, loud speakers, frame aerials, etc.
Pirtoid.—H. Clarke and Co. (M/c), Ltd. Insulation.
Pix.—British Pix Co., Ltd. General trade mark.
Pixie.—L. R. Wood. General trade mark.
Plaza.—British Homophone Co., Ltd. Records.
Plumex.—Vee Cee Dry Cell Co. (1927), Ltd.
Plus-A-Gram.—J. and A. Margolin.
Plus Four.—Paul Taylor. H.T. dry battery.
Polar.—Wingrove and Rogers, Ltd. Variable condensers and slow motion drives.
Polar-N.S.F.—Wingrove and Rogers, Ltd. Components.
Polymet.—R. A. Rothermel, Ltd. Electrolytic condensers.

TRADE NAMES

Pop.—Graham Farish, Ltd. Terminal mount.
Popular.—Baker's Selhurst Radio, Ltd. Speakers.
Popular.—Ever-Ready Co. (Great Britain), Ltd. H.T. batteries.
Portadyne.—Portadyne Radio (Gorst Elec. Co., Ltd.). Sets.
Portrola.—Decca Gramophone Co., Ltd. Portable radio-gram.
Powerlite.—Primus Manufacturing Co. H.T. pocket and torch batteries.
Power Puncher.—Varley. H.T. economiser.
Premierphone.—Lisenin Wireless Co. Sets.
Pre-Selec.—Radio Instruments Ltd. All-mains and battery receivers.
Presto.—Ward and Goldstone, Ltd. Two-pin plug adaptor.
Prima Donna.—Aladdin Gramophone and Accessories Co. Sound boxes.
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.
Progress.—British G.W.Z. Battery Co., Ltd. H.T. batteries.
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.
Pylon.—Time Recorder and Equipment Co. Electric clocks.
Pye.—Pye Radio, Ltd. General trade mark.
P.B.—McLeod and McLeod, Ltd. Tapes (varnished).
P.D.—Automobile Accessories (Bristol), Ltd. Valve set and components.
P.H.B.—T.M.C. Harwell (Sales) Ltd. Electric fittings.
P.M.—Mullard Wireless Service Co., Ltd. General trade mark.
P.P.M.—Celestion Ltd. Speakers.

Quad-Astatic.—Radio Instruments, Ltd. H.F. choke.
Quadruple.—Baker's Selhurst Radio, Ltd. Speakers.
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. Connector.
Quickwyre.—A. F. Bulgin and Co., Ltd. Slip covered connecting wire.
Quip.—Graham Farish Ltd. Q.P.P. transformer.
Quixo.—Runbaken Magneto Co., Ltd. Battery testers.
Q.C.C.—Quartz Crystal Co. Crystals and transmitting apparatus.
Q.J.—Wingrove and Rogers, Ltd. Variable condenser.

Radenite.—Van Raden and Co., Ltd.
Radiamp.—Radiamp Co., Ltd. Components.
Radiant.—Dawkins Trading Co., Ltd. Accumulators.
Radio for the Million.—United Radio Mfrs., Ltd. Kit set.
Radio Crystals.—Sylvex Ltd. Permanent detector crystals.
Radioformer.—Radioformer Ltd. General trade mark.
Radio-Graphophone.—Columbia Graphophone Co., Ltd. Radio-gramophones.
Radiola.—Richardsons (R.M.L.), Ltd. Gramophones.
Radiolab.—Everett Edgcumbe & Co., Ltd. Portable testing apparatus.
Radiolux.—Amplion (1932), Ltd. Receiver and radiogramophone.
Radiomatic.—Gent and Co., Ltd. Valve set.
Radiomonic.—Radiomonic Ltd. General trade mark.
Radionite.—British Radio Mfg. Co. (Liverpool), Ltd. Synthetic crystal rectifiers.
Radio Record.—Record Radio, Ltd. Valves.
Radio Recorder.—Radiomobile, Ltd. Reproducer of records, radio, and speech.
Radiotrope.—Thompson Diamond and Butcher Gramophone to radio conversion unit.
Radiovox.—Radiovox Wireless Services, Ltd. Amplifying equipment.
Radio XXX.—M. Feldman. Accumulators and 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.
Ray.—Ray Eng. Co., Ltd. General trade mark.
Reactone.—Wolsey (Radio and Allied Trades), Ltd.
Reactone.—Sylvex, Ltd. Coils.
Recepticon.—Concordia Electric Wire Co., Ltd. Insulated aerial wire.
Record. — Ward and Goldstone, Ltd. Dry battery.
Rectatone.—Varley. Transformer.
Red-ditch.—Clarkes (Redditch), Ltd. Gramophone needles.
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 Star.—Curry's, Ltd. Batteries and accumulators.
Red Triangle.—Peto Scott Co., Ltd. Ebonite panels.
Refty.—Davis and Timmins, Ltd. Terminals.
Regal.—Spicers, Ltd. Ebonite.
Regal-Zonophone.—Columbia Graphophone Co., Ltd. Records.
Regentone Products.—Regentone Products, Ltd. Mains and battery receivers, etc.
Regis.—E. W. Bonson. Plugs.
Rejectostat.—Kolster Brandes, Ltd. Man-made static eliminator.
Reliability.—J. H. Taylor and Co. Batteries, variable and fixed condensers and ebonite.
Reliance.—A. Diggle and Co. Charging plant.
Reliomac.—Manufacturers' Accessories Co. (1928), Ltd. H.T. battery.
Renown.—Goodmans (Clerkenwell), Ltd. P.M. M.C. speaker.
Renown.—Mile End Radio Co. Components and accessories.
Resinkor.—British Insulated Cables Ltd. Solder.
Rex.—Crystalate Gramophone Record Manufacturing Co., Ltd. Gramophone records.
Rheoswitch.—A. F. Bulgin and Co., Ltd. Combined H.T. and L.T. switch.
Rich and Bundy.—Rich and Bundy, Ltd. General trade mark.
Richtone.—London Radio Co. (Leeds), Ltd. Covered aerial wire, A.C. and battery sets, and A.C. radiogram.
Rifanco.—Regent Fittings Co. Gramophones and accessories.
Riley Radio.—W. Riley and Son. Sets and radiograms.
Ring.—George Bowerman, Ltd. H.T. battery.
Ritz.—Radio Instruments Ltd. Receivers.
Rival.—Hobday Bros., Ltd. Components and accessories.
Riverside.—Carrington Mfg. Co., Ltd. Cabinet.
Rogers-Majestic.—Fourwave, Ltd. Receivers.
Rola.—British Rola Co., Ltd. Moving coil speakers.
Rolls-Caydon.—Consolidated Radio Co., Ltd.

Ross, Courtney.—Ross, Courtney and Co., Ltd. Terminals.
Rothermel.—R. A. Rothermel, Ltd. General trade mark.
Rothermel-Brush.—R. A. Rothermel, Ltd. Piezo-electric devices.
Rotor-Ohms.—Rotor Electric, Ltd. Variable resistances.
Royalty.—R. A. Rothermel, Ltd. Wirewound grid-leak, resistance and modulator.
Rozinal.—Gre-Solvent Co. Soldering paste.
Rubyphone.—F. Cholerton. Receiver.
Runbaken.—Runbaken Products.
R. and A.—Reproducers and Amplifiers, Ltd. General trade mark.
R.A.P.—R.A.P., Ltd. General trade mark.
R.C.—Radio Electric Products Co. General trade mark.
R.C. and S.—R. Cooper and Son (Wolverhampton), Ltd. Static interference suppressor and microphone.
R.E.G.—E. A. Wood. Products, batteries and insulating tape.
R.G.D.—Radio-Gramophone Development Co. Radio-gramophones, speaker, pick-ups and arms.
R.G. Greatrex.—R. G. Greatrex and Co. Portables, battery and mains and speakers.
R.K.—British Thomson-Houston Co., Ltd. Coil-driven speaker and amplifiers.
R.L.—R. Cadisch and Sons. Switches, terminals and plugs.
R.W.—R. W. Products, Ltd. General trade mark.

Sackville.—Halford Distributors, Ltd. Medium, long and all-wave receivers.
Salford.—Salford Electrical Instruments, Ltd. General trade mark.
Salon Decca.—Decca Gramophone Co., Ltd. Acoustic gramophone, portable and cabinet.
Sampson.—Ward and Goldstone, Ltd. Accumulators and accumulator carriers.
Sandringham.—Goodmans (Clerkenwell), Ltd. Cone speaker.
Savage.—W. Bryan Savage, Ltd. Amplifiers, microphones and condensers.
Savage Sound.—W. Bryan Savage, Ltd. Amplifiers, microphones and condensers.
Savana.—Rose, Morris and Co., Ltd. General trade mark.
Saxbestos.—Saxonia Elec. Wire Co., Ltd. Asbestos cord wires.
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.
Screened Superial.—New London Electron Works, Ltd. Aerial designed to eliminate local interference.
Scrufuse.—Belling and Lee, Ltd. Long path wire fuse.
Seamark.—C. E. Needham and Brother, Ltd. Batteries.
Seamless.—R. O. Bridger and Co., Ltd. Moulded paper cones.
Segic.—S. Guiterman and Co., Ltd. Battery charging clips, battery fillers and hydrometers.
Selectatune.—C. G. Chalkley. Tuning unit.
Senator.—A. F. Bulgin and Co., Ltd. Transformers.
Sensity.—Formo Products, Ltd. Iron-coned coils.
Setaw.—London and Provincial Factors, Ltd. Meters.
Shakeproof.—Barber and Colman, Ltd. Lock-washers and locking terminals.
Shearex.—A. E. Shearing. Components.
Sickles.—R. A. Rothermel, Ltd. Coils.
Siemens.—Siemens Electric Lamps and Supplies, Ltd. Batteries.
Siemens and Halske.—Siemens Schuckert (Gt. Britain), Ltd. General trade mark.
Siftron.—Amplion (1932), Ltd. Aerials.
Silcor.—Magnetic and Electrical Alloys, Ltd. Silicon iron cores.
Silktex.—Celluloid Printers, Ltd. Scales.
Siltit.—Central Equipment, Ltd. Earths.
Silverdome.—Octron, Ltd. Valves.
Silver Fox.—Currys, Ltd. Batteries.
Silver Radio.—Hellesens, Ltd. H.T. batteries.
Simple-strip.—New London Electron Works, Ltd. Perforated instrument wire.
Simplicity.—S. Guiterman and Co., Ltd. Acid pump.
Simplicon.—Williams and Moffat, Ltd. Components.
Simpson's Electric Turntable.—Kingsway Radio, Ltd. A.C. gramophone motor.
Sinew.—Clarkes (Redditch), Ltd. Steel springs. terminals, spring clips, and aerial springs.
Sistoflex.—Spicers, Ltd. Insulating sleeving and materials.
Skyscraper.—Lissen, Ltd. Kits.
Slipquik.—Concordia Elec. Wire Co., Ltd. Insulated connecting wire.
Slot.—Graham Farish, Ltd. Aerial filter.
Snail.—Formo Products, Ltd. Slow motion dual ratio drive and escutcheon.
Snap.—Graham Farish, Ltd. Switches.
Solex.—British Homophone Co., Ltd. Records.
Sonette.—Amplion (1932), Ltd. Moving coil speaker.
Sonia.—Murdoch Trading Co. Main springs.
Sonomac.—Metal Agencies Co., Ltd. Moving coil speakers, amplifiers, and microphones.
Sopranist.—London and Provincial Factors, Ltd. Accumulators, batteries, components and hydrometers.
Sorbo.—Sorbo, Ltd. General trade mark.
Sound Service.—Hillman Bros., Ltd. Accumulators and earth tubes.
Sovereign.—Atlas Carbon and Battery Co., Ltd. Batteries.
Sparta.—Fuller Accumulator Co. (1926), Ltd. Dry batteries.
Specpure.—Adam Hilger, Ltd. Trade mark for spectroscopically standardised substances.
Speedway.—McLeod and McLeod, Ltd.
Spekker.—Adam Hilger, Ltd. Trade mark for specialised spectroscope, spectro photometer, etc.
Spirohm.—Dubilier Condenser Co. (1925), Ltd. Wire-wound resistors.
Sprague.—R. A. Rothermel, Ltd. Electrolytic condensers.
Springflat.—J. G. Beddoes, Ltd. Collapsible spring handle.
Springmore.—Igranic Electric Co., Ltd. Wander plug.
Square Peak.—Varley. Coils.
Stadium.—Stadium, Ltd. Hydrometers, voltmeters and ammeters.
Stafford.—Reproducers and Amplifiers, Ltd. P.M. cabinet speakers for relay operation.
Stalloy.—Joseph Sankey and Sons, Ltd. Transformer laminations and diaphragms.
Standard.—Graham Farish, Ltd. Grid leak.
Standard.—Baker's Selhurst Radio, Ltd. Speakers.
Standard Radio.—Standard Telephones and Cables, Ltd. General trade mark.
Standynis.—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.
Staric.—George Bowerman, Ltd. Condensers, transformers, switches and flex.
Starmac.—Metal Agencies Co., Ltd. Accumulators.
Steed.—Amalgamated Manufacturers. Coil winder.
Stentoriam.—Whiteley Electrical Radio Co., Ltd. Speakers.
Sterling.—Sterling Batteries, Ltd. General trade mark.
Sterno.—British Homophone Co., Ltd. Records.
St. Ivel.—British General Radio Co., Ltd. General trade mark.
Stokmar.—Stockall Marples and Co., Ltd. Synchronous clocks.
Storch.—F. L. Lesingham. Two-pin plugs and sockets.
Straight Five.—Charlton Higgs (Radio), Ltd. Receivers.

TRADE NAMES

Stremlin.—Aladdin Gramophone and Accessories Co. Tone arm.
Stronkor.—Johnson & Phillips, Ltd. Flexible cable.
Strucktakit.—Peto Scott Co., Ltd. Kits.
Sturdy.—Sturdy Electric Co. Mains transformers and chokes.
Sunbeam.—Fuller Accumulator Co. (1926), Ltd. Dry batteries.
Sunco.—Sun Electrical Co., Ltd. General trade mark.
Super.—Hellesens, Ltd. H.T. batteries.
Super 1.—Ever-Ready Co. (Gt. Britain), Ltd. H.T. battery.
Super Artiste.—Pohlman and Son, Ltd. Radiogram.
Super Automatic Lidstay.—S. Greenman, Ltd. Radiogram.
Superbe Label.—Columbia Graphophone Co., Ltd. Needles.
Supercell.—Runwell Cycle Co. (Birmingham), Ltd. Accumulators.
Super Cinema.—Radio Development Co. Speakers.
Super Dwarf.—Radio Development Co. Speakers.
Super-ferrodyne.—A. C. Cossor, Ltd. Receivers and radiograms.
Superial.—New London Electron Works, Ltd. Insulated aerial wire.
Superscale.—Everett, Edgcumbe and Co., Ltd. Moving iron and moving coil ammeters and voltmeters.
Suprecision.—F. C. Heayberd and Co. Measuring instruments.
Supreme.—Vee Cee Dry Cell Co. (1927), Ltd.
Supremus.—Supremus Specialities, Ltd. General trade mark.
Supronic.—L.P.S. Electrical Co., Ltd. Resistance alloys.
Sutra.—George Bowerman, Ltd. Transformers, voltmeters, valve holders, coil holders, mains supply units, etc.
Sylphone.—Frederick Squire, Ltd. Moving coil speaker.
Sylvania.—Claude Lyons, Ltd. Valves.
Sylverex.—Sylvex, Ltd. Cone material, cone washers and tinsel fabric for speakers.
Sylverex.—Wolsey (Radio and Allied Trades), Ltd.
Symphonion.—Dulcetto Polyphon, Ltd. Gramophones.
Symphony.—J. Toubkin. Speakers.
Synchratune.—Sydney S. Bird and Sons, Ltd. Ganged variable condensers with individual adjustment.
Synchronomains.—Synchronome Co., Ltd. Synchronous clocks.
Synchronome.—Synchronome Co., Ltd. Electrical impulse clocks.
Synchrophone.—Synchrophone Ltd. Home talkie apparatus.
Synclock.—Everett, Edgcumbe and Co., Ltd. Synchronous clocks and time switches.
S.E.—Service Equipment Co., Ltd. Hydrometers and turntables for portables.
S. G. Brown.—National Radio Service Co. Headphones.
S.I.W.—Scott Insulated Wire Co., Ltd. Instrument wire.
S.L.—Spicers, Ltd. Ebonite.
S.R.S.—Stonehouse Radio Supplies. General trade mark.
S.S.—F. W. Lechner and Co., Ltd.

Tachy.—Acme Album Service. Record carrying case.
Talkie Label.—Columbia Graphophone Co., Ltd. Needles for cinema use.
Tangent.—Gent and Co., Ltd. Components and accessories, mains transformers and chokes.
Tannoy.—Tannoy Products. General trade mark.
Tarry.—Tarry's. General trade mark.
Telecontrol.—Halford Distributors, Ltd. Receivers and radiograms.
Telelux.—British Television Supplies, Ltd. Television neon lamp and other television apparatus
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.
Termytabs.—Money Hicks, Ltd. Terminal labels.
Terralto.—R. Custerson. Speakers, cones and receiving sets.
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.
Three Star.—Three Star Accumulators, Ltd. Accumulators.
Ti.—Television Instruments Ltd. Television lamps and electric clock movements.
Titian.—H. J. Fletcher and Co., Ltd. Spring motors.
Toco.—Multitone Electric Co., Ltd. Tone control transformers.
Tone Selector.—Harlie, Ltd. Components and accessories.
Torex.—Lissen, Ltd. Transformers.
Torpedo.—British Needle Co., Ltd. Gramophone needles.
Touchtone.—Gent and Co., Ltd. Speaker.
Tournaphone.—Murdoch Trading Co. Gramophones.
Transchoke.—Varley, Q.P.P. Output components.
Transcoupler.—A. F. Bulgin and Co., Ltd. Transformer unit.
Transfeeda.—Benjamin Electric, Ltd. Parallel feed transformer.
Trefoil.—Bakelite, Ltd. Laminated sheet.
Trelleborgs.—P. C. Michell. Ebonite and bakelite.
Triparte.—Ward and Goldstone, Ltd. Terminals.
Trix.—Trix Electrical Co., Ltd., P.A. Equipment, receivers, components, transformers.
True-Bass-Boffle.—Hartley Turner Radio, Ltd. Non-resonant box baffle.
Truescrews.—True Screws, Ltd. General trade mark.
Truevibro.—R. O. Bridger and Co., Ltd. Cones.
Truphonic.—Truphonic Radio (Putney), Ltd. General trade mark.
Truqual.—Wharfedale Wireless Works. Volume controls.
Trutone.—Richardsons (R.M.L.), Ltd. Gramophones, components, covered aerials, accumulators, and H.T. batteries.
Truvolt.—R. A. Rothermel, Ltd. Resistance.
Truvox.—Universal Gramophone and Radio Co., Ltd. General trade mark.
Tube Wire.—J. Moores and Co. Connecting wire.
Tunewell.—Tunewell Neon and Radio, Ltd. General trade mark.
Tungar.—British Thomson-Houston Co., Ltd. Battery charger.
Tungsram.—Tungsram Electric Lamp Work (Great Britain), Ltd., and British Tungsram Radio Works, Ltd. Valves.
Tungstalite.—Tungstalite, Ltd. Crystal and crystal detector.
Tungstone.—Tungstone Accumulator Co., Ltd. Accumulators.
Tungstyle.—Gramophone Co., Ltd. Semi-permanent needles.
Twentieth Century.—Radio Development Co. Speakers.
Twin-cone.—Green and Faulconbridge, Ltd. Speakers.
Twingrip.—J. G. Beddoes, Ltd. Automatic safety lock.
Twoside.—Redferns Rubber Works, Ltd. Ebonite panels.
T.A.C.—T. Allnutt & Co. General trade mark.
T.C.C.—Telegraph Condensor Co., Ltd. Fixed condenser.
T.E.C.—Efandem Co., Ltd. Dry cell and accumulator.
T.M.C.-Hydra.—Telephone Mfg. Co., Ltd. Condensers.
T.S.F.—Campart, C. General trade mark.
Tyrela.—Tyrela Elec., Ltd. General trade mark.

Priestly & Ford
Proprietor:- JOHN PRIESTLY.
IN STOCK? OF COURSE IT IS!
THE NATIONAL RADIO DISTRIBUTORS
BIRMINGHAM • NOTTINGHAM • MANCHESTER

T.S.L. Products.—True Screws, Ltd. General trade mark.
T.X.—T.X. Products Co., Ltd. Adaptors.

Unic.—Richardsons (R.M.L.), Ltd. Components and gramophones.
Unicore.—Varley. Coils.
Unicorn.—British Needle Co., Ltd. Gramophone needles.
Uniflex.—Liverpool Radio Supplies. Sets.
Unigrad.—Radio Instruments, Ltd. Volume-controls.
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. Mirror drum scanners.
Unit.—Belling and Lee, Ltd. Pick-up.
United Press.—R. A. Rothermel, Ltd. Moulded cones.
Unitron.—Service Equipment Co., Ltd. Battery chargers.
Universal.—E. J. Francois. Terminals, wander-plugs and switches.
Universal Avominor.—Automatic Coil Winder and Electrical Equipment Co., Ltd. Testing Instrument.
Univolt.—Univolt Elec. Ltd. Radiogram units.
Utility.—Wilkins and Wright, Ltd.
U 56 R.—Charlton Higgs (Radio), Ltd. Receivers.

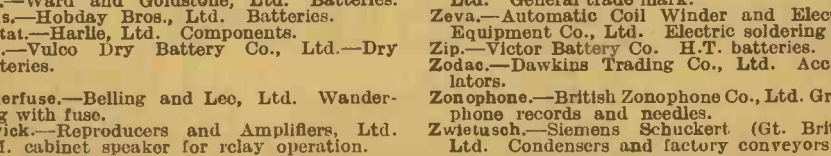
Van Raden.—Van Raden and Co., Ltd. H.T. and L.T. accumulators.
Varial.—New London Electron Works, Ltd. Variable aerial.
Variband.—Varley. Variable selectivity I.F. unit.
Varicap.—Radio Instruments, Ltd. Preset condenser.
Vari Dep.—Telephone Manufacturing Co., Ltd. Microphones.
Varitone.—Radio Instruments, Ltd. L.F. Transformer.
Varsity.—Guillaume and Sons, Ltd. Gramophone needles.
Vee Cee.—Vee Cee Dry Cell Co. (1927), Ltd. H.T. dry cell batteries.
Vee Cee Bee.—V. C. Bond and Sons, Ltd. Cabinets.
Vega.—Ootron Ltd. Valves, components and accessories.
Venauto.—Venner Time Switches, Ltd. Automatic programme selector.
Verto.—Baxendale and Co., Ltd. Accumulators.
Vessco.—H. Joseph. Electric clocks.
Vibro.—Burne Jones and Co., Ltd. Valve-holder.
Vibrolder.—Benjamin Electric, Ltd. Anti-microphonic valve holders.
Vicor.—Magnetic and Electrical Alloys, Ltd. Output transformer cores.
Victor.—Victor Battery Co. H.T. Battery.
Victor.—R. and A., Ltd. P.M.-M.C. speakers.
Violute.—E. A. Wood. Loudspeakers, cabinets and gramophones.
Viophone.—E. A. Wood. Loudspeakers.
Visitron.—Claude Lyons, Ltd. Photocells.
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.
Volex.—Ward and Goldstone, Ltd. Batteries.
Volpus.—Hobday Bros., Ltd. Batteries.
Volustat.—Harlie, Ltd. Components.
Vulco.—Vulco Dry Battery Co., Ltd.—Dry batteries.

Wanderfuse.—Belling and Lee, Ltd. Wander-plug with fuse.
Warwick.—Reproducers and Amplifiers, Ltd. P.M. cabinet speaker for relay operation.
Waterhouse.—F. Waterhouse, Ltd.. General trade mark.
Watmel.—Watmel Wireless Co., Ltd. Components and valve receivers.
Wavemaster.—Webb Condenser Co., Ltd. Variable condenser.
Waveola.—Aladdin Gramophone and Accessories Co. Amplifiers.
Waverley.—M. Sanger and Son. Batteries, accumulators and covered aerial wire.
Wayfarer.—London Electric Appliances, Ltd. Portable midget receivers.
Wearite.—Wright and Weaire, Ltd. Components and accessories.
Webber.—R. A. Webber, Ltd. P.A. Loud-speakers.
Webster.—R. A. Rothermel, Ltd. Amplifiers.
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. General trade mark.
Westminster.—Currys, Ltd. Sets, batteries and transformers.
Weston.—Weston Electrical Instrument Co., Ltd. Measuring instruments.
Wharfedale.—Wharfedale Wireless Works. Loudspeakers.
Wilco.—L. Wilkinson. General trade mark.
William and Mary.—Halford Distributors, Ltd. Receivers and radiograms.
Wilson.—R.C. and Wilson Elec. Ltd. Microphone bar amplifier.
Wilson.—E. Wilson. Aerial pulley.
Winner.—Ever-Ready Co. (Gt. Britain), Ltd. H.T. and G.B. dry batteries.
Wirelect.—Wireless Electric (Wholesale), Ltd. Aerial wire and accumulators.
Wolf.—S. Wolf and Co., Ltd. Electrical soldering iron and portable electric tools.
Wolsey.—Wolsey Television, Ltd. Kits.
Wo-Tan.—Frys (London), Ltd. Reamers and end mills.
Wurlitzer.—Wurlitzer Lyric Radio, Ltd. Receivers.
Wyephone.—W. Butcher and Sons (Ross), Ltd. Receiver.
W.B.—Walter Balmford, Ltd. General mark.
W.B.—Whiteley Electrical Radio Co., Ltd. General trade mark.
W.S.—Lithanode Co., Ltd.—Accumulators.
W. and W. Ltd.—Wright and Weaire, Ltd. Components.

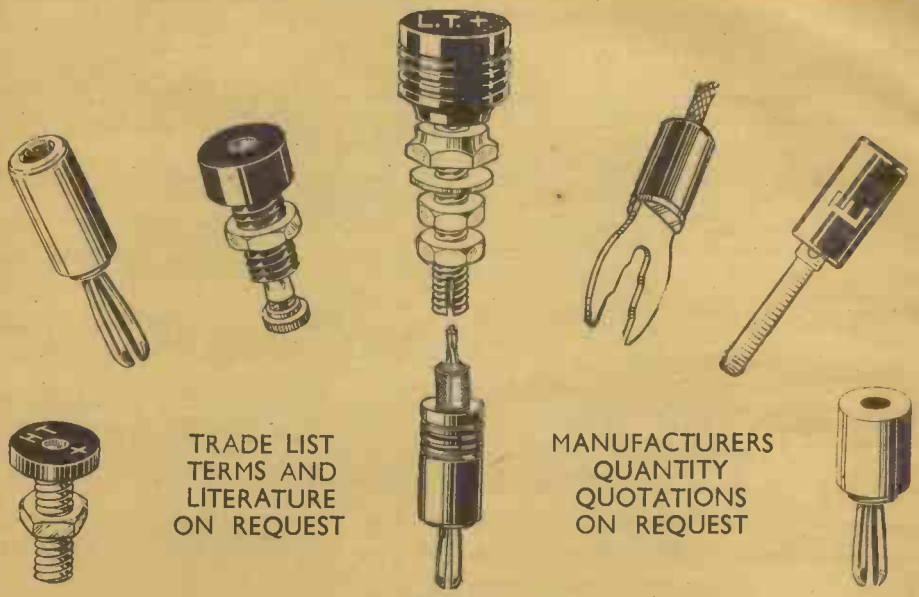
Xaltona.—G. F. Baker and Co., Ltd. Gramophones and radio.
X.L.N.T.—W. G. West. Cabinets and accumulator crates.

Yaxley.—R. A. Rothermel, Ltd. Rheostats and switches.
Yeoman.—Hillman Bros., Ltd. H.T. and G.B. batteries.
Young.—Young Accumulator Co. (1929), Ltd. General trade mark.

Zapon.—Ioco Rubber and Waterproofing Co., Ltd. Leather cloth.
Zaza.—Metropolitan Lighting Co., Ltd. Dry battery.
Zenite.—Zenith Electric Co., Ltd. Vitreous wire-wound resistance unit.
Zenith.—Zenith Electric Co., Ltd. General mark.
Zenohm.—Zenith Elec. Co., Ltd. Heavy duty strip resistance units.
Zetavox.—Zetavox Radio and Television Co., Ltd. General trade mark.
Zeva.—Automatic Coil Winder and Electrical Equipment Co., Ltd. Electric soldering iron.
Zip.—Victor Battery Co. H.T. batteries.
Zodac.—Dawkins Trading Co., Ltd. Accumulators.
Zonophone.—British Zonophone Co., Ltd. Gramophone records and needles.
Zwietusch.—Siemens Schuckert (Gt. Britain), Ltd. Condensers and factory conveyors.

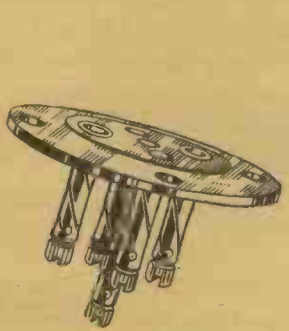


Perfect Contact Components

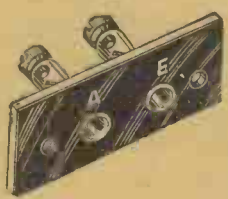


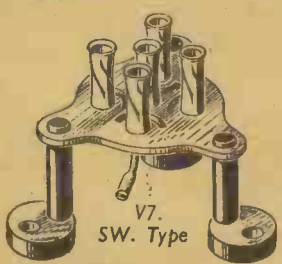
TRADE LIST
TERMS AND
LITERATURE
ON REQUEST

MANUFACTURERS
QUANTITY
QUOTATIONS
ON REQUEST

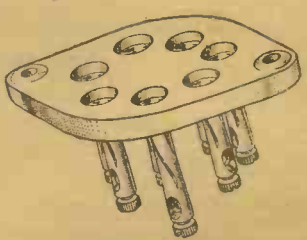


V1. Standard Type





V7. SW. Type



V5. SW. Type

TELEPHONE :
VICTORIA
3541/2 & 3516.

CLIX

TELEGRAMS :
"TROLINX,"
SOWEST,
LONDON.

LECTRO LINX LIMITED,

79a, ROCHESTER ROW, LONDON, S.W.I.

RADIO PRODUCTS SUPPLIED

ACCUMULATORS, L.T.

Accumulator Construction Co.
A.E.F. Mfg. Co.
Barnard Accumulator Co.
Batteries, Ltd.
Block Batteries, Ltd.
Boynton & Co., Ltd.
Britannia Batteries, Ltd.
Browning Wireless Mfrs.
Chorlton Metal Co., Ltd.
Cossor, Ltd., A.C.
Dawkins Trading Co., Ltd.
Edison Storage Battery Distributors, Ltd.
Edison Swan Electric Co., Ltd.
Efandem Co., Ltd.
Ever Ready Co. (Great Britain), Ltd.
Fuller Accumulator Co. (1926), Ltd.
General Electric Co., Ltd.
Grosvenor Electric Batteries, Ltd.
Hellesens, Ltd.
Kolster Brandes, Ltd.
Lampex Radio & Elec. Co.
Lissen, Ltd.
Lithanode Co., Ltd.
Lugton & Co., Ltd.
Manufacturers Accessories Co. (1928), Ltd.
Metal Agencies, Ltd.
Milnes Radio Co.
Oldham & Son, Ltd.
Peto & Radford.
Price & Co. (M/C), Ltd.
Richardsons (R.M.L.), Ltd.
Siemens Elec. Lamps & Supplies Co., Ltd.
Three Star Accumulators, Ltd.
Toubkin, J.
Wood, E. A.
Young Accumulator Co. (1929), Ltd.

ACCUMULATORS, H.T.

Accumulators Elite.
Barnard Accumulator Co.
Block Batteries.
Boynton & Co.
Britannia Batteries.
Chloride Elec. Storage Co., Ltd.
Fuller Accumulator Co. (1926), Ltd.
General Electric Co., Ltd.
Grosvenor Electric Batteries, Ltd.
London Radio Co. (Leeds), Ltd.
Milnes Radio, Ltd.
Oldham & Son, Ltd.
Peto & Radford.
Price & Co. (M/C), Ltd.
Richardsons (R.M.L.), Ltd.
Three Star Accumulators, Ltd.
Young Accumulator Co. (1929), Ltd.

ACCUMULATOR ACID.

Barnard Accumulator Co.
Imperial Chemical Industries, Ltd.
Wireless Elec. (Wholesale), Ltd.

ACCUMULATOR CHARGERS, A.C.

Arvin Elec., Ltd.
Baty, E. J.
British Rectifiers Eng. Co.
Chorlton Metal Co.
Clarke & Co. (M/C), Ltd., H.
Crypton Equipment, Ltd.
Dyson & Co., Ltd., J.
Eagle Engineering Co., Ltd.
Elliotts.
Ferranti, Ltd.
General Electric, Ltd.
Gordon & Co., F. J.
Heayberd & Co., F. C.
Higgs Motors, Ltd.
Meritus (Barnet), Ltd.
Midland Radio & Television Co.
Midland Transformer Co.
Milnes Radio, Ltd.
M.P.R. Elec. Co.
National Radio Service Co. (N.R.S.), Ltd.
Partridge, Wilson & Co., Ltd.
Philips Industrial (Philips Lamps, Ltd.).
Ray Engineering Co., Ltd.
Runbaken Products.
Salisbury Transformer & Elec. Co.
Service Equipment Co., Ltd.
Smurthwaite, Ltd., F. W.
Sound Sales, Ltd.
Tannoy Products.
Toubkin, J.
Trix Electrical Co., Ltd.
Westinghouse Brake & Signal Co., Ltd.

ACCUMULATOR CHARGERS, D.C.

Arvin Electric, Ltd.
Baty, E. J.
Crypton Equipment, Ltd.
Electro Dynamic Construction Co., Ltd.
General Electric Co., Ltd.
Gordon & Co., F. J.
Heayberd & Co., F. C.
Higgs Motors, Ltd.
London Electrical Co. (Sherborne Lane), Ltd.
Meritus (Barnet), Ltd.
Midland Radio & Television Co.
Midland Transformer Co.
M.P.R. Elec. Co.
National Radio Service Co. (N.R.S.), Ltd.
Partridge, Wilson & Co.
Ray Engineering Co., Ltd.
Runbaken Products.
Salisbury Transformer & Elec. Co.
Service Equipment Co., Ltd.
Sound Sales, Ltd.
Supremus Specialities, Ltd.
Tannoy Products.
Ward & Goldstone, Ltd.

ACCUMULATOR CHARGING STATION PLANT.

Baty, E. J.
British Radiophone, Ltd.
British Rectifiers Eng. Co.
Clarke & Co. (M/C), Ltd., H.
Crypton Equipment, Ltd.
Curtis Mfg. Co., Ltd.
Elliotts.
General Electric Co., Ltd.
Gordon & Co., F. G.
Heayberd & Co., F. C.
Higgs Motors, Ltd.
London Elec. Co. (Sherborne Lane), Ltd.
Meritus (Barnet), Ltd.
Midland Radio & Television Co.
Midland Transformer Co.
M.P.R. Electrical Co.
National Radio Service Co. (N.R.S.), Ltd.
Oldham & Son, Ltd.
Partridge, Wilson & Co., Ltd.
Philips Industrial (Philips Lamps, Ltd.).
Ray Engineering Co., Ltd.
Salisbury Transformer & Elec. Co.
Service Equipment Co., Ltd.
Sound Sales, Ltd.
Tannoy Products.
Trix Electrical Co., Ltd.
Ward & Goldstone, Ltd.

ADAPTORS, VALVE.

Belling & Lee, Ltd.
Bulgin & Co., Ltd., A. F.
Eastick & Sons, J. J.
Elliotts Radio Mfg. Co., Ltd.
Eon Vacuum Wireless Co.
E.M.I. Service, Ltd.
Ferranti, Ltd.
McLeod & McLeod, Ltd.
Mica Mfg. Co., Ltd.
Price & Co. (Manchester), Ltd.
Radio Instruments, Ltd.
Tannoy Products.
Wright & Weairé, Ltd.

P&F. IN STOCK? OF COURSE IT IS! BIRMINGHAM NOTTINGHAM MANCHESTER

PRODUCTS SUPPLIED

AERIALS (frame, indoor and portable).

Aerialite, Ltd.
Altham Radio Co.
Amplion (1932), Ltd.
Birmingham Sound Reproducers, Ltd.
British Blue Spot Co., Ltd.
British Insulated Cables, Ltd.
British Radiophone, Ltd.
British Television Supplies.
Caradio Services, Ltd.
Castagnoli, G.
Castle Fuse & Engineering Co., Ltd.
Chorlmet Radio Elec., Ltd.
Colvern, Ltd.
Concordia Elec. Wire Co., Ltd.
Daly, H. C.
Eastick & Sons, J. J.
Elliotts.
Eon Vacuum Wireless Co.
Franklin Elec. Co., Ltd.
International Majestic Radio Corp., Ltd.
Ivory Electric, Ltd.
Kniveton Cable Works, Ltd.
Leibovici, J.
London Radio Co. (Leeds), Ltd.
National Radio Service Co. (N.R.S.), Ltd.
Price & Co. (M/C), Ltd.
Radio Elec. Products Co.
Radioformer, Ltd.
Reliance Elec. Wire Co.
Richardsons (R.M.L.), Ltd.
R.W. Products, Ltd.
Shearing, A. E.
Stratton & Co., Ltd.
Toubkin, J.
Trent Electric Wire Works, Ltd.
Ward & Goldstone, Ltd.
Watmel Wireless Co., Ltd.
Wright & Weaire, Ltd.

BAKELITE AND SYNTHETIC RESIN (sheet and mouldings).

Attwater & Sons.
Bowyer Lowe & A. E. D., Ltd.
Bromley Langton Elec. Wire & Insulator Co., Ltd.
Campart, C.
Clarke & Co. (M/C), Ltd., C.
Coates, Ltd., J. G.
Cole, Ltd., E. K.
Crystalate Gramophone Record Mfg. Co., Ltd.
De la Rue & Co., Ltd., Thomas.
General Electric Co., Ltd.
General Inductance Co.
General Mouldings Co., Ltd.
Harrison & Co., A. T.
Healey, Ltd.
Kolster Brandes, Ltd.
Lissen, Ltd.
MacEchern & Co., Ltd.
McLeod & McLeod.
Maul & Murphy, Ltd.
Mica Mfg. Co., Ltd.
Micanite & Insulators, Ltd.
Michell, P. C.
Money, Hicks, Ltd.
Moores & Co., J.
Mountford Rubber Co., Ltd.
Philips Lamps, Ltd.
Pooley, G. J.
Ray Engineering Co.
Reliance Mfg. Co. (Southwark), Ltd.
Scott, Geo. L., & Co., Ltd.
Shearing, A. E.
Stadium, Ltd.
Telephone Mfg. Co., Ltd.
Ward & Goldstone, Ltd.
Westinghouse Brake & Signal Co., Ltd.
Whiteley Elec. Radio Co., Ltd.

BATTERIES (dry).

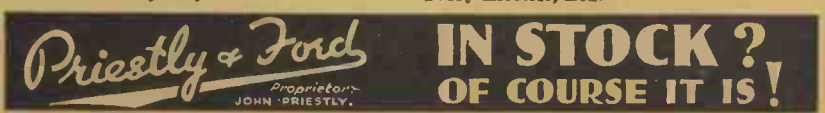
Aerialite, Ltd.
Atlas Carbon & Battery Co., Ltd.
Boynton & Co., Ltd.
Britannia Batteries, Ltd.
British G.W.Z. Battery Co., Ltd.
Burgess Products Co.
Burndept, Ltd.
Chloride Electrical Storage Co., Ltd.
Chorlton Metal Co., Ltd.
Cossor, Ltd., A. C.
Eagle Engineering Co., Ltd.
Efandem Co., Ltd.
Elliotts.
Ever Ready Co. (Great Britain), Ltd.
Fuller Accumulator Co. (1926), Ltd.
General Electric Co., Ltd.
Gilbert & Co., Ltd., C.
Grosvenor Electric Batteries, Ltd.
Kolster Brandes, Ltd.
Lampex Radio & Elec. Co.
Lissen, Ltd.
London Radio Co. (Leeds), Ltd.
Manufacturers Accessories Co. (1928), Ltd.
Metal Agencies, Ltd.
Mile End Radio Co.
Oldham & Son, Ltd.
Price & Co. (M/C), Ltd.
Primus Mfg. Co.
Scott, Geo. L., & Co., Ltd.
Siemens Electric Lamps & Supplies, Ltd.
Three Star Accumulators, Ltd.
Toubkin, J.
Victor Battery Co.
Vulco Dry Battery Co., Ltd.
Ward & Goldstone, Ltd.
Wireless Elec. (Wholesale), Ltd.
Wood, E. A.

BOBBINS (headphone, loudspeaker or transformer).

Amplion (1932), Ltd.
Bromley-Langton Electric Wire & Insulator Co. Ltd.
Chorlmet Radio Elec., Ltd.
Crystalate Gramophone Record Mfg. Co., Ltd.
Custerson, R.
Elvy, C. L.
General Electric Co., Ltd.
General Mouldings Co., Ltd.
Goodmans (Clerkenwell), Ltd.
Ivory Electric, Ltd.
Kingsway Radio, Ltd.
Lechner & Co., Ltd., F. W.
London Transformer Products, Ltd.
McLeod & McLeod.
Mica Mfg. Co., Ltd.
Mile End Radio Co.
Millet, J.
National Radio Service Co. (N.R.S., Ltd.).
Salford Elec. Instruments, Ltd.
Shearing, A. E.
Sound Sales, Ltd.
Tannoy Products.
Telephone Mfg. Co., Ltd.
Trix Electrical Co., Ltd.
Watmel Wireless Co., Ltd.
Whiteley Elec. Radio Co., Ltd.

BRASSWORK.

Allnutt & Co., Thos.
Andrews & Co., A. E.
Belling & Lee, Ltd.
Burne-Jones & Co., Ltd.
Castagnoli, G.
Christie & Sons, Ltd., J.
Cooper & Son (Wolverhampton), Ltd., R.
Eagle Engineering Co., Ltd.
Edmonds, Ltd., G.
Francois, E. J.
Gee (Birmingham), Ltd.
General Electric Co., Ltd.
George Tucker Eyelet Co., Ltd.
Goodmans (Clerkenwell), Ltd.
Green & Co., G.
Harris, G. & R.
Harrison & Co., A. T.
Henderson & Co., Ltd., D. M.
Ivory Electric, Ltd.



Jackson Bros. (London), Ltd.
Lilley & Son, Ltd., S.
London Elec. Co. (Sherborne Lane), Ltd.
McLeod & McLeod, Ltd.
M.P.R. Electrical Co.
Muller & Co. (England), Ltd.
Prideaux, Junr., R.
Radiamp Co., Ltd.
Ross, Courtney & Co., Ltd.
Toubkin, J.
Trix Electrical Co., Ltd.
True Screws, Ltd.
Whiteley Electrical Radio Co., Ltd.
Wilkins & Wright, Ltd.
Williams & Gray, Ltd.
Williams & Moffat, Ltd.
Wright & Weaire, Ltd.

CABINETS (wood).

Ace Radio.
Allied Elec. & Furniture Industries.
Ambassador Radio Gramophones.
Anson & Hopwood, Ltd.
Arvin Electric, Ltd.
Automobile Accessories (Bristol), Ltd.
British East Light, Ltd.
British Rola Co., Ltd.
Browning Wireless Mfrs.
Carrington Mfg. Co.
Castagnoli, G.
City Accumulator Co.
Custerson, R.
Eagle Engineering Co., Ltd.
Elliotts.
Elvy, C. L.
Empiric, Ltd.
Eon Vacuum Wireless Co.
Ferranti, Ltd.
General Electric Co., Ltd.
Hyatt & Co., Ltd., J.
Joseph, H.
Lampex Radio and Elec. Co.
Lathwood, J.
Lissen, Ltd.
Lock, Ltd., W. & T.
London Elec. Co. (Sherborne Lane), Ltd.
Margolin, J. & A.
Northampton Plating Co.
Pohlmann & Son.
Regent Fittings Co.
Reproducers & Amplifiers, Ltd.
Richardsons (R.M.L.), Ltd.
R.A.P., Ltd.;
Scott, Sessions & Co.
Standard Telephones & Cables, Ltd.
Storrar & Balls.
Unit Radio.
Waterhouse, F.
Wood, E. A.

CABINETS (leather and fabric for portables).

Automobile Accessories (Bristol), Ltd.
Eastick & Son, J. J.
Elvy, C.
Eon Vacuum Wireless Co.
Hyatt & Co., Ltd., J.
Lampex Radio & Elec. Co.
London Elec. Co. (Sherborne Lane), Ltd.
Regent Fittings Co.
Storrar & Balls.
Thompson, Diamond & Butcher.

CABINETS (metal).

British East Light, Ltd.
Cooper & Son (Wolverhampton), Ltd., R.
General Electric Co., Ltd.
Gresley Radio, Ltd.
Hounslow & Co., C.
Lampex Radio & Elec. Co.
Regent Fittings Co.
Sound Sales, Ltd.
Stratton & Co., Ltd.
Tannoy Products.
Unit Radio.
Whiteley Elec. Radio Co., Ltd.

CAR RADIO.

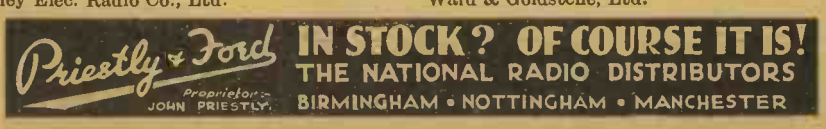
Altham Radio Co.
Arvin Electric, Ltd.
Betterset Radio, Ltd.
British Belmont Radio, Ltd.
Castagnoli, G.
City Accumulator Co.
Cullums, Ltd., J.
Decca Gramophone Co., Ltd.
Electro Dynamic Construction Co., Ltd.
Empiric, Ltd.
Eon Vacuum Wireless Co.
Ferranti, Ltd.
General Electric Co., Ltd.
Halson Radio Co., Ltd.
International Majestic Radio Corp., Ltd.
Kolster-Brandes, Ltd.
Lampex Radio & Elec. Co.
Lissen, Ltd.
London Electrical Co. (Sherborne Lane), Ltd.
Midland Radio & Television Co.
National Radio Service Co. (N.R.S., Ltd.).
Philco, Ltd.
Philips Lamps, Ltd.
Price & Co. (M/C), Ltd.
Radio Mobile, Ltd.
Trix Electrical Co., Ltd.

CAR RADIO AERIALS.

Altham Radio Co.
Arvin Electric, Ltd.
Automobile & Home Radio, Ltd.
Brunswick, Ltd.
Castagnoli, G.
City Accumulator Co.
Cullums, Ltd., J.
E.M.I. Service, Ltd.
Eon Vacuum Wireless Co.
Fox Industrial, Ltd.
Franklin Elec. Co., Ltd.
General Electric Co., Ltd.
Halson Radio Co., Ltd.
International Majestic Radio Corp., Ltd.
Kniveton Cable Works, Ltd.
Kolster-Brandes, Ltd.
Lampex Radio & Elec. Co.
National Radio Service Co. (N.R.S., Ltd.).
Price & Co. (M/C), Ltd.
Radiomobile, Ltd.
Philips Lamps, Ltd.
Radio Development Co.
Radiomobile, Ltd.
Reliance Elec. Wire Co., Ltd.
Remax Cables.
Ripaults, Ltd.
Standard Telephone & Cables.
Toubkin, J.
Trent Elec. Wire Works, Ltd.
Ward & Goldstone, Ltd.
Wood, L. R.

CAR RADIO SUPPRESSION EQUIPMENT.

Arvin Electric, Ltd.
Belling & Lee, Ltd.
British Centralab, Ltd.
British N.S.F. Co., Ltd.
Brunswick, Ltd.
City Accumulator Co.
Cullums, Ltd., J.
Decca Gramophone Co., Ltd.
Dubilier Condenser Co. (1935), Ltd.
Eon Vacuum Wireless Co.
E.M.I. Service, Ltd.
Franklin Elec. Co., Ltd.
General Electric Co., Ltd.
International Majestic Radio Corp., Ltd.
Kolster-Brandes, Ltd.
Lampex Radio & Elec. Co.
Lyons, Ltd., Claude.
Midland Radio & Television Co.
Midland Transformer Co.
National Radio Service Co. (N.R.S. Ltd.).
Radio Resistor Co.
Radiomobile, Ltd.
Tannoy Products.
Toubkin, J.
Ward & Goldstone, Ltd.



PRODUCTS SUPPLIED

CATHODE RAY TUBES.

Cossor, Ltd., A. C.
Edison Swan Electric Co., Ltd.
General Electric Co., Ltd.
Lechner & Co., Ltd., F. W.
Mullard Radio Valve Co., Ltd.
Mullard Wireless Service Co., Ltd.
Octron, Ltd.
Rothermel, Ltd., R. A.
Siemens Elec. Lamps & Supplies, Ltd.
Siemens Schuckert (G. B.), Ltd.
362 Radio Valve Co., 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.
Micanite & Insulators, Ltd.
Moores & Co., J.
Pomona Rubber Co.
Weedon Power Link Radio Co.

CHOKES.

Advance Components, Ltd.
Aerodyne Radio, Ltd.
Altham Radio Co.
Amplion (1932), Ltd.
Anson & Hopwood, Ltd.
Belling & Lee, Ltd.
Benjamin Electric, Ltd.
Berclif, Ltd.
Birmingham Sound Reproducers, Ltd.
British Television Supplies, Ltd.
Bryce & Co., W. Andrew.
Bulgin & Co., Ltd., A. F.
Burne Jones & Co., Ltd.
Castagnoli, G.
Chalkley, C. G.
Chorlmet Radio Elec., Ltd.
Chorlton Metal Co., Ltd.
Clarke & Co. (M/C), Ltd.
Climax Radio Electric, Ltd.
Correx Amplifiers.
Custerson, R.
Dulci Elec. Co., Ltd.
Dyson & Co., Ltd., J.
Eagle Engineering Co., Ltd.
Elliotts.
Ferranti, Ltd.
Film Industries, Ltd.
General Electric Co., Ltd.
Goodmans (Clerkenwell), Ltd.
Graham Farish, Ltd.
Harrison & Co., A. T.
Hartley Turner Radio, Ltd.
Heayberd & Co., F. C.
Igranic Elec. Co., Ltd.
Ivory Electric, Ltd.
Kingsway Radio, Ltd.
Lechner & Co., Ltd., F. W.
Lissen, Ltd.
London Elec. Co. (Sherborne Lane), Ltd.
London Elec. Mfg. Co., Ltd.
Meritus (Barnet), Ltd.
Metal Agencies, Ltd.
Midland Radio & Television Co.
Midland Transformer Co.
Mile End Radio Co.
Multitone Elec. Co., Ltd.
M.P.R. Electrical Co.
National Radio Service Co. (N.R.S., Ltd.).
Partridge & Mee, Ltd.
Partridge, N.
Partridge, Wilson & Co., Ltd.
Radiamp Co., Ltd.
Radio Instruments, Ltd.
Radioformer, Ltd.
Radiovox Wireless Services, Ltd.
Regentone Products, Ltd.
Reproducers & Amplifiers, Ltd.
Savage, W. B.
Shearing, A. E.
Sifam Elec. Instrument Co., Ltd.
Sound Sales, Ltd.
Stratton & Co., Ltd.
Sturdy Elec. Co.
Tannoy Products.
Telsen Elec. Co. (1935), Ltd
Trix Electrical Co., Ltd.
Unit Radio.
Varley.
Ward & Goldstone, Ltd.
Watmel Wireless Co., Ltd.
Weedon Power Link Radio Co.
Whiteley Electrical Radio Co., Ltd.
Wright & Weaire, Ltd.

COIL FORMERS.

Andrews & Co., A. E.
British Television Supplies, Ltd.
Bromley-Langton Electric Wire & Insulator Co., Ltd.
Castagnoli, G.
Clarke, H., & Co. (M/C), Ltd.
Colvern, Ltd.
Eagle Eng. Co., Ltd.
Eastick & Sons, J. J.
Elliotts.
Evington Elec. Mfg. Co.
Ferranti, Ltd.
Formo Products, Ltd.
General Electric Co., Ltd.
General Inductance Co.
General Mouldings Co., Ltd.
Harrison & Co., A. T.
Ivory Electric, Ltd.
Lissen, Ltd.
Mica Mfg. Co., Ltd.
Micanite & Insulators Co., Ltd.
Radiamp Co., Ltd.
Redfern's Rubber Works, Ltd.
Salford Elec. Instruments, Ltd.
Shearing, A. E.
Sound Sales, Ltd.
Steatite & Porcelain Products, Ltd.
Stratton & Co., Ltd.
Trix Electrical Co., Ltd.
Unit Radio,
Ward & Goldstone, Ltd.
Whiteley Electrical Radio Co., Ltd.
Wright & Weaire, Ltd.

COILS (dual range).

Aerodyne Radio, Ltd.
Altham Radio Co.
Amplion (1932), Ltd.
Andrews & Co., A. E.
Anson & Hopwood, 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.
Chalkley, C. G.
Chorlmet Radio Elec., Ltd.
Chorlton Metal Co., Ltd.
Clifford Pressland (Sales), Ltd.
Custerson, R.
Eagle Engineering Co., Ltd.
Eastick & Sons, J. J.
Elliotts.
Eon Vacuum Wireless Co.
Evington Elec. Mfg. Co.
Evrizone Radio Co.
Formo Products, Ltd.
General Electric Co., Lt
Halson Radio Co., Ltd.
Igranic Elec. Co., Ltd.
Ivory Electric, Ltd.
Kingsway Radio, Ltd.
Lissen, Ltd.
London Radio Development Services, Ltd.
London Transformer Products, Ltd.
Northampton Plating Co.

Plessey Co., Ltd.
Pooley, G. J.
Radiamp Co., Ltd.
Radio Instruments, Ltd.
Shearing, A. E.
Sound Sales, Ltd.
Tannoy Products.
Telsen Electric Co. (1935), Ltd.
Varley.
Ward & Goldstone, Ltd.
Whiteley Elec. Radio Co., Ltd.
Wright & Weaire, Ltd.

COILS (iron-cored).

Aerodyne Radio, Ltd.
Altham Radio Co.
British Ferrocart Co., Ltd.
British Radiophone, Ltd.
Burne-Jones & Co., Ltd.
Chorlmet Radio Elec., Ltd.
Chorlton Metal Co., Ltd.
Colvern, Ltd.
Elliott Radio Mfg. Co., Ltd.
Elliotts.
Formo Products, Ltd.
General Electric Co., Ltd.
Ivory Electric, Ltd.
Lechner & Co., Ltd., F. W.
Lissen, Ltd.
Northampton Plating Co.
Plessey Co., Ltd.
Pooley, G. J.
Radio Instruments, Ltd.
Reproducers & Amplifiers, Ltd.
Salford Elec. Instruments, Ltd.
Shearing, A. E.
Siemens Schuckert (G.B.), Ltd.
Sound Sales, Ltd.
Standard Tels. and Cables, Ltd
Tannoy Products.
Telsen Elec. Co. (1935), Ltd.
Varley.
Ward & Goldstone, Ltd.
Whiteley Elec. Radio Co., Ltd.
Wright & Weaire, Ltd.

CONDENSERS (fixed, Mansbridge).

Altham Radio Co.
Amplion (1932), Ltd.
British Television Supplies, Ltd.
Bryce & Co., W. A.
Chorlmet Radio Elec., Ltd.
Chorlton Metal Co., Ltd.
Daly, H. C.
Dubilier Condenser Co. (1925), Ltd.
Elliotts.
Ferranti, Ltd.
Franklin Elec. Co., Ltd.
General Electric Co., Ltd.
Graham Farish, Ltd.
International Majestic Radio Corp., Ltd.
Ivory Electric, Ltd.
Lissen, Ltd.
London Elec. Mfg. Co., Ltd.
Millet, J.
Muirhead & Co., Ltd.
Savage, W. B.
Sound Sales, Ltd.
Standard Telephones & Cables, Ltd.
Supremus Specialities, Ltd.
Telegraph Condenser Co., Ltd.
Telsen Elec. Co. (1935), Ltd.
T.M.C.-Harwell (Sales), Ltd.
Ward & Goldstone, Ltd.
Wego Condenser Co., Ltd.

CONDENSERS (fixed, mica).

Altham Radio Co.
Amplion (1932), Ltd.
British Insulated Cables, Ltd.
British N.S.F. Co., Ltd.
British Television Supplies, Ltd.
Campart, C.
Castagnoli, G.
Chorlton Metal Co., Ltd.
Dubilier Condenser Co. (1925), Ltd.
Ferranti, Ltd.
Franklin Elec. Co., Ltd.
General Electric Co., Ltd.
Graham Farish, Ltd.
Hellesens, Ltd.
International Majestic Radio Corp., Ltd.
Ivory Electric, Ltd.
Lissen, Ltd.
London Elec. Mfg. Co., Ltd.
Millet, J.
Muirhead & Co., Ltd.
Rothermel, Ltd., R. A.
Sullivan, Ltd., H. W.
Taylor & Petters, Ltd.
Telegraph Condenser Co., Ltd.
Trix Electrical Co., Ltd.
Wingrove & Rogers, Ltd.

CONDENSERS (electrolytic).

Altham Radio Co.
British Insulated Cables, Ltd.
British N.S.F. Co., Ltd.
British Radiophone, Ltd.
British Television Supplies, Ltd.
Bryce & Co., W. J.
Chorlton Metal Co., Ltd.
Daly, H. C.
Dubilier Condenser Co. (1925), Ltd.
Ferranti, Ltd.
Franklin Elec. Co., Ltd.
General Electric Co., Ltd.
Halson Radio Co., Ltd.
Hellesens, Ltd.
International Majestic Radio Corp., Ltd.
London Elec. Mfg. Co., Ltd.
Millet, J.
Plessey Co., Ltd.
Rothermel, Ltd., R. A.
Telegraph Condenser Co., Ltd.
Toubkin, J.
Wingrove & Rogers, Ltd.

CONDENSERS (variable).

Aerodyne Radio, Ltd.
Altham Radio Co.
Andrews & Co., A. E.
Bird & Sons, Sidney S.
British Radiophone, Ltd.
British Television Supplies, 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.
General Electric Co., Ltd.
Graham Farish, Ltd.
Ivory Electric, Ltd.
Jackson Bros. (London), Ltd.
Lissen, Ltd.
London Elec. Mfg. Co., Ltd.

FRANKLIN

Reliability plus Economy

Write for Samples & Prices.

FRANKLIN ELECTRIC Co., Ltd.
Gray House, 150, Charing Cross Rd.
London, W.C.2. Temple Bar 5834

CONDENSERS & RESISTANCES

ELECTROLYTIC Condensers (Wet, Dry, Semi-Dry, Midget).
TUBULAR Condensers (Small). For mounting in any position.
VARIABLE CONDENSERS (All Types.)
WIRE-WOUND AND COMPOSITION Resistances. 100% technically efficient.

PRODUCTS SUPPLIED

Lyons, Ltd., Claude.
Muirhead & Co., Ltd.
Plessey Co., Ltd.
Pooley, G. J.
Reliance Mfg. Co. (Southwark), Ltd.
Rothermel, Ltd., R. A.
Shearing, A. E.
Stratton & Co.
Sullivan & Co., H.W.
Telsen Elec. Co. (1935), Ltd.
Trix Electrical Co., Ltd.
Ward & Goldstone, Ltd.
Webb Condenser Co., Ltd.
Wilkins & Wright, Ltd.
Williams & Moffat, Ltd.
Wingrove & Rogers, Ltd.

CORDS

Altham Radio Co.
British Insulated Cables.
Bromley-Langton Elec. Wire & Insulator Co., Ltd.
Bulgin & Co., Ltd., A. F.
Chorlton Metal Co., Ltd.
Concordia Electric Wire Co.
General Electric Co., Ltd.
Halson Radio Co., Ltd.
Hart Bros. Elec. Mfg. Co., Ltd.
Henry Ford Radio, Ltd.
Ivory Elec., Ltd.
Kniveton Cable Works, Ltd.
Lechner & Co., Ltd., F. W.
London Elec. Wire Co. & Smiths, Ltd.
McLeod & McLeod.
Millet, J.
National Radio Service Co. (N.R.S., Ltd.).
Reliance Electric Wire Co.
Remax Cables.
Telsen Elec. Co. (1935), Ltd.
Trent Elec. Wire Works, Ltd.
Trix Electrical Co., Ltd.
Ward & Goldstone, Ltd.

CRYSTAL (quartz oscillating).

Altham Radio Co.
Brookes Measuring Tools.
Chorlton Metal Co., Ltd.
Empiric, Ltd.
Hilger, Ltd., Adam.
Imp Radio Co.
Lyons, Ltd., Claude.
Millet, J.
Pioneer Mfg. Co.
Quartz Crystal Co.
Radio Elec. Products Co.
Radioformer, Ltd.
Toubkin, J.
Universal Services.

DEAF AIDS.

Ardente Acoustic Laboratories.
Automobile Accessories (Bristol), Ltd.
Birmingham Sound Reproducers, Ltd.
Empiric, Ltd.
Goodmans (Clerkenwell), Ltd.
Ivory Electric, Ltd.
Midland Radio & Television Co.
Midland Transformer Co.
Multitone Elec. Co., Ltd.
Ossicaide, Ltd.
Radioformer, Ltd.
Reliance Mfg. Co. (Southwark), Ltd.
Rothermel, Ltd., R. A.
Tannoy Products.
Wilkins & Wright, Ltd.

DIALS.

Aerodyne Radio, Ltd.
Altham Radio Co.
Bird & Sons, Ltd., Sydney S.
British Radiophone Co.
British Television Supplies.
Bulgin & Co., Ltd., A. F.
Burndept, Ltd.
Cellgrave Co.
Celluloid Printers, Ltd.
Chorlton Metal Co., Ltd.
Crystalate Gramophone Record Mfg. Co., Ltd.
Formo Products, Ltd.
General Mouldings Co., Ltd.
Harrison & Co., A. T.
Igranic Elec. Co., Ltd.
Ivory Elec., Ltd.
Jackson Bros. (London), Ltd.
Lechner & Co., Ltd., F. W.
Lissen, Ltd.
Lyons, Ltd., Claude.
McLeod & McLeod.
Mica Mfg. Co., Ltd.
Money Hicks, Ltd.
Muirhead & Co., Ltd.
Plessey Co., Ltd.
Standard Telephones & Cables, Ltd.
Stilwell & Sons.
Telsen Electric (1935), Ltd.
Webb Condenser Co., Ltd.
Williams & Moffat, Ltd.

DIAPHRAGMS (phone and speaker).

Amplion (1932), Ltd.
Bridger & Co., R. O.
General Electric Co., Ltd.
Goodmans (Clerkenwell), Ltd.
Ivory Electric, Ltd.
Lechner & Co., Ltd., F. W.
Mica Mfg. Co., Ltd.
National Radio Service Co. (N.S.R., Ltd.).
Radio Development Co.
Reproducers & Amplifiers, Ltd.
Rothermel, Ltd., R. A.
Sankey & Sons, Ltd., Joseph.

EARTH TUBES (plates, mats and clips).

Aerialite, Ltd.
Altham Radio Co.
British Blue Spot Co., Ltd.
British Insulated Cables, Ltd.
Chorlton Metal Co., Ltd.
Clarke's (Redditch), Ltd.
Climax Radio Electric, Ltd.
Dyson & Co., Ltd., J.
Gee (Birmingham), Ltd.
General Electric Co., Ltd.
Graham Farish, Ltd.
Ivory Electric, Ltd.
Kniveton Cable Works, Ltd.
Laker Co., Ltd., J. & J.
Leibovici, J.
Lilley & Son, Ltd., S.
Linolite, Ltd.
London Electrical Co. (Sherborne Lane), Ltd.
Millet, J.
National Radio Service Co. (N.R.S., Ltd.).
Price & Co. (M/C), Ltd.
Richardson's (R.M.L.), Ltd.
R.W. Products, Ltd.
Toubkin, J.
Trix Electrical Co., Ltd.
Ward & Goldstone, Ltd.
Watmel Wireless Co., Ltd.
Wright & Weaire, Ltd.

EBONITE (panel, sheet, rod and tube).

Altham Radio Co.
Attwater & Sons.
Bromley-Langton Electric Wire & Insulator Co., Ltd.
Chorlton Metal Co., Ltd.
General Electric Co., Ltd.
Harrison & Co., A. T.
Ivory Electric, Ltd.
London Elec. Co. (Sherborne Lane), Ltd.
McLeod & McLeod, Ltd.
Maul & Murphy, Ltd.
Michell, P. C.
Moores & Co., J.
Mountford Rubber Co., Ltd.
Radiamp Co., Ltd.
Redfern's Rubber Works, Ltd.
Siemens Electric Lamps & Supplies, Ltd.
Ward & Goldstone, Ltd.

ENGRAVING.

Anson & Hopwood, Ltd.
Automobile Accessories (Bristol), Ltd.
Belling & Lee, Ltd.
Burne-Jones & Co., Ltd.
Castagnoli, G.
Cellgrave Co.
H.S.P. Wireless Co.
Jeacocks.
Money, Hicks, Ltd.
Radiamp Co., Ltd.
Stebbings, J. R.
Stilwell & Sons.

ENGRAVING MACHINES.

Automobile Accessories (Bristol), Ltd.
Runbaken Products.
Ward & Goldstone, Ltd.

ERINOID AND CASEIN PRODUCTS.

Belling & Lee, Ltd.
Castle Fuse & Engineering Co., Ltd.
Cellgrave Co.
Celluloid Printers, Ltd.
Ferranti, Ltd.
Freed, S. R. F.
Greenman, Ltd., S.
Harrison & Co., A. T.
Healey, Ltd., P.
Lilley & Son, Ltd., S.
McLeod & McLeod, Ltd.
Radiamp Co., Ltd.

FIBRE.

Attwater & Sons.
MacEchern & Co., Ltd.
Micanite & Insulators Co., Ltd.
Moores & Co., J.
Mountford Rubber Co., Ltd.

FUSES.

Advance Components, Ltd.
Altham Radio Co.
Amplion (1932), Ltd.
Belling & Lee, Ltd.
Beswick, Ltd., K. E.
British Loewe Mfg. Co.
Bromley-Langton Electric Wire & Insulator Co., Ltd.
Bryce & Co., W. A.
Bulgin & Co., Ltd.
Chorlton Metal Co., Ltd.
Collett Manufacturing Co., S. H.
Crabtree & Co., Ltd., J. A.
Ferranti, Ltd.
General Electric Co., Ltd.
Imp Radio Co.
Ivory Electric, Ltd.
Lechner & Co., Ltd., F. W.
Lissen, Ltd.
McLeod & McLeod, Ltd.
Microfuses, Ltd.
Millet, J.
Pifco, Ltd.
Reliance Mfg. Co. (Southwark), Ltd.
Sifam Electrical Instrument Co., Ltd.
Sound Sales, Ltd.
Toubkin, J.
Ward & Goldstone, Ltd.

GENERATORS (rotary).

Crypton Equipment, Ltd.
Electro-Dynamic Construction Co., Ltd.
General Electric Co., Ltd.
Higgs Motors, Ltd.
Midland Radio & Television Co.
Midland Transformer Co.
Richardson's (R.M.L.), Ltd.
Rothermel, Ltd., R. A.
Siemens Schuckert (Gt. Britain), Ltd.
Ward & Goldstone, Ltd.

GRAMOPHONES (acoustic).

Baker & Co., Ltd., G. F.
Balcombe, Ltd., A. J.
British Homophone Co., Ltd.
Brunswick, Ltd.
Dallas & Sons, Ltd., J. E.
Decca Gramophone Co., Ltd.
E.M.G. Hand Made Gramophones, Ltd.
Gilbert & Co., Ltd., C.
Gramophone Co., Ltd.
Lugton & Co., Ltd.
Margolin, J. & A.
Regent Fittings Co.
Rose Morris & Co., Ltd.
Ruhl (1922), Ltd., O.
Stockall, Marples & Co., Ltd.
Thompson, Diamond & Butcher.
Wood, E. A.

GRAMOPHONES (electric).

Aerodyne Radio, Ltd.
Anson & Hopwood, Ltd.
Arvin Electric, Ltd.
Baker & Co., Ltd., G. F.
Birmingham Sound Reproducers, Ltd.
British Radiovision Corpn.
Brunswick, Ltd.
Castagnoli, G.
Chalkley, C. G.
Charlton Higgs (Radio), Ltd.
Clarke & Co. (M/C), Ltd., H.
Cosmocord, Ltd.
Dallas & Sons, Ltd., J. E.
Decca Gramophone Co., Ltd.
Eagle Engineering Co., Ltd.
Dulcetto Polyphon, Ltd.
Film Industries, Ltd.
General Electric Co., Ltd.
Gramophone Co., Ltd.
Hartley Turner Radio, Ltd.
London Elec. Co. (Sherborne Lane), Ltd.
Magnaphone Production Co.
Margolin, J. & A.
Midgley Harmer, Ltd.
Midland Radio & Television Co.
Partridge & Mee, Ltd
Radiovox Wireless Services, Ltd.
Regent Fittings Co.
Savage, W. B.
Scott, Sessions & Co., G.
Siemens Schuckert (Gt. Britain), Ltd.
Smurthwaite, Ltd., F. W.
Thompson, Diamond & Butcher.
Trix Electrical Co., Ltd.
Voigt Patents, Ltd.
Wood, L. R.

GRAMOPHONES (portable).

Arvin Electric, Ltd.
Baker & Co., Ltd., G. F.
Balcombe, Ltd., A. J.
British Homophone Co., Ltd.
Brunswick, Ltd.
Dallas & Sons, Ltd., J. E.
Decca Gramophone Co., Ltd.
Gilbert & Co., Ltd., C.
Gramophone Co., Ltd.
Lugton & Co., Ltd.
Margolin, J. & A.
Pohlmann & Son.
Regent Fittings Co.
Richardsons (R.M.L.), Ltd.
Rose, Morris & Co., Ltd.
Ruhl (1922), Ltd., O.
Stockall, Marples & Co., Ltd.
Thompson, Diamond & Butcher.

HEADPHONES.

Altham Radio Co.
Ardente Acoustic Laboratories.
Edison Swan Electric Co., Ltd.
Edmonds, Ltd., G.
Ericsson Telephones, Ltd.
General Electric Co., Ltd.
Ivory Electric, Ltd.
Kolster-Brandes, Ltd.

PRODUCTS SUPPLIED

Millet, J.
Multitone Electric Co., Ltd.
National Radio Service Co. (N.R.S., Ltd.).
Regent Fittings Co.
Rothermel, Ltd., R. A.
Standard Telephones & Cables, Ltd.
Sullivan, Ltd., H. W.
Ward & Goldstone, Ltd.

HETERODYNE FILTERS.

British Radiovision Corpn.
Brown Radio, Ltd., W. F.
Bulgin & Co., Ltd., A. F.
Hartley Turner Radio, Ltd.
London Electrical Co. (Sherborne Lane), Ltd.
London Radio Development Services, Ltd.
Midland Radio & Television Co.
Scott, Sessions & Co., G.
Siemens Schuckert (Gt. Britain), Ltd.
Sound Sales, Ltd.
Universal Services.
Voigt Patents, Ltd.
Ward & Goldstone, Ltd.
Wright & Weaire, Ltd.

HOME RECORDING APPARATUS.

Partridge & Mee, Ltd.
Radiomobile, Ltd.
Siemens Schuckert (Gt. Britain), Ltd.
Trix Electrical Co., Ltd.

HYDROMETERS.

Altham Radio Co.
Chloride Electric Storage Co., Ltd.
Chorlton Metal Co., Ltd.
Collie & Co., J. H.
Cookson & Co.
Crypton Equipment, Ltd.
Eastick & Sons, J. J.
Gordon, Fredk. J.
Ivory Electric, Ltd.
Millet, J.
M.P.R. Electrical Co.
Partridge, Wilson & Co., Ltd.
Service Equipment Co., Ltd.
Stadium, Ltd.
Toubkin, J.
Ward & Goldstone, Ltd.

INSULATING MATERIALS.

Altham Radio Co.
Attwater & Sons.
British Insulated Cables, Ltd.
British Television Supplies, Ltd.
Bromley-Langton Electric Wire & Insulator Co., Ltd.
Callenders Cable & Construction Co., Ltd.
Clarke & Co. (M/C), Ltd., H.
Chorlton Metal Co., Ltd.
Concordia Electric Wire Co., Ltd.
Crystalate Gramophone Record Mfg. Co., Ltd.
De La Rue & Co., Ltd.
Elvy, C. L.
General Electric Co., Ltd.
Harrison & Co., A. T.
Ivory Electric, Ltd.
London Electrical Co. (Sherborne Lane), Ltd.
McLeod & McLeod, Ltd.
Maul & Murphy, Ltd.
Mica Mfg. Co., Ltd.
Micanite & Insulators Co., Ltd.
Michell, P. C.
Moores & Co., J.
Pomona Rubber Co.
Scott & Co., Ltd., G. L.
Siemens Elec. Lamps & Supplies, Ltd.
Steatite & Porcelain Products, Ltd.
Stratton & Co., Ltd.
Taylor & Petters, Ltd.

INTERFERENCE SUPPRESSORS.

Belling & Lee, Ltd.
British N.S.F. Co., Ltd.
Bulgin & Co., Ltd., A. F.
Cooper & Son (Wolverhampton), Ltd., R.
Dubilier Condenser Co. (1925), Ltd.
E.M.I. Service, Ltd.
Erie Resistor, Ltd.
Ferranti, Ltd.
Franklin Electric, Ltd.
General Electric Co., Ltd.
Graham Farish, Ltd.
Kolster-Brandes, Ltd.
London Electrical Co. (Sherborne Lane), Ltd.
London Radio Development Services, Ltd.
Meritus (Barnet), Ltd.
Midland Radio & Television Co.
Midland Transformer Co.
Muirhead & Co., Ltd.
National Radio Service Co. (N.R.S., Ltd.).
Osdur Manufacturing Co.
Radioformer, Ltd.
Radio Resistor Co.
Rich & Bundy, Ltd.
Scott, Sessions & Co., G.
Sifam Electrical Instrument Co., Ltd.
Tannoy Products.
Telegraph Condenser Co., Ltd.
Trix Electrical Co., Ltd.
Ward & Goldstone, Ltd.
Wego Condenser Co., Ltd.
Wingrove & Rogers, Ltd.

KIT SETS.

Andrews & Co., A. E.
British Television Supplies, Ltd.
Bulgin & Co., Ltd., A. F.
Burne-Jones & Co., Ltd.
City Accumulator Co.
Cossor, Ltd., A. C.
Elliott Radio Mfg. Co., Ltd.
Eon Vacuum Wireless Co.
Forbat, Eugen.
Franklin Electric, Ltd.
Graham Farish, Ltd.
Hartley Turner Radio, Ltd.
Jackson Bros. (London), Ltd.
Lissen, Ltd.
London Radio Development Services, Ltd.
Regent Fittings Co.
Scott, Sessions & Co., G.
Stonehouse Radio Supplies.
Stratton & Co., Ltd.
United Radio Mfrs., Ltd.

KNOBS.

Aerodyne Radio, Ltd.
Altham Radio Co.
British Radiophone, Ltd.
Bulgin & Co., Ltd., A. F.
Chorlton Metal Co., Ltd.
Crystalate Gramophone Record Mfg. Co., Ltd.
Empiric, Ltd.
Formo Products, Ltd.
General Electric Co., Ltd.
General Mouldings Co., Ltd.
Graham Farish, Ltd.
Greenman, Ltd., S.
Harrison & Co., A. T.

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Wood, L. R.

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Baty, E. J.
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Garrard Engineering & Manufacturing Co., Ltd.
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Moores & Co., J.
Regent Fittings Co.
Wood, E. A.

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Collaro, Ltd.
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Moores & Co., J.
Regent Fittings Co.
Wood, E. A.

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British Radiovision Corp.
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Castagnoli, G.
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Custerson, R.
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Haynes Radio.
Kolster-Brandes, Ltd.
London Electric Co. (Sherborne Lane), Ltd.
London Radio Development Services, Ltd.
London Transformer Products, Ltd.
Londona, Ltd.
Magnaphone Production Co.
Metal Agencies Co., Ltd.
Midgley Harmer, Ltd.
Midland Radio & Television Co.
Midland Transformer Co.
M.P.R. Elec. Co.
Nuvolion Electrics, Ltd.
Partridge & Mee, Ltd.
Partridge, Wilson & Co., Ltd.
Philips Industrial (Philips Lamps, Ltd.).
Plessey Co., Ltd.
Prism Mfg. Co.
Radio Development Co.
Radioformer, Ltd.
Radiovox Wireless Services, Ltd.
Reproducers & Amplifiers, Ltd.
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Rothermel, Ltd., R. A.
Savage, Ltd., W.B.
Scientific Supply Stores (Wireless), Ltd.
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Sifam Electrical Instrument Co., Ltd.
Smurthwaite, Ltd., F. W.
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T.M.C.-Haswell (Sales), Ltd.
Trix Electrical Co., Ltd.
Truvoice, Ltd.
Universal Gramophone & Radio Co., Ltd.
Volgt Patents, Ltd.
Webber, Ltd., R. A.
362 Radio Valve Co., Ltd.

PUBLIC ADDRESS EQUIPMENT (to hire).

Ardent Acoustic Laboratories.
Automobile Accessories (Bristol), Ltd.
Boynton & Co., Ltd.
Brunswick, Ltd.
Castagnoli, G.
Correx Amplifiers.
Custerson, R.
Edison Swan Elec. Co., Ltd.
Film Industries, Ltd.
General Electric Co., Ltd.
H.S.P. Wireless Co.
Kolster-Brandes, Ltd.
London Elec. Co. (Sherborne Lane), Ltd.
Magnaphone Production Co.
Metal Agencies Co., Ltd.
Metropolitan Radio Service Co.
Midland Radio & Television Co.
Midland Transformer Co.
M.P.R. Elec. Co.
Partridge & Mee, Ltd.
Philips Industrial (Philips Lamps, Ltd.).
Prism Mfg. Co.
Radio Development Co.
Radiovox Wireless Services, Ltd.
Tannoy Products.
Truvoice, Ltd.
Universal Gramophone & Radio Co., Ltd.
362 Radio Valve Co., Ltd.

RADIO-GRAMOPHONES (Spring and Battery-driven).

Aerodyne Radio, Ltd.
Allwave International Radio & Television, Ltd.

TRIX

MICROPHONES and AMPLIFIERS
of definitely superior quality
The TRIX Electrical Company Ltd.,
8/9, Clerkenwell GREEN, London, E.C.1.
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Altham Radio Co.
Arvin Elec., Ltd.
Automobile Accessories (Bristol), Ltd.
Balcombe, Ltd., A. J.
Berclif, Ltd.
Betterset Radio, Ltd.
British Radiophone, Ltd.
Burne Jones & Co., Ltd.
Castagnoli, G.
City Accumulator Co.
Custerson, R.
Elliotts.
E.M.G. Hand-Made Gramophones, Ltd.
Evrizone Radio Co.
Keates & Co. (Radio), Ltd.
London Electrical Co. (Sherborne Lane), Ltd.
London Radio Co. (Leeds), Ltd.
Midland Radio & Television Co.
Milne's Radio Co., Ltd.
Nation Radio Service Co. (N.R.S., Ltd.).
Plessey Co., Ltd.
Price & Co. (M/C), Ltd.
Smurthwaite, Ltd., F. W.
Tannoy Products.
Trix Electrical Co., Ltd.
Truphonic Radio (Putney), Ltd.
Wood, L. R.

RADIO-GRAMOPHONES (A.C.)

Ace Radio.
Aerodyne Radio, Ltd.
Allwave International Radio & Television, Ltd.
Altham Radio Co.
Ambassador Radio Gramophones.
Amplion (1932), Ltd.
Anson & Hopwood, Ltd.
Arvin Elec., Ltd.
Balcombe, A. J.
Berclif, Ltd.
Betterset Radio, Ltd.
Birmingham Sound Reproducers, Ltd.
British Blue Spot Co., Ltd.
British Capehart Corp., Ltd.
British Radiovision Corp.
British Radiophone, Ltd.
Browning Wireless Mfrs.
Brunswick, Ltd.
Burgoyne Wireless (1930), Ltd.
Burndept, Ltd.
Burne Jones & Co., Ltd.
Castagnoli, G.
Chalkley, C. G.
Charlton Higgs (Radio), Ltd.
City Accumulator Co.
Clarke & Co. (M/c), Ltd., W.
Cole, Ltd., E. K.
Cossor, Ltd., A. C.
Custerson, R.
Decca Gramophone Co., Ltd.
Distavox Radio, Ltd.
Eagle Eng. Co., Ltd.
Edge Radio, Ltd.
Eldeco Radio, Ltd.
Elec., Equip. & Carbon Co., Ltd.
Elliotts.
E.M.G. Hand Made Gramophones, Ltd.
Evrizone Radio Co.
Factors (Nottm.), Ltd.
Ferranti, Ltd.
Fourwave, Ltd.
Fox Industrial, Ltd.
General Electric Co., Ltd.
Gramophone Co., Ltd.
Hacker & Sons, H.
Halcyon Radio, Ltd.
Hartley Turner Radio, Ltd.
Haynes Radio.
H.S.P. Wireless Co.
International Majestic Radio Corp., Ltd.
Keates & Co. (Radio), Ltd.
Kenwell Radio, Ltd.
Kolster Brandes, Ltd.
Lampex Radio & Elec. Co.
Lissen, Ltd.
London Electrical Co. (Sherborne Lane), Ltd.
London Radio Co. (Leeds), Ltd.
London Radio Development Services, Ltd.
Marconiphone Co., Ltd.
Midgley Harmer, Ltd.
Midland Radio & Television Co.
Midland Transformer Co.
Milnes Radio Co., Ltd.
Murphy Radio, Ltd.
National Radio Service Co. (N.R.S., Ltd.).
Orr Radio, Ltd.
Philips Lamps, Ltd.
Plessey Co., Ltd.
Pohlmann & Son.
Price & Co. (M/c), Ltd.
Prism Mfg. Co.
Pye Radio, Ltd.
Radio Development Co.
Radio Instruments Ltd.
Radiomobile, Ltd.
Regentone Products, Ltd.
Riley & Son, W.
R. A. P., Ltd.
Scott Sessions & Co., G.
Smurthwaite, Ltd., F. W.
Solectric, Ltd.
Tannoy Products.
Trix Electrical Co., Ltd.
Truphonic Radio (Putney), Ltd.
Ultra Electric, Ltd.

RADIO-GRAMOPHONES (A.C./D.C.).

Ace Radio.
Aerodyne Radio, Ltd.
Altham Radio Co.
Allied Elec. & Furniture Industries.
Ambassador Radio Gramophones.
Arvin Elec., Ltd.
Balcombe, Ltd., A. J.
Berclif, Ltd.
Betterset Radio, Ltd.
British Radiovision Corp.
British Radiophone, Ltd.
Browning Wireless Mfrs.
Brunswick, Ltd.
Burgoyne Wireless (1930), Ltd.
Burndept, Ltd.
Burne-Jones & Co., Ltd.

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PRODUCTS SUPPLIED

Castagnoli, G.
Charlton Higgs (Radio), Ltd.
Clarendon Radio, Ltd.
Custerson, R.
Decca Gramophone Co., Ltd.
Distavox Radio, Ltd.
Evrizone Radio Co.
Factors (Nottm.), Ltd.
Forbat, Eugene.
Fox Industrial, Ltd.
Hacker & Sons, H.
Halcyon Radio Ltd.
H.S.P. Wireless Co.
International Majestic Radio Corp., Ltd.
Kenwell Radio, Ltd.
Kolster Brandes, Ltd.
Lampex Radio & Elec. Co., Ltd.
London Elec. Co. (Sherborne Lane), Ltd.
London Radio Co. (Leeds), Ltd.
London Radio Development Services, Ltd.
Midland Radio & Television Co.
Midland Transformer Co.
Murphy Radio, Ltd.
National Radio Service (N.R.S., Ltd.).
Orr Radio, Ltd.
Plessey Co., Ltd.
Price & Co. (M/c), Ltd.
Radio Development Co.
Radiomobile, Ltd.
Regent Investment Sales, Ltd.
Regentone Products, Ltd.
Riley & Son, W.
R. A. P., Ltd.
Scott Sessions & Co., G.
Smurthwaite, Ltd., F. W.
Tannoy Products.
Truphonic Radio (Putney), Ltd.
Universal High Voltage Radio, Ltd.

RADIO-GRAMOPHONES (D.C.).

Allwave International Radio & Television, Ltd.
Altham Radio Co.
Arvin Elec., Ltd.
Balcombe, Ltd., A. J.
Berclif, Ltd.
Betterset Radio, Ltd.
British Capehart Corp., Ltd.
British Radiophone, Ltd.
Brunswick, Ltd.
Burne-Jones & Co., Ltd.
Castagnoli, G.
Custerson, R.
Decca Gramophone Co., Ltd.
Elec. Equip. & Carbon Co., Ltd.
Evrizone Radio Co.
E.M.G. Hand Made Gramophones, Ltd.
Fox Industrial, Ltd.
Gramophone Co., Ltd.
H.S.P. Wireless Co.
International Majestic Radio Corp., Ltd.
Kenwell Radio, Ltd.
Kolster Brandes, Ltd.
Lampex Radio & Elec. Co.
London Electrical Co. (Sherborne Lane), Ltd.
London Radio Co. (Leeds), Ltd.
Marconiphone Co., Ltd.
Midland Radio & Television Co.
Midland Transformer Co.
Murphy Radio, Ltd.
National Radio Service Co. (N.S.R., Ltd.).
Plessey Co., Ltd.
Price & Co. (M/c), Ltd.
Radio Development Co.
Radio Instruments, Ltd.
Scott Sessions & Co., G.
Smurthwaite, Ltd., F. W.
Tannoy Products.
Trix Electrical Co., Ltd.
Ultra Electric, Ltd.

RADIO-GRAMOPHONES (portable).

Allwave International Radio & Television, Ltd.
Arvin Elec., Ltd.
British Radiophone, Ltd.
Brunswick Ltd.
Castagnoli, G.
Custerson, R.
Decca Gramophone Co., Ltd.
Elliotts.
Gramophone Co., Ltd.
Lampex Radio & Elec. Co., Ltd.
Pohlmann & Son.
Price & Co. (M/c), Ltd.
Scott Sessions & Co., G.
Tannoy Products.
Trix Electrical Co., Ltd.

RECEIVERS (crystal).

Altham Radio Co.
Automobile Accessories (Bristol), Ltd.
Berclif, Ltd.
British Radiophone, Ltd.
Burne-Jones & Co., Ltd.
Castognoli, G.
Chalkley, C. G.
Custerson, R.
Distavox Radio, Ltd.
Elliotts
Ivory Electric, Ltd.
National Radio Service (N.R.S.), Ltd.
Radio Elect. Products Co.
Scott Sessions & Co., G.
Ward & Goldstone, Ltd.
Wood, L. R.

RECEIVERS (chassis).

Ace Radio.
Allwave International Radio & Television, Ltd.
Altham Radio Co.
Ambassador Radio Gramophones.
Amplion (1932), Ltd.
Anson & Hopwood, Ltd.
Arvin Electric, Ltd.
Automobile Accessories (Bristol), Ltd.
Birmingham Sound Reproducers, Ltd.
British Radiophone, Ltd.
Browning Wireless Mfrs.
Brunswick, Ltd.
Burndept, Ltd.
Burne-Jones & Co., Ltd.
Custerson, R.
Decca Gramophone Co., Ltd.
Eagle Engr. Co., Ltd.
Elliotts.
Empiric, Ltd.
Evrizone Radio Co.
Factors (Nottm.), Ltd.
Fox Industrial, Ltd.
Hacker & Sons, H.
Hartley Turner Radio, Ltd.
Haynes Radio.
Hounslow & Co., C.
H.S.P. Wireless Co.
International Majestic Radio Corpn., Ltd.
Ivory Electric, Ltd.
Kolster Brandes, Ltd.
Lampex Radio & Elec. Co., Ltd.
London Electrical Co. (Sherborne Lane), Ltd.
London Radio Co. (Leeds), Ltd.
London Radio Development Services, Ltd.
Mains Radio Mfg. Co.
Midland Radio & Television Co.
Midland Transformer Co.
National Radio Service (N.S.R.), Ltd.
Parsonage, W. F.
Plessey Co., Ltd.
Psychon Radio, Ltd.
Radio Development Co.
R.A.P., Ltd.
Sound Sales, Ltd.
Stratton & Co., Ltd.
Tannoy Products.
Trix Electrical Co., Ltd.
Universal High Voltage Radio, Ltd.
Westminster Chassis Co., Ltd.
Whiteley Electrical & Radio Co., Ltd.

RECEIVERS (all-wave).

Ace Radio.
Acrodyne Radio, Ltd.
Allied Elec. & Furniture Industries.
Allwave International Radio & Television, Ltd.
Altham Radio Co.
Arvin Electric, Ltd.

COLVERN for Coils & Potentiometers

Automobile Accessories (Bristol), Ltd.
Balcombe, Ltd., A. J.
Betterset Radio, Ltd.
British Belmont Radio, Ltd.
British Radiophone, Ltd.
British Radiovision Corpn.
Brunswick, Ltd.
Bulmer, F.
Burndept, Ltd.
Burne-Jones & Co., Ltd.
Castognoli, G.
Charlton Higgs (Radio), Ltd.
Chorlmet Radio Elec., Ltd.
Clarendon Radio, Ltd.
Climax Radio Elec., Ltd.
Cole, Ltd., E. K.
Cullums, Ltd., J.
Custerson, R.
Decca Gramophone Co., Ltd.
Distavox Radio, Ltd.
Edge Radio, Ltd.
Elliotts.
Empiric, Ltd.
Eon Vacuum Wireless Co.
Evrizone Radio Co.
Faraday Allwave Wireless.
Ferranti, Ltd.
Fourwave, Ltd.
Fox Industrial, Ltd.
General Electric Co., Ltd.
Hacker & Sons, H.
H.S.P. Wireless Co.
International Majestic Radio Corpn., Ltd.
Keates & Co. (Radio), Ltd.
Kolster Brandes, Ltd.
Lampex Radio & Elec. Co.
Lissen, Ltd.
London Electrical Co. (Sherborne Lane), Ltd.
London Radio Co. (Leeds), Ltd.
London Radio Development Services, Ltd.
Mains Radio Mfg. Co.
Mervyn Sound & Vision Co., Ltd.
Midland Radio and Television Co.
National Radio Service Co. (N.R.S.), Ltd.
Orr Radio, Ltd.
Pegasus, Ltd.
Philip Lamps, Ltd.
Plessey Co., Ltd.
Pohlmann & Son.
Price & Co. (M/c), Ltd.
Pye Radio, Ltd.
Radio Development Co.
Radiomobile, Ltd.
Regent Investment Sales, Ltd.
Riley & Son, W.
R.A.P., Ltd.
Solectric, Ltd.
Stonehouse Radio Supplies.
Stratton & Co., Ltd.
Tannoy Products.
Telsen Elec. Co. (1935), Ltd.
Truphonic Radio (Putney), Ltd.
Unit Radio.
Universal High Voltage Radio, Ltd.
Univolt Electric, Ltd.

RECEIVERS (battery type).

Ace Radio.
Aerodyne Radio, Ltd.
Allwave International Radio & Television, Ltd.
Altham Radio, Co.
Ambassador Radio Gramophones.
Arvin Electric, Ltd.
Automobile Accessories (Bristol), Ltd.
Balcombe, Ltd., A. J.
Berclif, Ltd.
Betterset Radio, Ltd.
British Blue Spot Co., Ltd.
British Radiovision Corpn.
British Radiophone, Ltd.
Browning. Wireless Mfrs.
Bulmer, F.
Burgoyne Wireless (1930), Ltd.
Burndept, Ltd.
Burne-Jones & Co., Ltd.
Burton, C. F. & H.
Bush Radio, Ltd.
Chalkley, C. G.
Charlton Higgs (Radio), Ltd.
Chorlmet Radio Elec., Ltd.
City Accumulator Co.
Clarke & Co. (M/c), Ltd.
Climax Radio Elec., Ltd.
Cole, Ltd., E. K.
Cossor, Ltd., A. C.
Cullums, Ltd., J.
Custerson, R.
Distavox Radio, Ltd.
Eagle Eng. Co., Ltd.
East Ham Wireless Supplies.
Edge Radio, Ltd.
Elliotts.
Evrizone Radio Co.
Factors (Nottm.), Ltd.
Ferranti, Ltd.
Fox Industrial, Ltd.
General Electric Co., Ltd.
Graham Farish, Ltd.
Halcyon Radio, Ltd.
H.S.P. Wireless Co.
Keates & Co. (Radio), Ltd.
Kolster-Brandes, Ltd.
Lampex Radio & Electric Co.
Lawrence, P. N.
Lissen, Ltd.
London Electrical Co. (Sherborne Lane), Ltd.
London Radio Co. (Leeds), Ltd.
London Radio Development Services, Ltd.
McMichael Radio, Ltd.
Mains Radio Mfg. Co., Ltd.
Marconiphone Co., Ltd.
Midland Radio & Television Co.
Mile End Radio Co.
Milnes Radio Co., Ltd.
Mullard Wireless Service Co., Ltd.
Multitone Elec. Co., Ltd.
Murphy Radio, Ltd.
National Radio Service Co. (N.R.S.), Ltd.
Northampton Plating Co.
Orr Radio, Ltd.
Parsonage, W. F.
Pegasus, Ltd.
Plessey Co., Ltd.
Pohlmann & Son.
Price & Co. (M/c), Ltd.
Pye Radio, Ltd.
Radio Development Co.
Radio Instruments, Ltd.
Radiomobile, Ltd.
Regentone Products, Ltd.
Riley & Son, W.
R.A.P., Ltd.
Smurthwaite, Ltd., W. F.
Stonehouse Radio Supplies.
Stratton & Co.
Truphonic Radio (Putney), Ltd.
Ultra Electric, Ltd.
Unit Radio.
Whiteley Elec. Radio, Co., Ltd.
Wood, E. A.
Wood, L. R.

HYVOLTSTAR UNIVERSAL ALL WAVES, ALL MAINS A.C./D.C. Receivers, Radiograms and Amplifiers. *This Year's Best Seller!*

All models available from stock complete or in chassis form. The revolut onary construction embodying the latest features, assures a ready sale.

Ask for details of our "ON APPROVAL SCHEME."

UNIVERSAL HIGH VOLTAGE RADIO LTD.,
28-29, Southampton St., Strand, W.C.2. *Telephone:* Temple Bar 4985 and 8608.

PRODUCTS SUPPLIED

RECEIVERS (short wave).

Allwave International Radio & Television, Ltd.
Altham Radio Co.
Arvin Electric, Ltd.
Bennett Television, Ltd.
Betterset Radio, Ltd.
British Radiophone, Ltd.
British Radiovision Corpn.
Brunswick, Ltd.
Bulmer, F.
Burndept, Ltd.
Burne-Jones Co., Ltd.
Castagnoli, G.
Chalkley, C. G.
Clarendon Radio, Ltd.
Coastal Radio, Ltd.
Cole, Ltd., E. K.
Cullums, Ltd., J.
Custerson, R.
Decca Gramophone Co., Ltd.
Distavox Radio, Ltd.
Elliotts.
Empiric, Ltd.
Eon Vacuum Wireless Co.
Evrizone Radio Co.
Faraday Allwave Wireless.
Forbat, E.
Fox Industrial, Ltd.
General Electric Co., Ltd.
Hacker & Sons, H.
H. S. P. Wireless Co.
International Majestic Radio Corpn., Ltd.
Keates & Co. (Radio), Ltd.
Kolster Brandes, Ltd.
Lampex Radio & Elec. Co.
Lissen, Ltd.
London Elec. Appliances, Ltd.
London Electrical Co. (Sherborne Lane), Ltd.
London Radio Development Services, Ltd.
Mains Radio Mfg. Co.
Mavox Radio, Ltd.
Mervyn Sound & Vision Co., Ltd.
National Radio Service Co. (N.R.S.), Ltd.
Pegasus, Ltd.
Price & Co. (M/c), Ltd.
Quartz Crystal Co.
Radio Development Co.
Regent Investment Sales, Ltd.
Rothermel, Ltd., R. A.
Scott, Sessions & Co., G.
Smurthwaite, Ltd., F. W.
Stonehouse Radio Supplies.
Stratton & Co., Ltd.
Tannoy Products.
Toubkin, J.
Trix Electrical Co., Ltd.
Unit Radio.

RECEIVERS (A.C.).

Acc Radio.
Aerodyne Radio, Ltd.
Allwave International Radio & Television, Ltd.
Altham Radio Co.
Ambassador Radio Gramophones.
Amplion (1932), Ltd.
Anson & Hopwood, Ltd.
Arvin Elec., Ltd.
Automobile Accessories (Bristol), Ltd.
Balcombe, Ltd., A. J.
Baty, E. J.
Berclif, Ltd.
Betterset Radio, Ltd.
Birmingham Sound Reproducers, Ltd.
British Belmont Radio, Ltd.
British Blue Spot Co., Ltd.
British Radiophone, Ltd.
British Radiovision Corp.
Browning Wireless Mfrs.
Brunswick, Ltd.
Burgoyne Wireless (1930), Ltd.
Burne-Jones & Co., Ltd.
Burton, C. F. & H.
Bush Radio, Ltd.
Castagnoli, G.
Chalkley, C. G.
Charlton Higgs (Radio), Ltd.
Chorlmet Radio Elec., Ltd.
City Accumulator Co.
Clarke & Co. (M/c), Ltd., H.
Climax Radio Electric, Ltd.
Cole, Ltd., E. K.
Cullums, Ltd., J.
Custerson, R.
Decca Gramophone Co., Ltd.
Distavox Radio, Ltd.
Eagle Engineering Co., Ltd.
East Ham Wireless Supplies.
Edge Radio, Ltd.
Elliotts.
E.M.G. Hand-Made Gramophones, Ltd.
Eon Vacuum Wireless Co.
Evrizone Radio Co.
Ferranti, Ltd.
Fox Industrial, Ltd.
General Electric Co., Ltd.
Gramophone Co., Ltd.
Hacker & Sons, H.
Halcyon Radio, Ltd.
Halson Radio Co., Ltd.
Hartley Turner Radio, Ltd.
Haynes Radio
Heayberd & Co., Ltd., F. C.
H.S.P. Wireless Co.
Impex Electrical, Ltd.
Keates & Co. (Radio), Ltd.
Kenwell Radio, Ltd.
Kolster-Brandes, Ltd.
Lampex Radio & Elec. Co.
Lawrence, P. Harold.
Lissen, Ltd.
London Electrical Co. (Sherborne Lane), Ltd.
London Radio Co. (Leeds), Ltd.
London Radio Development Services, Ltd.
McMichael Radio, Ltd.
Mains-Radio Mfg. Co.
Marconiphone Co., Ltd.
Mervyn Sound & Vision Co., Ltd.
Midgley Harmer, Ltd.
Midland Radio & Television Co.
Midland Transformer Co.
Mile End Radio Co.
Milnes Radio Co., Ltd.
Multitone Electric Co., Ltd.
Murphy Radio, Ltd.
National Radio Service Co. (N.R.S., Ltd.).
Orr Radio, Ltd.
Parsonage, W. F.
Pegasus, Ltd.
Philips Lamps, Ltd.
Plessey Co., Ltd.
Pohlmann & Son.
Price & Co. (Manchester), Ltd.
Pye Radio, Ltd.
Radio Development Co.
Radio Instruments, Ltd.
Regentone Products, Ltd.
Riley & Son, W.
R. A. P., Ltd.
Scott, Sessions & Co., G.
Smurthwaite, Ltd., F. W.
Solectric, Ltd.
Stonehouse Radio Supplies.
Stratton & Co., Ltd.
Tannoy Products.
Telsen Elec. Co. (1935), Ltd.
Toubkin, J.
Trix Electrical Co., Ltd.
Truphonic Radio (Putney), Ltd.
Ultra Electric, Ltd.
Unit Radio.
Univolt Elec., Ltd.
Whiteley Electrical & Radio Co., Ltd.

RECEIVERS (D.C.).

Allwave International Radio & Television, Ltd.
Altham Radio Co.
Amplion (1932), Ltd.
Arvin Elec., Ltd.
Balcombe, Ltd., A. J.
Baty, E. J.
Berclif, Ltd.
Betterset Radio, Ltd.
British Radiophone, Ltd.

TRUPHONIC RADIO

Brunswick, Ltd.
Burne, Jones & Co., Ltd.
Burton, C. F. & H.
Castagnoli, G.
Conways Elec., Ltd.
Cullums, Ltd., J.
Custerson, R.
Decca Gramophone Co., Ltd.
Eagle Engineering Co., Ltd.
East Ham Wireless Supplies.
Eon Vacuum Wireless Co.
E.M.G. Hand-Made Gramophones, Ltd.
Fox Industrial, Ltd.
General Electric Co., Ltd.
Gramophone Co., Ltd.
Hacker & Sons, H.
Hartley Turner Radio, Ltd.
H.S.P. Wireless Co.
International Majestic Radio Corporation, Ltd.
Kenwell Radio, Ltd.
Kolster Brandes, Ltd.
Lampex Radio & Electrical Co.
London Electrical Co. (Sherborne Lane), Ltd.
London Radio Co. (Leeds), Ltd.
Mains Radio Mfg. Co.
Mervyn Sound & Vision Co., Ltd.
Midland Radio & Television Co.
Midland Transformer Co.
Murphy Radio, Ltd.
National Radio Service Co. (N.R.S.), Ltd.
Plessey Co., Ltd.
Price & Co. (Manchester), Ltd.
Pye Radio, Ltd.
Radio Development Co.
Radio Instruments, Ltd.
Scott Sessions & Co., G.
Smurthwaite, Ltd., F. W.
Stonehouse Radio Supplies.
Tannoy Products.
Trix Electrical Co., Ltd.
Ultra Electric, Ltd.
Whiteley Electrical & Radio Co., Ltd.

RECEIVERS (A.C./D.C.).

Ace Radio.
Aerodyne Radio, Ltd.
Allied Electrical & Furniture Industries.
Allwave International Radio & Television, Ltd.
Altham Radio Co.
Ambassador Radio Gramophones.
Arvin Electric, Ltd.
Automobile Accessories (Bristol), Ltd.
Automobile & Home Radio, Ltd.
Balcombe, Ltd., A. J.
Baty, E. J.
Bercliff, Ltd.
Betterset Radio, Ltd.
British Belmont Radio, Ltd.
British Blue Spot Co., Ltd.
British Radiophone, Ltd.
British Radiovision Corporation, Ltd.
Browning Wireless Manufacturers.
Brunswick, Ltd.
Burgoyne Wireless (1930), Ltd.
Burndept, Ltd.
Burne-Jones & Co., Ltd.
Castagnoli, G.
Charlton Higgs (Radio), Ltd.
Clarendon Radio, Ltd.
Clarke & Co. (Manchester), Ltd., H.
Climax Radio Elec., Ltd.
Cole, Ltd., E. K.
Cossor, Ltd., A. C.
Cullums, Ltd., J.
Custerson, R.
Decca Gramophone Co., Ltd.
Distavox Radio, Ltd.
Eagle Engineering Co., Ltd.
Eon Vacuum Wireless Co.
Evrizone Radio Co.
Ferranti, Ltd.
Forbat, E.
Fox Industrial, Ltd.
General Electric Co., Ltd.
Hacker & Sons, H.
Halcyon Radio, Ltd.
Halson Radio Co.
H.S.P. Wireless Co.
Impex Electrical Co.
International Majestic Radio Corporation, Ltd.
Kenwell Radio, Ltd.
Kolster Brandes, Ltd.
Lampex Radio & Electrical Co.
Lissen, Ltd.
London Electrical Co. (Sherborne Lane), Ltd.
London Radio Co. (Leeds), Ltd.
London Radio Development Services, Ltd.
McMichael Radio, Ltd.
Mains Radio Manufacturing Co.
Marconiphone Co., Ltd.
Midland Radio & Television Co.
Midland Transformer Co.
Mullard Wireless Service Co., Ltd.
Murphy Radio, Ltd.
National Radio Service Co. (N.R.S.), Ltd.
Orr Radio, Ltd.
Parsonage, W. F.
Pegasus, Ltd.
Philips Lamps, Ltd.
Plessey Co., Ltd.
Price & Co. (Manchester), Ltd
Pye Radio, Ltd.
Radio Development Co.
Radiomobile, Ltd.
Regent Investment Sales, Ltd.
Regentone Products, Ltd.
Riley & Son, Wm.
R.A.P., Ltd.
Scott Sessions & Co., G.
Smurthwaite, Ltd., F. W.
Solectric, Ltd.
Stonehouse Radio Supplies.
Tannoy Products.
Telsen Elec. Co. (1935), Ltd.
Toubkin, J.
Trix Electrical Co., Ltd.
Truphonic Radio (Putney), Ltd.
Ultra Electric, Ltd.
Unit Radio.
Universal High Voltage Radio, Ltd.
Univolt Elec., Ltd.
Whiteley Electrical & Radio Co., Ltd.

RECEIVERS (portable).

Aerodyne Radio, Ltd.
Allwave International Radio & Television, Ltd.
Altham Radio Co.
Arvin Elec., Ltd.
Bedford Elec. & Radio Co., Ltd.
Betterset Radio, Ltd.
Boynton & Co., Ltd.
British Radiophone, Ltd.
Browning Wireless Mfrs.
Brunswick, Ltd.
Bulmer, F.
Burgoyne Wireless (1930), Ltd.
Burndept, Ltd.
Burne-Jones & Co., Ltd.
Castagnoli, G.
Cole, Ltd., E. K.
Custerson, R.
Decca Gramophone Co., Ltd.
Distavox Radio, Ltd.
Eagle Engineering Co., Ltd.
Elliotts.
Empiric, Ltd.
Eon Vacuum Wireless Co.
Gramophone Co., Ltd.
Handisets, Ltd.
Henry Ford Radio, Ltd.
H.S.P. Wireless Co.
International Majestic Radio Corp., Ltd.
Kenwell Radio, Ltd.
Kolster Brandes, Ltd.
Lampex Radio & Elec. Co.
Lissen, Ltd.
London Elec. Appliances, Ltd.
McMichael Radio, Ltd.
Marconiphone Co., Ltd.
National Radio Service Co. (N.R.S., Ltd.).
Pohlmann & Son.
Price & Co. (M/C), Ltd.
Pye Radio, Ltd.
Tannoy Products.
Trix Electrical Co., Ltd.

CATHEDRAL TONED

PRODUCTS SUPPLIED

RECORDS.

British Homophone Co., Ltd.
British Zonophone Co., Ltd.
Brunswick, Ltd.
Crystalate Gramophone Record Mfg. Co., Ltd.
Decca Gramophone Co., Ltd.
E.M.G. Hand-Made Gramophones, Ltd.
Gramophone Co., Ltd.
Levy's Sound Studios, Ltd.
Parlophone Co., Ltd.
Partridge & Mee, Ltd.
Radiovox Wireless Services, Ltd.
Thompson, Diamond & Butcher.

RECORD ALBUMS.

British East Light, Ltd.
British Homophone Co., Ltd.
Brunswick, Ltd.
Decca Gramophone Co., Ltd.
Gramophone Co., Ltd.
Lugton & Co., Ltd.
Regent Fittings Co.
Rose, Morris & Co., Ltd.
Thompson, Diamond & Butcher.
Wood, E. A.

RECORD CARRYING CASES.

British East Light, Ltd.
Brunswick, Ltd.
Dallas & Sons, Ltd., John E.
Decca Gramophone Co., Ltd.
Gramophone Co., Ltd.
Hyatt & Co., Ltd., J.
Lugton & Co., Ltd.
Regent Fittings Co.
Rose Morris & Co., Ltd.
Thompson, Diamond & Butcher.

RECORD CHANGERS.

Anson & Hopwood, Ltd.
British Capehart Corpn., Ltd.
Brunswick, Ltd.
Decca Gramophone Co., Ltd.
Garrard Engineering & Mfg. Co., Ltd.
Regent Fittings Co.
Truphonic Radio (Putney), Ltd.

RECORD FILING CABINETS.

Anson & Hopwood, Ltd.
Balcombe, Ltd., A. J.
British East Light, Ltd.
Brunswick, Ltd.
City Accumulator Co.
Dallas & Sons, Ltd., John E.
Decca Gramophone Co., Ltd.
E.M.G. Hand-Made Gramophones, Ltd.
Hyatt & Co., Ltd., J.
Lock, Ltd., W. & T.
London Elec. Co. (Sherborne Lane), Ltd.
Lugton & Co., Ltd.
Thompson, Diamond & Butcher.
Waterhouse, Ltd., F.

RECTIFIERS (metal).

Clarke & Co. (M/C), Ltd., H.
Lechner & Co., Ltd., F. W.
Lissen, Ltd.
National Radio Service Co. (N.R.S., Ltd.).
Standard Telephones & Cables, Ltd.
Supremus Specialities, Ltd.
Westinghouse Brake & Signal Co., Ltd.

RELAY APPARATUS

Birmingham Sound Reproducers, Ltd.
British Radiovision Corp.
Bulgin & Co., Ltd., A. F.
Bullers, Ltd.
Castagnoli, G.
Coates, Ltd., J. G.
Film Industries, Ltd.
General Electric Co., Ltd.
Goodmans (Clerkenwell), Ltd.
Harrison & Co., A. T.
London Radio Development Services, Ltd.
Midland Transformer Co.
Nuvolion Electric, Ltd.
Partridge & Mee, Ltd.
Philips Industrial (Philips Lamps), Ltd.
Plessey Co., Ltd.
Radio Development Co.
Radioformer, Ltd.
Radiovox Wireless Services, Ltd.
Reproducers & Amplifiers, Ltd.
Rich & Bundy, Ltd.
Savage, Ltd., W. B.
Siemens-Schuckert (Gt. Britain), Ltd.
Sifam Electrical Instrument Co., Ltd.
Smurthwaite, Ltd., F. W.
Standard Telephones & Cables, Ltd.
Tannoy Products.
Trix Electrical Co., Ltd.
Webber, Ltd., R. A.
Whiteley Elec. Radio Co., Ltd.

REMOTE CONTROL UNITS.

Aerodyne Radio, Ltd.
Anson & Hopwood, Ltd.
Bulgin & Co., Ltd., A. F.
Castagnoli, G.
Dubilier Condenser Co. (1925), Ltd.
General Electric Co., Ltd.
Harrison & Co., A. T.
Radioformer, Ltd.
Tannoy Products.

REPAIRS FOR THE TRADE.

Altham Radio Co.
American Radio Repair Service.
Amplion (1932), Ltd.
Automobile Accessories (Bristol), Ltd.
Berclif, Ltd.
British Sampson Products.
Caradio Services, Ltd.
Castagnoli, G.
Custerson, R.
Distavox Service & Television Co.
East Ham Wireless Supplies.
E.M.I. Service, Ltd.
Evrizone Radio Co.
Gee (Birmingham), Ltd.
Graham's Radio.
Henry Ford Radio, Ltd.
H.S.P. Wireless Co.
International Majestic Radio Corp., Ltd.
Lampex Radio & Elec. Co.
London Elec. Co. (Sherborne Lane), Ltd.
London Radio Development Services, Ltd.
Majestic Service Co.
Metal Agencies Co., Ltd.
Metropolitan Radio Service Co.
Midland Radio & Television Co.
Midland Transformer Co.
National Radio Service Co. (N.R.S., Ltd.).
Parsonage, W. F.
Radio Development Co.
Radiomobile, Ltd.

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HENRY FORD RADIO, LTD.
56, Howland St., Tottenham Court Rd., London, W.1.
Telephone: Museum 5675.

REPAIRS
Leading service specialists for American receivers, also British; trade work particularly; estimates free.

Radiovox Wireless Services, Ltd.
Regent Fittings Co.
Robson's Trade Radio Service.
Runbakern Products.
Scott, Sessions & Co., G.
Sturdy Electric Co.
Universal Services.
Weedon Power Link Radio Co.

RESISTANCES (composition).

Amplion (1932), Ltd.
British Centralab, Ltd.
British N.S.F., Co., Ltd.
British Television Supplies, Ltd.
Bryce & Co., W. A.
Bulgin & Co., Ltd., A. F.
Curtis Manufacturing Co., Ltd.
Dubilier Condenser Co. (1925), Ltd.
Erie Resistor, Ltd.
Ferranti, Ltd.
Formo Products, Ltd.
Franklin Elec. Co., Ltd.
General Electric Co., Ltd.
Graham Farish, Ltd.
Harrison & Co., A. T.
International Majestic Radio, Corp., Ltd.
Lechner & Co., F. W.
London Elec. Mfg. Co., Ltd.
Lyons, Ltd., Claude.
McLeod & McLeod, Ltd.
Omic, Ltd.
Radio Resistor Co.
Reliance Mfg. Co. (Southwark), Ltd.
Rotor Elec., Ltd.
Salford Elec. Instruments, Ltd.
Siemens Schuckert (Gt. Britain), Ltd.
Varley.
Watmel Wireless Co., Ltd.
Wingrove & Rogers, Ltd.

RESISTANCES (wire-wound).

Altham Radio Co.
Amplion (1932), Ltd.
British N.S.F. Co., Ltd.
British Radiophone, Ltd.
British Television Supplies, Ltd.
Bryce & Co., W. A.
Bulgin & Co., Ltd., A. F.
Burne-Jones & Co., Ltd.
Calvete, Ltd., I.
Castagnoli, G.
Chorlton Metal Co., Ltd.
Colvern, Ltd.
Concordia Elec. Wire Co., Ltd.
Curtis Mfg. Co., Ltd.
Daly, H. C.
Dubilier Condenser Co. (1925), Ltd.
Erie Resistor Co.
Ferranti, Ltd.
Franklin Elec. Co., Ltd.
General Electric Co., Ltd.
Goodmans (Clerkenwell), Ltd.
Harrison & Co., A. T.
International Majestic Radio Corp., Ltd.
Lechner & Co., F. W.
Lissen, Ltd.
London Elec. Mfg., Co., Ltd.
Lyons, Ltd., Claude.
Midland Radio & Television Co.
Midland Transformer Co.
Partridge & Mee.
Partridge Wilson & Co., Ltd.
Plessey Co., Ltd.
Radio Resistor Co.
Reliance Mfg. Co. (Southwark), Ltd.
Reproducers & Amplifiers, Ltd.
Rotor Elec., Ltd.
Scott & Co., Ltd., A. C.
Siemens-Schuckert (Gt. Britain), Ltd.
Supremus Specialities, Ltd.
Varley.
Walsall Elec. Co., Ltd.
Ward & Goldstone, Ltd.
Watmel Wireless Co., Ltd.
Whiteley Elec. Radio Co., Ltd.
Wingrove & Rogers, Ltd.
Wright & Weaire, Ltd.
Zenith Electric Co., Ltd.

RHEOSTATS.

Bowyer Lowe & A.E.D., Ltd.
British Centralab, Ltd.
British Television Supplies, Ltd.
Bulgin & Co., Ltd., A. F.
Burne-Jones & Co., Ltd.
Castagnoli, G.
Colvern, Ltd.
Eagle Eng. Co., Ltd.
Empiric, Ltd.
Goodmans (Clerkenwell), Ltd.
Harrison & Co., A. T.
Heayberd & Co., F. C.
Ivory Electric, Ltd.
Lechner & Co., F. W.
London Elec. Mfg. Co., Ltd.
Mervyn Sound & Vision Co., Ltd.
Midland Radio & Television Co., Ltd.
Midland Transformer Co.
Millet, J.
Partridge, Wilson & Co.
Plessey Co., Ltd.
Radio Instruments, Ltd.
Ray Engineering Co., Ltd.
Reliance Mfg. Co. (Southwark), Ltd.
Rotor Electric, Ltd.
Salford Elec. Instruments, Ltd.
Sullivan, Ltd., H. W.
Tannoy Products.
Walsall Elec. Co., Ltd.
Ward & Goldstone, Ltd.
Watmel Wireless Co., Ltd.
Wright & Weaire, Ltd.
Zenith Elec. Co., Ltd.

SCRATCH FILTERS.

British Radiovision Corp.
Brown Radio, Ltd., Wm. F.
Bulgin & Co., Ltd., A. F.
Castagnoli, G.
H.S.P. Wireless Co.
Kingsway Radio, Ltd.
London Elec. Co. (Sherborne Lane), Ltd.
London Radio Development Services, Ltd.
Midland Radio & Television Co.
Radiovox Wireless Services, Ltd.
Sound Sales, Ltd.
Tannoy Products.
Trix Electrical Co., Ltd.
Ward & Goldstone, Ltd.

SCREENS.

Andrews & Co., A. E.
Burne-Jones & Co., Ltd.
Colvern, Ltd.
Cooper & Son (Wolverhampton), Ltd., R.
General Electric Co., Ltd.
Ivory Electric, Ltd.
Jackson Bros. (London), Ltd.
Plessey Co., Ltd.
Sankey & Sons, Ltd., J.
Whiteley Elec. Radio Co., Ltd.
Wright & Weaire.

TRUWIND PRODUCTS LTD.
Wire Wound Resistances and Volume Controls
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PRODUCTS SUPPLIED

SERVICE EQUIPMENT.

Aerodyne Radio, Ltd.
Brown Radio, Ltd., Wm., F.
Castagnoli, G.
Cole, Ltd., E. K.
Distavox Service & Television Co.
Elliotts.
E.M.I. Service, Ltd.
Ferranti, Ltd.
Franklin Elec. Co., Ltd.
General Electric Co., Ltd.
London Elec. Co. (Sherborne Lane), Ltd.
Lyons, Ltd., Claude.
Midland Radio & Television Co.
Midland Transformer Co.
Plessey Co., Ltd.
Radio Development Co.
Radiometers, Ltd.
Sifam Elec. Instrument Co., Ltd.
Universal Services.
Weston Elec Instrument Co., Ltd.
Wolf & Co., Ltd., S.

SHORT WAVE ADAPTORS.

Aerodyne Radio, Ltd.
Allwave International Radio & Television, Ltd.
Baty, E. J.
Bennett Television Co.
Betterset Radio, Ltd.
British Radiovision Corp.
British Radiophone, Ltd.
British Television Supplies, Ltd.
Burne-Jones & Co., Ltd.
Castagnoli G.
City Accumulator Co.
Dulci Elec., Co., Ltd.
Eagle Eng. Co.
Eastick & Sons, J. J.
Elliotts.
Eon Vacuum Wireless Co.
Evrizone Radio Co.
Forbat, E.
Fox Industrial, Ltd.
Hacker & Sons, H.
International Majestic Radio Corp., Ltd.
Ivory Elec., Ltd.
Kingsway Radio, Ltd.
Kolster Brandes, Ltd.
London Elec. Co. (Sherborne Lane), Ltd.
London Radio Development Services, Ltd.
Mains Radio Mfg., Co.
Mervyn Sound & Vision Co., Ltd.
National Radio Service Co. (N.R.S., Ltd.).
Radio Instruments, Ltd.
Radio Reconstruction Co.
Stonehouse Radio Supplies.
Stratton & Co., Ltd.
Tannoy Products.
Trix Elec. Co., Ltd.
Unit Radio.
Universal High Voltage Radio, Ltd.
Whiteley Elec. Radio Co., Ltd.

SHORT WAVE COMPONENTS.

Allwave International Radio & Television, Ltd.
Altham Radio Co.
Bennett Television Co.
Bird & Sons, Ltd., Sydney S.
British Radiophone, Ltd.
British Radiovision Co., Corp.
British Television Supplies, Ltd.
Bulgin & Co., Ltd., A. F.
Burne-Jones & Co., Ltd.
Chorlton Metal Co., Ltd.
Eastick & Sons, J. J.
Elliott Radio Mfg. Co.
Empiric, Ltd.
Evington Elec. Mfg. Co.
Evrizone Radio Co.
Ferranti, Ltd.
Formo Products, Ltd.
Ivory Elec., Ltd.
Jackson Bros. (London), Ltd.
Kingsway Radio, Ltd.
Lectro Linx, Ltd.
London Radio Development Services, Ltd.
Mervyn Sound & Vision Co., Ltd.
Pooley, G. J.
Radiamp Co., Ltd.
Radio Development Co.
Radio Instruments, Ltd.
Rothermel, Ltd., R. A.
Scientific Supply Stores (Wireless), Ltd.
Shearing, A. E.
Steatite & Porcelain Products, Ltd.
Stonehouse Radio Supplies.
Stratton & Co., Ltd.
Telsen Electric Co. (1935), Ltd.
Trix Electrical Co., Ltd.
Unit Radio.
Webb Condenser Co., Ltd.
Whiteley Elec. Radio Co., Ltd.
Wingrove & Rogers, Ltd.
Wright & Weaire, Ltd.

SLEEVING (insulating).

Altham Radio Co.
Bromley Langton Elec. Wire & Insulator Co., Ltd.
Chorlton Metal Co., Ltd.
Clarke & Co. (M/c), Ltd., H.
Concordia Elec. Wire Co., Ltd.
Elvy, C. L.
Francois, E. J.
General Elec. Co., Ltd.
Harrison & Co., A. T.
Ivory Elec., Ltd.
Kniveton Cable Works, Ltd.
Leibovici, J.
London Elec. Wire Co., & Smith, Ltd.
McLeod & McLeod.
Mica Mfg. Co., Ltd.
Micanite & Insulators, Ltd.
Millet, J.
Moores & Co., J.
Reliance Elec. Wire Co., Ltd.
Scott & Co., Ltd., G. L.
Steatite & Porcelain Products, Ltd.
Toubkin, J.
Ward & Goldstone, Ltd.
Wright & Weaire, Ltd.

SOLDERING MATERIALS.

British Insulated Cables.
Fluxite, Ltd.
General Elec. Co., Ltd.
Green & Co., G.
Ivory Electric, Ltd.
Lechner & Co., Ltd., F. W.
London Elec. Mfg. Co., Ltd.
Moores & Co., J.
Radio Elec. Products Co.
Standard Telephones & Cables, Ltd.
Ward & Goldstone, Ltd.
Wolf & Co., Ltd., S.

SOUND BOXES.

Balcombe, Ltd., A. J.
British Goldring Products, Ltd.
British Ideal Patents, Ltd.
Brunswick, Ltd.
Decca Gramophone Co., Ltd.
E.M.G. Hand-Made Gramophones, Ltd.
Leibovici, J.
Parlophone Co., Ltd.
Pohlmann & Son.
Regent Fittings Co.
Rose, Morris & Co., Ltd.
Stockall, Marples & Co., Ltd.
Thompson, Diamond & Butcher.
Wendell Mfg. Co.
Wood, E. A.

SPEAKER CONES.

Altham Radio Co.
Amplion (1932), Ltd.
British Rola Co., Ltd.
Clarke & Co. (M/c), Ltd., H.
Custerson, R.
Eagle Eng., Co., Ltd.
Elliott Radio Mfg. Co., Ltd.
Ferranti, Ltd.

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MADE AT THE LARGEST AND BEST EQUIPPED SPEAKER FACTORY IN EUROPE

The history of the Radio Industry is the history of Rola, and Rola supremacy has been maintained down through the years. To-day the 2 London Rola Factories constitute the best equipped Speaker Plants in Europe making Cones, Speech Coil Assemblies, Cone Housings, Field Housings, Front Plates, and all parts of Moving Coil Speakers. **ENQUIRIES ARE SOLICITED FROM SPEAKER MANUFACTURERS AND OTHERS FOR ANY OF THESE PARTS.**

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F720—P.M.T. (9¾" Diameter) - - - 35/-

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9¾" WIDE RANGE RESPONSE MODELS GIVING VASTLY BETTER PERFORMANCE.

F720—P.M.M. (For all receivers with Low Impedance Extension Terminals), 27/6
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Above models supplied in magnificent Mahogany, Lacquered Oak, or Burr Walnut Cabinet at an additional cost of 27/6.

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F5 (6½" Diameter) - - - - - 25/-
F6 (8" Diameter) - - - - - 30/-
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Supplied in the following resistances:—8 ohm field (6-8v. D.C.); 2,000 ohm field (110-130v. D.C.); 2,500 ohm field (110-140v. D.C.); 6,500 ohm field (200-240v. D.C.); 7,500 ohm field (250v. D.C.).

G.12. (A 12" High Fidelity Speaker of great Power-Handling Capacity).

D.C. MODEL - - - - £5 . 10

Supplied in the following resistances:—750 ohm field (105v. 140 M/A.); 1,000 ohm field (122v. 122 M/A.); 1,250 ohm field (137v. 109 M/A.); 1,500 ohm field (150v. 100 M/A.); 2,000 ohm field (172v. 86 M/A.); 2,500 ohm field (191v. 77 M/A.); 6,500 ohm field (310v. 48 M/A.). These figures apply to Field Dissipation of 15 watts.

A.C. MODEL - - - - £7 . 15

(200/250v. 50/60 cycles. Equipped with standard rectifier valve.)

ROLA CLASS 'B' SPEAKER AMPLIFIER UNITS

Model A: For Mullard PM2B and PM2BA, Cossor 220B, B.T.H. PD220 and PD220A, Standard 13B1, Hivac B220, Marconi B21, G.E.C. B21, Clarion B22 (without valve) **40/-**

Model B: For Cossor 240B, Ferranti HP2, Clarion B24 (without valve) **40/-**

ROLA DUAL BALANCED PAIRS

Type A	2	F.5	Field Excited - - - -	£2 . 2 . 6
Type B	2	F.514	Permanent Magnet - -	£2 . 0 . 0
Type C	2	F.6	Field Excited - - - -	£2 . 12 . 6
Type D	1	F.6	Field Excited and	
	1	F.7	Field Excited - - - -	£3 . 2 . 6
Type E	2	F.620	Permanent Magnet - -	£2 . 17 . 6
Type F	1	F.620	Permanent Magnet and	
	1	F.720	Permanent Magnet - -	£3 . 0 . 0
Type G	1	F.6	Field Excited and	
	1	F.720	Permanent Magnet - -	£2 . 17 . 6

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THE BRITISH ROLA CO., LTD.

Minerva Road, Park Royal, N.W.10.

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PRODUCTS SUPPLIED

General Electric Co., Ltd.
Gilbert & Co., Ltd., C.
Goodmans (Clerkenwell), Ltd.
Ivory Elec., Ltd.
Lissen, Ltd.
National Radio Service Co. (N.R.S., Ltd.).
Radio Development Co.
Reproducers & Amplifiers, Ltd.
Rothermel, Ltd., R. A.
Weedon Power Link Radio Co.
Whiteley Elec. Radio Co., Ltd.

SPEAKER UNITS.

Altham Radio Co.
Amplion (1932), Ltd.
British Radiophone, Ltd.
British Rola Co., Ltd.
Celestion, Ltd.
Chorlton Metal Co., Ltd.
Custerson, R.
Eagle Engineering Co., Ltd.
East Ham Wireless Supplies.
Edison Swan Elec. Co., Ltd.
Elliott Radio Mfg. Co., Ltd.
Ferranti, Ltd.
General Electric Co., Ltd.
Goodmans (Clerkenwell), Ltd.
Ivory Electric, Ltd.
Kolster Brandes, Ltd.
Lissen, Ltd.
London Radio Co. (Leeds), Ltd.
National Radio Service Co. (N.R.S., Ltd.).
Radio Development Co.
Sound Sales, Ltd.
Tannoy Products.
Thompson, Diamond & Butcher.
Toubkin, J.
Voigt Patents, Ltd.
Waterhouse, Ltd.
Whiteley Elec. Radio Co., Ltd.

SPEAKERS (cone type).

Altham Radio Co.
Amplion (1932), Ltd.
British Radiophone, Ltd.
Bryce & Co., W. A.
Custerson, R.
Eagle Engineering Co., Ltd.
Elliott Radio Mfg. Co., Ltd.
Film Industries, Ltd.
Goodmans (Clerkenwell), Ltd.
Ivory Electric, Ltd.
Kolster Brandes, Ltd.
Lissen, Ltd.
Marks & Son, S.
National Radio Service Co. (N.R.S., Ltd.).
Plessey Co., Ltd.
Radio Development Co.
Reproducers & Amplifiers, Ltd.
Tannoy Products.
Thompson, Diamond & Butcher.
Whiteley Elec. Radio Co., Ltd.
Wood, E. A.

SPEAKERS (extension types in cabinets).

Aerodyne Radio, Ltd.
Ambassador Radio Gramophones.
Amplion (1932), Ltd.
Baker's Selhurst Radio, Ltd.
British Blue Spot Co., Ltd.
British Radiophone, Ltd.
British Rola Co., Ltd.
Castagnoli, G.
Celestion, Ltd.
Charlton Higgs (Radio), Ltd.
Correx Amplifiers.
Custerson, R.
Dent & Co., and Johnson, Ltd.
Distavox Radio, Ltd.
Elliotts.
Ferranti, Ltd.
Film Industries, Ltd.
General Electric Co., Ltd.
Goodmans (Clerkenwell), Ltd.
Hartley Turner Radio, Ltd.
Kingsway Radio, Ltd.
Kolster Brandes, Ltd.
Lissen, Ltd.
London Elec. Co. (Sherborne Lane), Ltd.
London Radio Development Services, Ltd.
Midland Radio & Television Co.
Milnes Radio Co., Ltd.
National Radio Service Co. (N.R.S., Ltd.).
Philips Industrial (Philips Lamps, Ltd.).
Plessey Co., Ltd.
Prism Mfg. Co.
Pye Radio, Ltd.
Radio Development Co.
Radiovox Wireless Services, Ltd.
Reproducers & Amplifiers, Ltd.
Thompson, Diamond & Butcher.
Waterhouse, Ltd., F.
Wharfedale Wireless Works.
Whiteley Elec. Radio Co., Ltd.

SPEAKERS (gauze for).

Altham Radio Co.
Chorlton Metal Co., Ltd.
Ivory Elec., Ltd.
Leibovici, J.
Pioneer Mfg. Co.
Regent Fittings Co.
Richardsons (R.M.L.), Ltd.
Telsen Elec. Co. (1935), Ltd.
Toubkin, J.

SPEAKERS, MOVING COIL TYPE (ENERGISED).

Amplion (1932), Ltd.
Baker's Selhurst Radio.
Benjamin Electric, Ltd.
Boynton & Co., Ltd.
British Radiophone, Ltd.
British Radiovision Corp.
British Rola Co., Ltd.
Bryce & Co., W. A.
Castagnoli, G.
Celestion, Ltd.
Chorlmet Radio Elec., Ltd.
Chorlton Metal Co., Ltd.
Clarke & Co. (M/C), Ltd., H.
Custerson, R.
East Ham Wireless Supplies.
Edison Swan Electric Co., Ltd.
Elliott Radio Mfg. Co., Ltd.
Elliotts.
Ferranti, Ltd.
General Electric Co., Ltd.
Goodmans (Clerkenwell), Ltd.
Hartley Turner Radio, Ltd.
Haynes Radio.
International Majestic Radio Corp., Ltd.
Kolster Brandes, Ltd.
Lissen, Ltd.
London Radio Co. (Leeds), Ltd.
London Radio Development Services, Ltd.
Midgely Harmer, Ltd.
Midland Transformer Co.
Milne's Radio Co., Ltd.
National Radio Service Co. (N.R.S., Ltd.).
Nuvolion Electrics, Ltd.
Plessey Co., Ltd.
Price & Co. (M/C), Ltd.
Radio Development Co.
Reproducers & Amplifiers, Ltd.
Rothermel, Ltd., R. A.
Siemens-Schuckert (Gt. Britain), Ltd.
Sound Sales, Ltd.
Tannoy Products.
Telsen Elec. (1935), Ltd.
Thompson, Diamond & Butcher.
Toubkin, J.
Ultra Electric, Ltd.
Universal Gramophone & Radio Co., Ltd.
Voigt Patents, Ltd.
Waterhouse, Ltd., F.

TRUPHONIC RADIO

Wharfedale Wireless Works.
Whiteley Electrical Radio Co., Ltd.
Wood, E. A.

SPEAKERS (P.A.).

Ardente Acoustic Laboratories.
Baker's Selhurst Radio, Ltd.
Birmingham Sound Reproducers, Ltd.
Boynton & Co., Ltd.
British Rola Co., Ltd.
Castagnoli, G.
Celestion, Ltd.
Chorlmet Radio Elec., Ltd.
Correx Amplifiers.
Custerson, R.
Ferranti, Ltd.
Film Industries, Ltd.
General Electric Co., Ltd.
Goodmans (Clerkenwell), Ltd.
Hacker & Sons, H.
Hartley Turner Radio, Ltd.
Kolster Brandes, Ltd.
London Radio Development Services, Ltd.
Magnaphone Production Co.
Metal Agencies Co., Ltd.
Midland Transformer Co.
Milne's Radio Co., Ltd.
Partridge & Mee, Ltd.
Philips Industrial (Philips Lamps, Ltd.).
Plessey Co., Ltd.
Price & Co. (M/C), Ltd.
Prism Mfg. Co.
Radio Development Co.
Radioformer, Ltd.
Radiovox Wireless Services, Ltd.
Reproducers & Amplifiers, Ltd.
Savage, Ltd., W. B.
Scientific Supply Stores (Wireless), Ltd.
Siemens-Schuckert (G.B.), Ltd.
Sound Sales, Ltd.
Tannoy Products.
Telsen Elec. Co. (1935), Ltd.
Universal Gramophone & Radio Co., Ltd.
Voigt Patents.
Waterhouse, Ltd., F.
Webber, Ltd., R. A.
Wharfedale Wireless Co.
Whiteley Elec. Radio Co., Ltd.

SPEAKERS, MOVING COIL TYPE, PERMANENT MAGNET.

Altham Radio Co.
Amplion (1932), Ltd.
Baker's Selhurst Radio.
Benjamin Elec., Ltd.
Boynton & Co., Ltd.
British Blue Spot Co., Ltd.
British Loewe Mfrs., Ltd.
British Radiophone, Ltd.
British Radiovision Corp.
British Rola Co., Ltd.
Bryce & Co., W. A.
Castagnoli, G.
Celestion, Ltd.
Chorlmet Radio Elec., Ltd.
Chorlton Metal Co., Ltd.
Clarke & Co. (M/C), Ltd., H.
Dent & Co., and Johnson, Ltd.
Eagle Engineering Co., Ltd.
Edison Swan Electric Co., Ltd.
Elliott Radio Mfg. Co., Ltd.
Elliotts.
Ferranti, Ltd.
Film Industries, Ltd.
General Electric Co., Ltd.
Goodmans (Clerkenwell), Ltd.
Gramophone Co., Ltd.
Halson Radio Co., Ltd.
Hartley Turner Radio, Ltd.
International Majestic Radio Corp., Ltd.
Kingsway Radio, Ltd.
Kolster Brandes, Ltd.
Lissen, Ltd.
Londona, Ltd.
London Radio Co. (Leeds), Ltd.
London Radio Development Services, Ltd.
Midgley Harmer, Ltd.
Milnes Radio Co., Ltd.
National Radio Service Co. (N.R.S., Ltd.).
Nuvolion Electrics, Ltd.
Partridge & Mee, Ltd.
Plessey Co., Ltd.
Price & Co. (M/C), Ltd.
Radio Development Co.
Radioformer, Ltd.
Reproducers & Amplifiers, Ltd.
Rothermel, R. A., Ltd.
Siemens-Schuckert (Gt. Britain), Ltd.
Sound Sales, Ltd.
Tannoy Products.
Telsen Elec. Co. (1935), Ltd.
Thompson, Diamond & Butcher.
Toubkin, J.
Ultra Electric, Ltd.
Universal Gramophone & Radio Co., Ltd.
Voigt Patents, Ltd.
Waterhouse, Ltd., F.
Wharfedale Wireless Works.
Whiteley Electrical Radio Co., Ltd.

SPEED TESTERS.

Gramophone Co., Ltd.

SPRINGS (Motor).

Clarkes (Redditch), Ltd.
Garrard Engineering & Manufacturing Co., Ltd.
Gilbert & Co., Ltd., C.
Ivory Elec., Ltd.
Leibovici, J.
Regent Fittings Co.
Richardsons (R.M.L.), Ltd.
Terry & Sons, Ltd., H.
Wood, E. A.

STOPS (automatic).

Aladdin Gramophone & Accessories Co.
Collaro, Ltd.
Garrard Engineering & Manufacturing Co., Ltd.
General Electric Co., Ltd.
Regent Fittings Co.

SWITCHES.

Aerodyne Radio, Ltd.
Altham Radio Co.
Andrews & Co., A. E.
British Radiophone, Ltd.
British Television Supplies, Ltd.
Bryce, W. A., & Co.
Bulgin & Co., Ltd., A. F.
Burne-Jones & Co., Ltd.
Busby & Co., Ltd.
Castagnoli, G.
Chalkley, C. G.
Chorlton Metal Co., Ltd.
Christie & Sons, Ltd., Jas.
Colvern, Ltd.
Crabtree & Co., Ltd., J. A.
Custerson, R.
Eagle Engineering Co., Ltd.
Edmonds, Ltd., G.
Eastick & Sons, J. J.
Francois, E. J.
General Electric Co., Ltd.
Goodmans (Clerkenwell), Ltd.
Graham Farish, Ltd.
Harrison & Co., A. T.
H.S.P. Wireless Co.
Ivory Electric, Ltd.
Joseph, H.
Lechner & Co., Ltd., F. W.
Lilley & Son, Ltd., S.
Lundberg & Sons, Ltd., A. P
Lyons, Ltd., Claude.
McLeod & McLeod, Ltd.
Maul & Murphy, Ltd.
Millet, J.
Milnes Radio Co., Ltd.
Person & Son, L.
Pioneer Mfg. Co.
Plessey Co., Ltd.

CATHEDRAL TONED

PRODUCTS SUPPLIED

Radiamp Co., Ltd.
Rothermel, Ltd., R. A.
Shearing, A. E.
Siemens-Schuckert (Gt. Britain), Ltd.
Stadium, Ltd.
Standard Telephones & Cables, Ltd.
Telephone Mfg. Co., Ltd.
Telsen Elec. Co. (1935), Ltd.
Toubkin, J.
Trix Electrical Co., Ltd.
T.M.C.-Harwell (Sales), Ltd.
Ward & Goldstone, Ltd.
Whiteley Electrical Radio Co., Ltd.
Wilkins & Wright, Ltd.
Wright & Weaire, Ltd.

TAPE (insulating).

Altham Radio Co.
Attwater & Sons.
British Insulated Cables, Ltd.
Bromley-Langton Elec. Wire & Insulator Co.,Ltd.
Callenders Cable & Construction Co., Ltd.
Chorlton Metal Co., Ltd.
Clarke & Co. (M/C), Ltd., H.
Concordia Electric Wire Co., Ltd.
Connollys (Blackley), Ltd.
General Electric Co., Ltd.
Hellesens, Ltd.
Ivory Electric, Ltd.
Kniveton Cable Works, Ltd.
Leibovici, J.
McLeod & McLeod, Ltd.
Mica Mfg. Co., Ltd.
Micanite & Insulators Co., Ltd.
Millet, J.
Moores & Co., J.
Pomona Rubber Co.
Price & Co. (M/C), Ltd.
Remax, Ltd.
Ripaults, Ltd.
Siemens Electric Lamps & Supplies, Ltd.
Toubkin, J.
Ward & Goldstone, Ltd.
Wood, E. A.

TELEVISION APPARATUS.

Allwave International Radio & Television, Ltd.
Baird Television, Ltd.
Bennett Television Co.
Betterset Radio, Ltd.
British Radiovision Corpn.
British Television Supplies, Ltd.
Bryce & Co., W. A.
Burne-Jones & Co., Ltd.
Castagnoli, G.
Distavox Service & Television Co.
Dubilier Condenser Co. (1925), Ltd.
Edison Swan Electric Co., Ltd.
Elliott Radio Mfg. Co., Ltd.
Elliotts.
Fox Industrial, Ltd.
Haynes Radio.
Igranic Electric Co., Ltd.
Ivory Electric, Ltd.
Kingsway Radio, Ltd.
Lampex Radio & Electric Co.
London Electrical Co. (Sherborne Lane), Ltd.
London Radio Development Services, Ltd.
London Transformer Products, Ltd.
McLeod & McLeod, Ltd.
Mains Radio Mfg. Co.
Mervyn Sound & Vision Co., Ltd.
Midland Radio & Television Co.
Midland Transformer Co.
National Radio Service Co. (N.R.S.), Ltd.
Radiamp Co., Ltd.
Scott-Sessions & Co., G.
Sound Sales, Ltd.
Stratton & Co., Ltd.
Wego Condenser Co., Ltd.
Whiteley Electrical Radio Co., Ltd.
Wolsey Television, Ltd.

TELEVISION RECEIVERS.

Bennett Television Co.
Betterset Radio, Ltd.
British Radiovision Corpn.
British Television Supplies, Ltd.
Bulmer, F.
Castagnoli, G.
Cossor, Ltd., A. C.
Custerson, R.
Distavox Service & Television Co.
Elliott Radio Mfg. Co., Ltd.
Elliotts.
Fox Industrial, Ltd.
Haynes Radio.
Lampex Radio & Electric Co.
London Electrical Co. (Sherborne Lane), Ltd.
London Radio Development Services, Ltd.
Mains Radio Mfg. Co.
Mervyn Sound & Vision Co., Ltd.
Midland Radio & Television Co.
Midland Transformer Co.
National Radio Service Co. (N.R.S.), Ltd.
Scott-Sessions & Co., G.
Universal Services.
Wolsey Television, Ltd.

TERMINALS, CONNECTORS AND TAGS.

Andrews & Co., A. E.
Belling & Lee, Ltd.
Bulgin & Co., Ltd., A. F.
Busby & Co., Ltd.
Castle Fuse & Engineering Co., Ltd.
Chorlton Metal Co.
Clarkes (Redditch), Ltd.
Collett Mfg. Co., S. H.
Colvern, Ltd.
Crystalate Gramophone Record Mfg. Co., Ltd.
Eastick & Sons, J. J.
Edmonds, Ltd., G.
Francois, E. J.
Gee (Birmingham), Ltd.
General Electric Co., Ltd.
George Tucker Eyelet Co., Ltd.
Grafton Electric Co.
Graham Farish, Ltd.
Ivory Electric, Ltd.
Jackson Bros. (London), Ltd.
Kniveton Cable Works, Ltd.
Lectro Linx, Ltd.
Leibovici, J.
Lilley & Son, Ltd., S.
Lissen, Ltd.
McLeod & McLeod, Ltd.
Mica Mfg. Co., Ltd.
Partridge Wilson & Co., Ltd.
Prideaux, Junr., R.
Radiamp Co., Ltd.
Remax, Ltd.
Ripaults, Ltd.
Ross, Courtney & Co., Ltd.
Telsen Electric Co. (1935), Ltd.
Trix Electrical Co., Ltd.
True Screws, Ltd.
Ward & Goldstone, Ltd.
Whiteley Electrical Radio Co., Ltd.

TIME SWITCHES.

Everett, Edgcumbe & Co., Ltd.
General Electric Co., Ltd.
Harrison & Co., A. T.
Millet, J.
Radioformer, Ltd.
Runbaken Products.
Siemens Electric Lamps & Supplies, Ltd.

TONE ARMS.

British Ideal Patents, Ltd.
Chorlmet Radio Elec. Ltd.
Gilbert & Co., Ltd., C.
Ivory Electric, Ltd.
Kolster-Brandes, Ltd.
Liebovici, J.
Regent Fittings, Co.

COLVERN for Coils & Potentiometers

Tannoy Products.
Telsen Electric Co. (1935). Ltd.
Wood, E. A.

TONE COMPENSATORS.

British Centralab, Ltd.
British Radiovision Corp.
Castagnoli, G.
London Radio Development Services, Ltd.
Midland Radio & Television Co.
Radiovox Wireless Services, Ltd.
Reproducers & Amplifiers, Ltd.
Sound Sales, Ltd.
Tannoy Products.
Whiteley Electrical Radio Co., Ltd.

TONE CONTROLS.

Bowyer-Lowe & A. E. D., Ltd.
British Centralab, Ltd.
British Loewe Mfrs., Ltd.
British N.S.F. Co., Ltd.
Bulgin & Co., Ltd., A. F.
Castagnoli, G.
Ferranti, Ltd.
General Electric Co., Ltd.
Igranic Electric Co., Ltd.
Ivory Electric, Ltd.
Lyons, Ltd., Claude.
Multitone Electric Co., Ltd.
Plessey Co., Ltd.
Radiovox Wireless Services, Ltd.
Reliance Mfg. Co. (Southwark), Ltd.
Reproducers & Amplifiers, Ltd.
Rotor Electric, Ltd.
Sound Sales, Ltd.
Standard Tels. & Cables, Ltd.
Tannoy Products.
Trix Electrical Co., Ltd.
Ward & Goldstone, Ltd.
Watmel Wireless Co., Ltd.
Whiteley Electrical Radio Co., Ltd.
Wingrove & Rogers, Ltd.
Wright & Weaire, Ltd.

TOOLS (Insulated).

General Electric Co., Ltd.
Gordon & Co., Ltd., F. J.

TRANSFERS.

Eagle Transfer, Ltd.
McLeod & McLeod, Ltd.

TRANSFORMERS L.F.

Aerodyne Radio, Ltd.
Altham Radio Co.
Amplion (1932), Ltd.
Anson & Hopwood, Ltd.
Benjamin Electric, Ltd.
Berclif, Ltd.
Birmingham Sound Reproducers, Ltd.
Boynton & Co., Ltd.
British Radiophone, Ltd.
British Television Supplies, Ltd.
Bryce & Co., W. A.
Bulgin & Co., Ltd., A. F.
Castagnoli, G.
Chorlmet Radio Elec. Ltd.
Chorlton Metal Co., Ltd.
Clarke & Co. (M/c), Ltd., H.
Climax Radio Electric, Ltd.
Concerton Radio & Electrical Co., Ltd.

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Correx Amplifiers.
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Daly, H. C.
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Elliotts.
Ferranti, Ltd.
Film Industries, Ltd.
General Electric Co., Ltd.
Goodmans (Clerkenwell), Ltd.
Graham Farish, Ltd.
Hartley Turner Radio, Ltd.
Heayberd & Co., F. C.
Henry Ford Radio, Ltd.
Igranic Electric Co., Ltd.
Ivory Electric, Ltd.
Kingsway Radio, Ltd.
Lechner & Co., F. W.
Lissen, Ltd.
London Electrical Mfg. Co.
London Radio Co. (Leeds), Ltd.
London Transformer Products, Ltd.
Midland Radio & Television Co.
Midland Transformer Co.
Mile End Radio Co.
Multitone Electric Co., Ltd.
M.P.R. Electrical Co.
National Radio Service Co. (N.R.S., Ltd.).
Northampton Plating Co.
Partridge & Mee, Ltd.
Partridge, N.
Plessey Co., Ltd.
Radio Development Co.
Radio Instruments, Ltd.
Regentone Products, Ltd.
Reproducers & Amplifiers, Ltd.
Savage, W. B.
Shearing, A. E.
Sound Sales, Ltd.
Standard Telephones & Cables, Ltd.
Stratton & Co., Ltd.
Tannoy Products.
Telephone Mfg. Co., Ltd.
Trix Electrical Co., Ltd.
T.M.C. Harwell Sales, Ltd.
Varley.
Weedon Power Link Radio Co.
Whiteley Elec. Radio Co., Ltd.

TRANSFORMERS (mains).

Aerodyne Radio, Ltd.
Anson & Hopwood, Ltd.
Automobile Accessories (Bristol), Ltd.
Berclif, Ltd.
Birmingham Sound Reproducers, Ltd.
British Radiophone, Ltd.
British Rectifiers Eng. Co.
British Television Supplies, Ltd.
Bryce & Co., W. A.
Campart, C.
Castagnoli, G.
Chorlmet Radio Elec., Ltd.
Chorlton Metal Co., Ltd.
Clarke & Co. (M/c.), Ltd., H.
Coates, Ltd., J. G.
Concerton Radio & Electric, Ltd.
Correx Amplifiers.
Custerson, R.
Daly, H. C.
Dyson & Co. (Works), Ltd., J.
Eagle Engineering Co., Ltd.
Elliott Radio Mfg. Co., Ltd.
Elliotts.
Ferranti, Ltd.
Film Industries, Ltd.
General Electric Co., Ltd.
Goodmans (Clerkenwell), Ltd.
Hartley Turner Radio, Ltd.
Heayberd & Co., F. C.
Henry Ford Radio, Ltd.
Igranic Electric Co., Ltd.
Ivory Electric, Ltd.
Kingsway Radio, Ltd.
Lechner & Co., Ltd., F. W.
London Elec. Co. (Sherborne Lane), Ltd.
London Electrical Mfg. Co., Ltd.
London Radio Co. (Leeds), Ltd.
Londona, Ltd

PRODUCTS SUPPLIED

London Transformer Products, Ltd.
Lyons, Ltd., Claude.
Mains Radio Mfg. Co.
Meritus (Barnet), Ltd.
Mervyn Sound & Vision Co., Ltd.
Metal Agencies Co., Ltd.
Midland Radio & Television Co.
Midland Transformer Co.
Mile End Radio Co.
Multitone Electric Co.
M.P.R. Electrical Co.
National Radio Service Co. (N.R.S., Ltd.).
Parsonage, W. F.
Partridge & Mee, Ltd.
Partridge, N.
Partridge, Wilson & Co., Ltd.
Plessey Co., Ltd.
Radio Development Co.
Radio Instruments, Ltd.
Radioformer, Ltd.
Radiovox Wireless Services, Ltd.
Ray Engineering Co., Ltd.
Regentone Products, Ltd.
Rich & Bundy, Ltd.
Salisbury Transformer & Electrical Co., Ltd.
Savage, W. B.
Scott Sessions & Co., G.
Shearing, A. E.
Sifam Electrical Instrument Co., Ltd.
Sound Sales, Ltd.
Standard Telephones & Cables, Ltd.
Stratton & Co., Ltd.
Sturdy Electric Co.
Supremus Specialities, Ltd.
Tannoy Products.
Telsen Electric Co. (1935), Ltd.
Trix Electrical Co., Ltd.
Varley.
Weedon Power Link Radio Co.
Whiteley Elec. Radio Co., Ltd.
Wright & Weaire, Ltd.
Zenith Electric Co., Ltd.

TRANSFORMERS (output).

Aerodyne Radio, Ltd.
Altham Radio Co.
Anson & Hopwood, Ltd.
Berclif, Ltd.
Birmingham Sound Reproducers, Ltd.
British Radiophone, Ltd.
British Television Supplies, Ltd.
Bryce & Co., W. A.
Bulgin & Co., Ltd., A. F.
Campart, C.
Castagnoli, G.
Celestion, Ltd.
Chorlmet Radio Elec., Ltd.
Clarke & Co. (M/c.), Ltd., H.
Concerton Radio & Electrical Co., Ltd.
Correx Amplifiers.
Custerson, R.
Eagle Engineering Co., Ltd.
Elliott Radio Mfg. Co., Ltd.
Elliotts.
Ferranti, Ltd.
Film Industries, Ltd.
General Electric Co., Ltd.
Goodmans (Clerkenwell), Ltd.
Hartley Turner Radio, Ltd.
Heayberd & Co., F. C.
Henry Ford Radio, Ltd.
Igranic Electric Co., Ltd.
Ivory Electric, Ltd.
Kingsway Radio, Ltd.
Lechner & Co., Ltd., F. W.
London Electrical Co. (Sherborne Lane), Ltd.
London Electrical Mfg. Co., Ltd.
London Radio Co. (Leeds), Ltd.
London Transformer Products, Ltd.
Londona, Ltd.
Meritus (Barnet), Ltd.
Metal Agencies, Co., Ltd.
Midland Radio & Television Co.
Midland Transformer Co.
Mile End Radio Co.
M.P.R. Electrical Co.
National Radio Service Co. (N.R.S.), Ltd.
Partridge & Mee, Ltd.
Partridge, N.
Patridge, Wilson & Co., Ltd.
Plessey Co., Ltd.
Radio Development Co.
Radio Instruments, Ltd.
Radioformer, Ltd.
Radiovox Wireless Services, Ltd.
Regentone Products, Ltd.
Reproducers & Amplifiers, Ltd.
Rich & Bundy, Ltd.
Rothermel, Ltd., R. A.
Savage, W. B.
Scott Sessions & Co., G.
Shearing, A. E.
Sifam Electrical Instrument Co., Ltd.
Sound Sales, Ltd.
Sturdy Electric Co.
Supremus Specialities, Ltd.
Tannoy Products.
Trix Electrical Co., Ltd.
Varley.
Voigt Patents, Ltd.
Weedon Power Link Radio Co.
Wharfedale Wireless Works.
Whiteley Elec. Radio Co., Ltd.
Zenith Electric Co., Ltd.

TURNTABLES (gramophone).

British Radiophone, Ltd.
Collaro, Ltd.
Garrard Engineering & Manufacturing Co., Ltd.
Kingsway Radio, Ltd.
Regent Fittings Co.
Thompson, Diamond & Butcher.

TURNTABLE BRAKES.

Aladdin Gramophone & Accessories Co.
Collaro, Ltd.
Garrard Engineering & Manufacturing Co., Ltd.
Leibovici, J.
Regent Fittings Co.

VALVES.

Altham Radio Co.
Amerad (Gt. Britain), Ltd.
Arvin Electric, Ltd.
Boynton & Co., Ltd.
British Tungsram Radio Works, Ltd.
Chorlton Metal Co., Ltd.
Clarion Radio Valve Co.
Concerton Radio & Electrical Co., Ltd.
Cossor, Ltd., A. C.
Edison Swan Electric Co., Ltd.
Ferranti, Ltd.
Fourwave, Ltd.
General Electric Co., Ltd.
Graham Farish, Ltd.
Impex Electrical, Ltd.
International Majestic Radio Corpn., Ltd.
Lissen, Ltd.
London Radio Co. (Leeds), Ltd.
Lyons, Ltd., Claude.
Majestic Service Co.
Mullard Radio Valve Co., Ltd.
Mullard Wireless Service Co., Ltd.
M.O. Valve Co., Ltd.
Octron, Ltd.
Price & Co. (M/c.), Ltd.
Radio Development Co.
Siemens Electric Lamps & Supplies, Ltd.
Toubkin, J.
Tungsram Electric Lamp Works (Gt. Britain), Ltd.
362 Radio Valve Co., Ltd.

VALVE-HOLDERS.

Advance Components, Ltd.
Aerodyne Radio, Ltd.
Altham Radio Co.
Bedford Electrical & Radio Co., Ltd.
Benjamin Electric, Ltd.
British Loewe Mfrs., Ltd.
British Radiophone, Ltd.

COLVERN for Coils & Potentiometers

Bulgin & Co., Ltd., A. F.
Chorlmet Radio Elect., Ltd.
Chorlton Metal Co., Ltd.
Christie & Sons, Ltd., Jas.
Crystalate Gramophone Record Mfg. Co., Ltd.
Ferranti, Ltd.
Graham Farish, Ltd.
Harrison & Co., A.T.
Ivory Electric, Ltd.
Lechner & Co., Ltd., F. W.
Lectro Linx, Ltd.
Lissen, Ltd.
London Electrical Mfg. Co., Ltd.
London Radio Co. (Leeds), Ltd.
Mica Mfg. Co., Ltd.
Partridge, Wilson & Co., Ltd.
Person & Son, L.
Plessey Co., Ltd.
Price & Co. (M/c.), Ltd.
Quartz Crystal Co.
Radiamp Co., Ltd.
Stratton & Co., Ltd.
Ward & Goldstone, Ltd.
Whiteley Elec. Radio Co., Ltd.
Williams & Moffatt, Ltd.
Wood, E. A.
Wright & Weaire, Ltd.

VALVE TESTERS.

Bulgin & Co., Ltd., A. F.
Distavox Service & Television Co.
Elliotts.
Ferranti, Ltd.
General Electric Co., Ltd.
London Electrical Co. (Sherborne Lane), Ltd.
Millet, J.
Plessey Co., Ltd.
Price & Co. (M/c.), Ltd.
Radiometers, Ltd.
Siemens Schuckert (Gt. Britain), Ltd.
Universal Services.
Wood, L. R.
Wright & Weaire, Ltd.

VOLUME CONTROLS.

Bowyer, Lowe & A. E. D., Ltd.
British Centralab, Ltd.
British Loewe Mfrs., Ltd.
British Goldring Products, 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.
Dubilier Condenser Co. (1925), Ltd.
Earl Mfg. Co., Ltd.
Erie Resistor. Ltd.
Ferranti, Ltd.
Franklin Electric, Ltd.
General Electric Co., Ltd.
Goodmans (Clerkenwell), Ltd.
Graham Farish, Ltd.
Grampian Reproducers, Ltd.
Haynes Radio.
Igranic Electric Co., Ltd.
Ivory Electric, Ltd.
Lechner & Co., F. W.
Lissen, Ltd.
Lyons, Ltd., Claude.
National Radio Service Co. (N.R.S.), Ltd.
Partridge & Mee, Ltd.
Plessey Co., Ltd.
Radio Instruments, Ltd.
Radio Resistor Co.
Reliance Mfg. Co. (Southwark), Ltd.
Reproducers & Amplifiers, Ltd.
Rotor Electric, Ltd.
Salford Electrical Instruments, Ltd.
Standard Telephones & Cables, Ltd.
Tannoy Products.
Varley.
Watmel Wireless Co., Ltd.
Wharfedale Wireless Works.
Whiteley Electrical Radio Co., Ltd.
Wingrove & Rogers, Ltd.
Wright & Weaire, Ltd.

WANDER PLUGS.

Altham Radio Co.
Andrews & Co., A. E.
Belling & Lee, Ltd.
Castle Fuse & Engineering Co., Ltd.
Chorlton Metal Co., Ltd.
Colvern, Ltd.
Eastick & Sons, J. J.
Edmonds, Ltd., G.
Francois, E. J.
General Electric Co., Ltd.
Ivory Electric, Ltd.
Kniveton Cable Works, Ltd.
Lectro Linx, Ltd.
Leibovici, J.
Lilley & Son, Ltd., S.
Lissen, Ltd.
London Electrical Mfg. Co., Ltd.
McLeod & McLeod, Ltd.
Millet, J.
Price & Co. (M/c.), Ltd.
Radiamp Co.. Ltd.
Remax, Ltd.
Siemens Electric Lamps & Supplies, Ltd.
Toubkin, J.
True Screws, Ltd.
Ward & Goldstone, Ltd.
Whiteley Electrical Radio Co., Ltd.

WAVEMETERS.

Allwave International Radio & Television, Ltd.
Berclif, Ltd.
Brown Radio, Ltd., W. F.
Castagnoli, G.
Custerson, R.
Distavox Service & Television Co.

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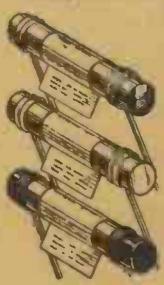

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Elliotts.
Everett Edgecumbe & Co., Ltd.
Ferranti, Ltd.
General Electric Co., Ltd.
Ivory Electric, Ltd.
London Electrical Co. (Sherborne Lane), Ltd.
Lyons, Ltd., Claude.
Muirhead & Co., Ltd.
Quartz Crystal Co.
Siemens-Schuckert (Gt. Britain), Ltd.
Stratton & Co., Ltd.
Sullivan, Ltd., H. W.
Tannoy Products.
Universal Services.

WAVE TRAPS.

Aerodyne Radio, Ltd.
Altham Radio Co.
Berclif, Ltd.
Brown Radio, Ltd., W. F.
Castagnoli, G.
Chalkley, C. G.
Custerson, R.
Distavox Service & Television Co.
Elliott Radio Mfg. Co., Ltd.
Elliotts.
Ferranti, Ltd.
H.S.P. Wireless Co.
Ivory Electric, Ltd.
Kingsway Radio, Ltd.
Kolster-Brandes, Ltd.
London Electrical Co. (Sherborne Lane), Ltd.
Shearing, A. E.
Ward & Goldstone, Ltd.
Whiteley Electrical Radio Co., Ltd.
Wright & Weaire, Ltd.

WIRE (aerial).

Aerialite, Ltd.
Altham Radio Co.
British Insulated Cables, Ltd.
British Ropes, Ltd.
Bromley-Langton Electric Wire & Insulator Co., Ltd.
Callenders Cable & Construction Co., Ltd.
Chorlmet Radio Elect., Ltd.
Chorlton Metal Co., Ltd.
Concordia Electric Wire Co., Ltd.
Connollys (Blackley), Ltd.
Elliotts.
Gilbert & Co., Ltd., C.
Hart Bros. Electrical Mfg. Co., Ltd.
Henry Ford Radio, Ltd.
Ivory Electric, Ltd.
Kniveton Cable Works, Ltd.
Laker Co., Ltd., J. & J.
London Radio Co. (Leeds), Ltd.
Midland Electric Wire Co., Ltd.
Millet, J.
Price & Co. (M/c.), Ltd.
Radioformer, Ltd.
Reliance Electrical Wire Co., Ltd.
Richardsons (R. M. L.), Ltd.
Ripaults, Ltd.
Siemens Electric Lamps & Supplies, Ltd.
Telsen Electric Co. (1935), 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.
Callenders Cable & Construction Co., Ltd.
Chorlton Metal Co., Ltd.
Concordia Electric Wire Co., Ltd.
General Electric Co., Ltd.
Hart Bros. Electrical Mfg. Co., Ltd.
Ivory Electric, Ltd.
Kniveton Cable Works, Ltd.
Leibovici, J.
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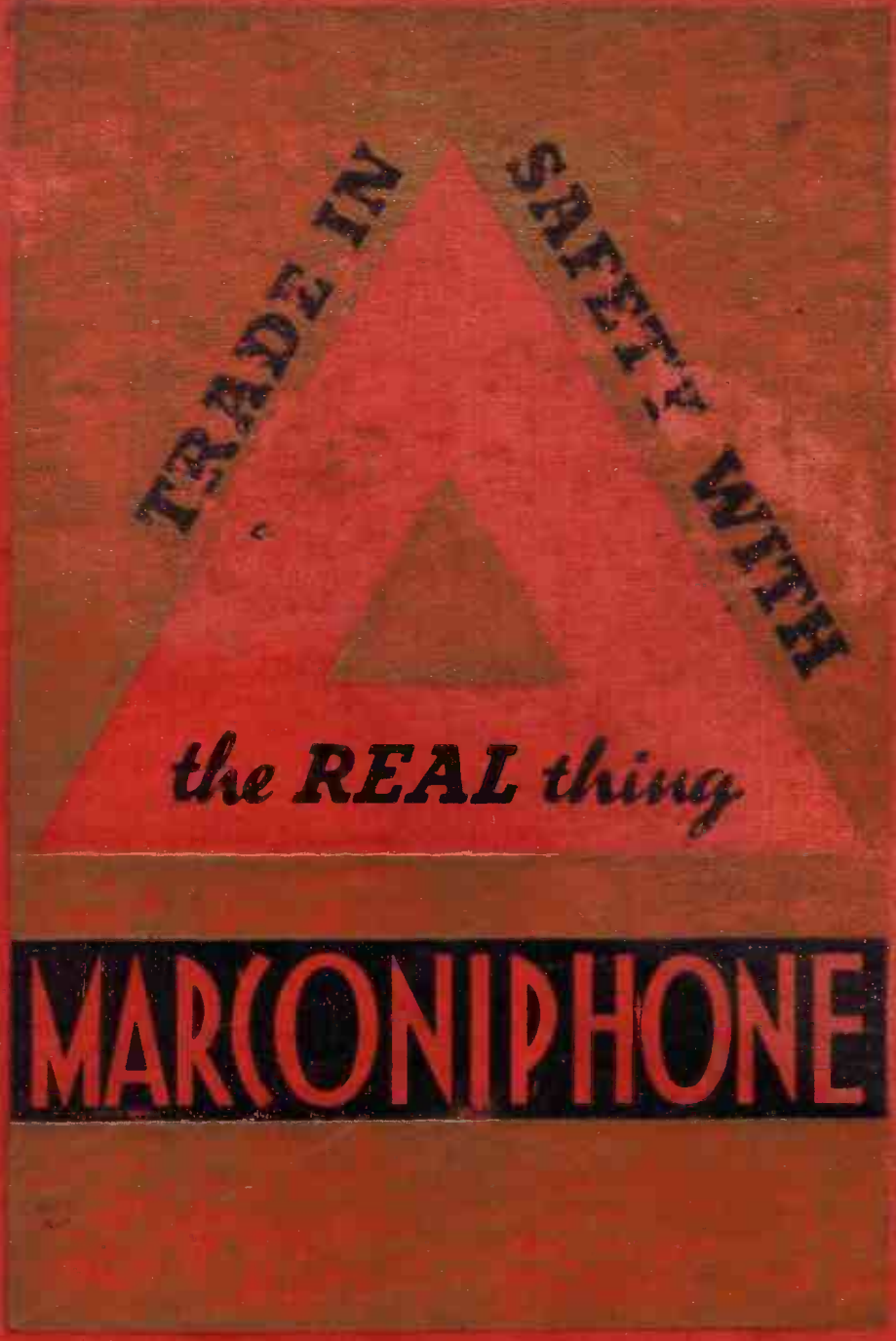
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