THE BROADCASTER TRADE ANNUAL 1935

Exide and Drydex BATTERIES

5/- NET

# The Broadcaster
## RADIO & GRAMOPHONE
# TRADE ANNUAL
# 1935


There is infi
an R.G.D. F

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You cannot
to equal R.C
so generous

DAILY MAIL
STATES:-

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RADIO G

*Write for complete catalogue, together wit
Factors in your area.*

**RADIO GRAMOPHONE DEVELOPMENT CO., LTD., 17/20, Frederick Str**

LONDON—40, Doughty St., W.C.1. MANCHESTER—17, Bridge St. INDIA—Hug
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*Holdens*

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Radio Gramophone.

place you earn a big
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sure. R.G.D. perform-
quote the WIRELESS
as high as it can be

sell a radio-gramophone
.D., or one which gives
a profit.

UPERB,
AS EVER

G·D

RAMOPHONES

*names of Stockist*

**et, Birmingham, 1.**

Engineering Co.
hambers, 32, Wilson Rd.,
ard Estate, Bombay

# R·G·D

## *Radio Gramophones are purchased by those who want immeasurably superior performance*

| | | | |
|---|---|---|---|
| Model | 700 | Auto | 57 GNS. |
| | | Non Auto | 50 GNS. |
| Model | 703 | Auto | 70 GNS. |
| | | Non Auto | 63 GNS. |
| Model | 1201 | Auto | 95 GNS. |
| | | Non Auto | 88 GNS. |
| Model | 1202 | Auto | 107 GNS. |
| | | Non Auto | 100 GNS. |
| Model | 1203 | Auto | 130 GNS. |

## *It pays better to sell*

# R·G·D

# NOT *a mere statement of* CLAIM . . . *but a* FACT *the* CRITICS *established*

"Austin"

## LEADERSHIP

. . . a quality often claimed yet merited only by one . . . a quality which others must ascribe, if it is to have worth. Such is the leadership of Austin Products. The opinions of the critics have placed Austin Receivers and Radiograms in the proud position of leadership.

## A.C. SUPERS
## BATTERY SUPERS
## &
## All British CAR RADIO

*All designed by Major W. I. G. Page, B.Sc. (Late "Wireless World.")*

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*Grams; City Acco, Barb, London*

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## for Battery & A.C. operation

# Quick Servicing! QUICK SALES!

**Get these instruments on your counter....show them "in action"....let your customers see the scientifically 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

**TEN 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. Ten 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/-**

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REGD TRADE MARK

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### 22 METERS IN ONE

What thousands are wanting! A small inexpensive combination meter *accurately* makes both A.C. and D.C. tests. Here—for everyone—is a younger brother of the famous *Universal* Avometer. Entirely new testing facilities are provided. A new ability is given for everyone to track radio faults quickly—accurately—easily. Twenty-two meters are combined in one. A.C. and D.C. volts and milliamps and resistance are all measured with easy simplicity. You—and your customers need this new AvoMinor.

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# Make 1935 a record year for Battery Sales

We can help you—by supplying a range of up-to-date Wireless Batteries and Dry Cells which are real profit earners—by consistent advertising in the radio press—by attractive window displays, posters and sales literature—and by giving that extra value for money which underlies the success of all Smith's products.


From the point of view of quality or price, you will not find a better line to handle than the new "Anodex" H.T. Batteries. Packed with superabundant power, they maintain a steady output for a very satisfying period. Supplied in Standard, Extra and Triple Power capacities.

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# The Broadcaster

## RADIO AND GRAMOPHONE TRADE ANNUAL

# 1935

## FOURTH 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 1934

| | JANUARY. | FEBRUARY. | MARCH. | APRIL. | MAY. | JUNE. |
|---|---|---|---|---|---|---|
| Sun. | . 7 14 21 28 | .. 4 11 18 25 | .. 4 11 18 25 | 1 8 15 22 29 | . 6 13 20 27 | .. 8 10 17 24 |
| Mon. | 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 |
| Tues. | 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 |
| Wed. | 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 |
| Thurs. | 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 |
| Fri. | 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 |
| Sat. | 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 |

| | JULY. | AUGUST. | SEPTEMBER. | OCTOBER. | NOVEMBER. | DECEMBER. |
|---|---|---|---|---|---|---|
| Sun. | 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 |
| Mon. | 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 |
| Tues. | 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 .. |
| Wed. | 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 .. |
| Thurs. | 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 .. |
| Fri. | 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 .. |
| Sat. | 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 .. |

# 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 .. |

# CALENDAR for 1936

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

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

# CONTENTS

*For Detailed Subject Index, see page 247.*

# THE PAST YEAR IN THE TRADE

Part exchange, the inauguration of the R.W.T.A. stop list, H.P. facilities and the attempts to obtain parliamentary sanction for relay powers have been the outstanding problems of the year.

Dealer discussions up and down the country showed that the part exchange problem was fast becoming one of first-rate importance. As the replacement market itself became a greater sales factor so did part exchange.

Finally, in an endeavour to set some sort of standard for allowance prices, THE BROADCASTER Resale Price schedule was evolved and is now published twice a year.

## *R.W.T.A. Stop List*

The R.W.T.A. Stop List, which was announced in December, 1933, had the effect of curtailing the activities of some of the larger and more blatant cutters. It may, in time, prove a sound deterrent to price cutting in general, but its effects are not as yet sufficiently widely felt.

The stop list is operated by the original subscribers to the R.W.T.A.

H.P. facilities and terms have been the subject matter of discussion between all three sections of the industry.

Some degree of uniformity has been arranged between a number of prominent manufacturers mainly with regard to the length of time over which monthly payments are spread.

No practical move has yet been made to bring the initial payment to a satisfactory level.

Relays and the attempts to obtain powers to operate them through Parliament have received considerable attention from the R.M.A.

Several Parliamentary moves have been defeated.

Recently all radio trade and allied associations have entrusted to the R.M.A. the task of combating a further attempt introduced by a private member to obtain sanction for the operation of relays over electricity power mains.

No fresh moves have been made with regard to the supply of radio receivers to co-operative societies.

The C.W.S. receiver marketed by the English retail societies has been followed by a Scottish C.W.S. receiver.

In both instances the instruments are being made for, and not by, the wholesale societies.

Technically, the year has been outstandingly superhet plus A.C./D.C. valves.

Many manufacturers dropped D.C. receivers and substituted A.C./D.C. versions.

The introduction of A.C./D.C. valves has still further complicated the dealers' valve stock problem, which is now urgently in need of attention.

The W.R.A. area scheme came into being during the period under review.

While the results so far are promising it is too early to sum up the total effect

A new "dealer definition" has been evolved by the R.W.T.A.

The alterations consisted of amendments to the notes attached to the original definition permitting (definitely) an electrical contractor without shop premises to be recognised as a radio dealer.

It is noteworthy to record that at the Convention of the Incorporated Municipal Electrical Association—one of the most powerful electrical organisations—considerable attention was paid to the subject of radio retailing, probably proving a growing desire on the part of electricity supply authorities to take active part in the retailing of radio receivers, the use of which is now responsible for a very considerable "load."

## *Marking Order on Sets*

During the year the R.M.A. applied for a marking order on imported sets and components—and obtained it.

Droitwich, which opened late in 1934, brought new factors into the radio market and will probably result next year in greater attention being paid to the design of the long wave side of radio sets.

Technical training is a subject of which much has been heard in recent months. An R.M.A. sponsored scheme was evolved, the full effects of which will be apparent next year.

A "high spot" during 1934 was the honour to the Industry conferred by the attendance of H.R.H. the Prince of Wales at the annual banquet of the R.M.A.

# THE BRITISH BROADCASTING CORPORATION YEAR

The re-allocation of wavelengths arranged at the Lucerne Conference duly came into operation on January 15, 1934. The amount of dislocation caused to listeners during the complicated change-over was relatively small.

On the medium wave-band, the new plan has proved as successful as was anticipated and, in general, there has been considerably less interference between stations working on adjoining ether channels than there was under the Prague Plan. This is due, of course, to the principle which was adopted of placing on adjoining ether channels those stations which were expected to produce comparatively low signal strength in each other's service areas.

On the long wave-band, the National transmitter is working on the frequency allotted to it in the Lucerne Plan—namely, 1,500 meters—but the general position in this band is not yet satisfactory ; the Lucerne Plan has not, in fact, been generally applied in this wave-band.

The new high-power, long-wave transmitter at Droitwich came into full service on October 7, 1934, and is providing a greatly improved National programme service over the whole of the British Isles. The aerial power of the new transmitter is 150 kilowatts and, as a result of research carried out by the B.B.C., the difficulty of obtaining full response to the upper audible frequencies in a long-wave transmitter has been overcome.

The new transmitter does not, therefore, suffer from the disadvantage of Daventry 5XX of attenuating the higher notes—in fact, its performance in this respect is equal to that of the medium-wave Regional transmitters.

The improved signal strength provided from Droitwich has enabled the transmitters at Belfast, Bournemouth and Plymouth, which previously relayed the National programme, to radiate a Regional type of programme, thus providing to those districts an alternative service to that obtainable from Droitwich.

The position of the new transmitter is approximately three miles north-east of Droitwich, and the new Midland Regional transmitter is being built at the same station. The latter will take over the Midland Regional service from the present transmitter at Daventry early in 1935. This will leave the Daventry site free for the Empire Station and for experiments in connection with the short-wave Empire Service.

Work has been begun on the construction of a new high-power Regional transmitter to serve Northern Ireland. The station will be completed towards the end of 1935. The work of modernising and expanding provincial studios and equipment was continued in several centres, in particular at Manchester, Bristol and Newcastle.

The B.B.C. has made a further extension of its programme hours, and now broadcasts from Monday to Friday a continuous service of alternative programmes from 10.45 a.m. till 11.15 p.m., after which the National programme carries on alone until midnight. The only regular exception to the above rule is the First News Bulletin at 6.0 p.m., which is radiated in both National and Regional programmes.

Monthly details of licence figures from August, 1933, to July, 1934, for every county in Great Britain are given on pages 144 and 145.

## 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. |
| West Region ... | 38 and 39 Park Place, Cardiff. |
| North Region ... | Broadcasting House, Piccadilly, Manchester. |
| Scottish Region | 5 and 6, Queen Street, Edinburgh. |
| Belfast ... ... | 31, Linenhall Street, Belfast. |

### Other B.B.C. Offices.

| | |
|---|---|
| Aberdeen ... | 15, Belmont Street. |
| Bournemouth... | 72, Holdenhurst Road. |
| Glasgow ... | 282, 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. |
| Bristol ... ... | 21–23, Whiteladies Road |


# THE RADIO MANUFACTURERS' ASSOCIATION

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*Trustees :*

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Belling Lee, Ltd., A. F. Bulgin & Co., Ltd., Chloride Electrical Storage 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., Varley (Oliver Pell Control, Ltd.), Westinghouse Brake & Saxby Signal Co., Ltd., Wingrove & Rogers, Ltd.

*Director and Secretary :*

D. Grant Strachan, Astor House, Aldwych, London, W.C.2 (Holborn 8346–7).

The membership of the R.M.A. at the end of October, 1934, was 122.

The National Radio Exhibition, at Olympia, in 1934, again occupied the Grand and National Halls, some 190 exhibitors taking 76,000 square feet of stand space. The Broadcasting Theatre, an innovation last year, was repeated on a larger scale, and, with the co-operation of the B.B.C., three variety performances were given each day by favourite broadcasting artistes. The visiting public, who welcomed last year's theatre in so marked a way, indicated by a tremendously increased attendance, their continued interest in this aspect of the exhibition.

The paid attendance at the exhibition far surpassed all previous records, the figure of 238,285 being over 28,000 more than last year's total.

Following the conclusion of Radiolympia, the Scottish Radio Exhibition, organised by the R.M.A., opened in the Kelvin Hall, Glasgow, on August 31 and ran until September 8. At this exhibition 84 exhibitors occupied over 32,000 square feet of floor space.

This year's Scottish Exhibition included a Broadcasting Theatre on lines similar to those followed in London and, for the first time, the G.P.O., who have for several years been represented at Olympia, participated in the Scottish show also. The paid attendance was 82,222, an increase of some 9,500 over last year's figures.

The application made by the Association to the Board of Trade for an order for the marking of imported radio apparatus with the country of origin was heard by the Standing Committee on July 16 and 17. Such Standing Committee formed the conclusion that an Order in Council ought to be made that the radio apparatus specified in the R.M.A. application should bear an indication of origin on sale or exposure for sale both wholesale and retail. The Committee have recommended, therefore, that such Order be made to come into force six months after the date on which it is made, or on July 1, 1935, whichever is the later date, in order to provide a reasonable period of notice to the trade.

The Association has given careful consideration to the problem of the training of radio engineers and technicians, and, in conjunction with the Board of Education, has been instrumental in the establishment of training courses at the Birmingham Central Technical College, the Royal Technical College, Salford, and the Manchester Municipal College of Technology. From the experience gained in these centres it is hoped to develop a general scheme embracing the country as a whole.

The problem of electrical interference with broadcasting is becoming one of serious import to the radio industry and has con-

sistently engaged the attention of the R.M.A. during the past year. The Association is represented on the I.E.E. Committee which is dealing with the matter, and in common with the B.B.C. and the G.P.O., has contributed towards the expenses of research work on the problem which is being carried out by the British Electrical and Allied Industries' Research Association. The Association is also represented on the committee supervising such research.

The R.M.A. was invited, in the summer, to give evidence before the Committee on Television appointed by the Government, and the R.M.A. representatives attended such Committee on several occasions in this connection.

The question of the running of Municipally owned Relay Stations, first mooted in 1933 by the Middlesbrough Corporation and then defeated in the House of Commons as a result of joint action by the R.M.A. and other interested parties, arose once more when, early in 1934, the Cardiff Corporation sought similar powers. Once again the R.M.A. action resulted in the withdrawal of the clause from the Cardiff Bill; but the matter was again revived in April, when an attempt was made to insert a clause in the Electricity (Supply) Bill to give supply undertakings the power to relay radio programmes over the supply mains.

The opposition organised by the R.M.A. sufficed to secure the defeat of the proposed clause, but the advocates thereof have intimated their intention of endeavouring to secure the desired powers by means of a Private Members' Bill—The Electricity Supply (Wireless) Bill—now before Parliament.

The R.M.A. has been active in organising opposition to this Bill, and has secured the support of all Associations concerned in the radio industry for the efforts it is making in this matter.

Mr. J. T. Mould, a Vice-President of the R.M.A. and a director of Igranic Electric Co., Ltd., died on September 6, 1934, at the age of 73. At the beginning of 1934 he had retired from the R.M.A. Council and from the office of trustee of the Association—a position he had held for many years.

During his career, he had taken a prominent part in the work of many of the Associations with which his company came into touch, including the F.B.I., the B.E.A.M.A., the B.E.S.A., and the E.R.A.

In 1926 he actively assisted in the formation of the Radio Manufacturers' Association. He became vice-chairman in 1928 and chairman in 1929.

He was popular throughout the industry, and by his death the Association lost a sagacious counsellor.

# 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 |

# 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 eight "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.
McMichael Radio, Ltd.
Marconiphone Co., Ltd.
Philips Lamps, Ltd.
Ultra Electric, Ltd.

The Manufacturer Subscribers include :—

A. J. Balcombe, Ltd.
Beethoven Radio, Ltd.
British Blue Spot Co., Ltd.
Burgoyne Wireless (1930), Ltd.
Climax Radio Electric, Ltd.
Cromwell (Southampton), Ltd.
Mullard Wireless Service Co., Ltd.
Portadyne Radio (Whittingham Smith & Co., Ltd.).
Radio Gramophone Development Co., Ltd.
Radio Instruments, Ltd.
Regentone, Ltd.
Six-Sixty Radio, Ltd.
United Radio Manufacturers, Ltd. (as kit makers only).

Approximately 170 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."

In connection with this definition, the Original Subscribers have instituted a Stop List which is now in operation. This list may only be altered with the consent of a Committee of Wholesale Subscribers.

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

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## BRITISH "WIRELESS FOR THE BLIND" FUND

The British "Wireless for the Blind" Fund has provided free wireless sets and installations for more than 25,000 blind persons in Great Britain and Northern Ireland, and is receiving many new applications every year. It does not undertake maintenance and is most grateful to the many members of the radio industry who have given their services during the past four years.

Many recipients of sets have sufficient means to look after the upkeep of their sets, but there are several thousands who are too poor. If there are retailers who would care to assist they are asked to communicate with the Secretary of the fund, or give in their names to their local society for the blind, through whom the wireless sets are distributed. All blind persons can obtain a wireless licence free of charge.

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.)

# 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.
Ferranti Ltd.
General Electric Co., Ltd.
Lissen, Ltd.
Marconiphone Co., Ltd.
Mullard Wireless Service Co., Ltd.
Philips Lamps, Ltd.
Six-Sixty Radio Co., Ltd.
Standard Telephones and Cables, Ltd.

*Associates*—
Cryselco, Ltd.
Siemens Electric Lamps and Supplies, Ltd.

Chairman :—S. R. Mullard.

Director :—H. Howitt.

*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 bye-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 or 22½ per cent. off Irish Free State 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 COMPONENT MANUFACTURERS' FEDERATION

*Chairman :* Major L. H. Peter, M.C., M.I.E.E. (Westinghouse Brake & Saxby Signal Co., Ltd.).

*Vice-Chairman :* Mr. A. F. Bulgin, M.I.R.E.

*Vice-President :* Lt.-Col. G. D. Ozanne, M.C., M.I.E.E. (Wingrove & Rogers, Ltd.).

*Treasurer :* Mr. E. M. Lee, B.Sc. (Belling & Lee, Ltd.).

*Executive Council :* Belling & Lee, Ltd. ; Colvern, Ltd. ; Dubilier Condenser Co. (1925), Ltd. ; Edison Swan Electric Co., Ltd. ; Ferranti, Ltd. ; Radio Instruments, Ltd. ; Telegraph Condenser Co., Ltd. ; Whiteley Electrical Radio Co., Ltd. ; Wright & Weaire, Ltd.

*Secretary :* Mr. C. Gordon Bonser, 83, Cannon Street, London, E.C.4.

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 guineas and the annual subscription is 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 ; and interference suppressors.

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 ; British Cellulose Lacquers, Ltd. ; C.A.C. Cabinets, Ltd. ; Caplan & Sons ; Carrington Manufacturing Co., Ltd. ; Christopher & Co. ; R. Cruickshank (Cellulose), Ltd. ; Eburite Corrugated Containers, Ltd. ; Edward Doherty & Sons ; John J. Dunster & Sons, Ltd. ; Durex Abrasives, Ltd. ; A. Ercolani & Sons, Ltd. ; Freertone Endura Co. ; Holmes Bros. (London), Ltd. ; J.B. Manufacturing Co. (Cabinets), Ltd. ; Lamplugh Radio, Ltd. ; W. & T. Lock, Ltd. ; Macfarlane, Burchell & Co. ; Nobel Chemical Finishes, Ltd. ; C. A. Osborn ; E. Sherry, Ltd. ; T. Stanton ; Union Glue and Gelatine Co., Ltd. ; Watkins Sporne & Co. ; R. C. Wilkinson & Co., Ltd. ; 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 1934–35 are as follows:—

President: E. W. Houghton (Ensign Ltd.)
Vice-President: B. R. Banks (Brown Bros., Ltd.)
Hon. Treasurer: A. G. Beaver (Sun Electrical Co., Ltd.)
Secretary: J. MacFarlane.

*Council:*

| | |
|---|---|
| T. Beadle .. | .. T. Beadle & Co., Ltd. |
| F. Brewerton | .. Ecco Radio, Ltd. |
| E. H. Burris | .. Fred Burris & Sons, Ltd. |
| E. J. Collier | .. East London Rubber Company. |
| W. E. Collins | .. Albion Electric Stores. |
| A. J. Dew .. | .. A. J. Dew & Co., Ltd. |
| C. H. G. Hobday | .. Hobday Brothers, Ltd. |
| G. Kent .. | .. Johnson Talking Machine Co., Ltd. |
| E. U. Redway | .. Southern Factors, Ltd. |
| J. W. Riddiough | .. Frank Riddiough & Son. |
| J. Robertson | .. James Robertson. |
| A. C. Robinson | .. Robinson & Hands Electric Co., Ltd. |
| R. Gordon Willis | .. Dulcetto-Polyphon, Ltd. |

*North Midland Section*—
Chairman: J. W. Riddiough (Frank Riddiough & Son).
Vice-Chairman: H. C. Needham (C. E. Needham & Brother).
Hon. Secretary: W. J. Smith (Sloan Electrical Co., Ltd.), 16, Jackson's Row, Manchester.

*South Western (Bristol) Section*—
Chairman: E. H. Burris (Fred Burris & Sons, Ltd.).
Vice-Chairman: F. D. Newcombe (F. D. Newcombe & Co.).
Hon. Secretary: John M. Sim (Sloan Electrical Co., Ltd.), 44, Victoria Street, Bristol.
Hon. Treasurer: A. J. Nicholl (Drake & Gorham (Wholesale), Ltd.).

*Midlands (Birmingham) Section*—
Chairman: E. Smith (Midland Auto Components).
Hon. Secretary and Treasurer: W. Balmford (Walter Balmford), 116, Steelhouse Lane, Birmingham, 4.

*Scottish (Glasgow) Section*—
Chairman: W. Harper (Wm. Harper & Co.).
Vice-Chairman: C. G. Tideman (Charles G. Tideman).
Hon. Secretary: J. B. H. Warden (Johnson Talking Machine Co., Ltd.).

*London & South Eastern Section*—
Chairman: A. A. Byne (L.E.S. Distributors, Ltd.).
Vice-Chairman: A. F. Hitchcock (Flinders (Wholesale), Ltd.).
Hon. Secretary: F. Brewerton (Ecco Radio, Ltd.), Ecco House, Princess Street, St. John's Wood, London, N.W.8.

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 six 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 over 270.

# NATIONAL ASSOCIATION OF RADIO WHOLESALERS

Founded in 1933, the objects of the National Association of Radio Wholesalers include :

To promote and protect the interests of members in connection with the wholesale distribution of radio and/or television goods.

To provide collective representation for members in negotiation with manufacturers and to make available confidentially to members useful information.

To investigate and report confidentially upon the trading status, financial strength and credit reputation of any retailer, and to assist members in collection of monies due from a retailer.

To provide assistance for members in matters arising in the course of trading as wholesalers, and if necessary provide professional assistance and advice of Chartered Accountants and Solicitors, and should the need arise, of Counsel.

To provide a Court of Arbitration for the economical and speedy determination of disputes between members or between non-members and members.

The Association has prepared a plaque which, in connection with manufacturers, will be attached to approved sets sold through the organisations of members of the Association.

*President :* W. A. Cooke, B.Sc. (Faudels, Ltd.).

*Council :* H. L. Levy (London and Provincial Factors, Ltd.) ; L. Hart (Lionel Hart, Ltd.) ; W. Marshall, (Sheffield Radio and Electric Co.) ; A. S. McHugh (A. S. McHugh and Co.) ; T. D. Young (T. D. Young and Sons, Ltd.) ; M. Lintine (Manufacturers and Accessories Co. (1928) Ltd.) ; W. Wolsey (Wolsey (Radio and Allied Trades) WholesaleLtd.) ; H. Turner (Turner and Co., Sevenoaks, Ltd.) ; J. S. James (Wilts. Wholesale Electrical Co.)

*Secretary :* C. Wilmot, c.o. Philip Mordant, Jarvis and Co., Chartered Accountants, 115–117, Cannon Street, E.C.4.

# 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. A new committee is elected at the Annual General Meeting, which is held in January each year.

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 8139.)

# 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, under the chairmanship of Mr. F. G. Quance, 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, to foster the interests of the Industry to promote fair trading, and to protect manufacturers, traders, and the public alike against the evils of irregular 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.

# WIRELESS RETAILERS' ASSOCIATION
## OF GREAT BRITAIN AND NORTHERN IRELAND

*Vice-Presidents :* A. E. Betambeau (London); H. A. J. Shearman Dyer (London); and S. Dagnall (Birmingham).
*Chairman :* P. L. Harrison (Lincoln).
*Vice-Chairman :* J. Fielding (Brighton).
*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 2,300 is increasing daily at a rapid pace.

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 102 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. Flsher, 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). H. Keeling, 83, Colmore Row, Birmingham.

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.

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

SOUTHERN AREA.—Bournemouth, 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, Northampton, Mid. Northants, Walsall, West Bromwich, 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. Warnford-Davis (Crystalate Gramophone Record Mfg. Co., Ltd.); *Vice-President*, Mr. D. S. Bilantz (Itonia, Ltd.); *Hon. Treasurer*, Mr. W. B. Beare (Beare & Son); *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.

# GRAMOPHONE AND RADIO DEALERS' ASSOCIATION

*President :* Mr. G. H. Russell (London).

*Vice-Presidents :* Mr. J. R. Whitfield (Huddersfield), Mr. F. T. Stokes (London).

*Council :*—Messrs. J. H. Bainbridge (Hollinwood), A. E. Ball (Bath), R. W. Brayne (London), H. E. Dale (Torquay), A. V. Day (Nottingham), W. J. East (Brighton), G. C. Forty (Birmingham), E. B. Gough (Streatham), J. F. Hardy (Stockport), A. E. Hider (London), C. H. Hutchence (Liverpool), E. J. Marshall (London), C. J. Price (Birmingham), E. Riley (Barnsley), N. T. Sherwin (Hanley), R. H. Squire (Ealing), J. Trapp (Crouch End).

*Secretary :*—Frank Ayliffe, 17, Wigmore Street, London, W.1. (Langham 1423).

*Divisional Secretaries :*—North Western Division : Mr. S. S. Jack, 20, St. Ann's Square, Manchester. Birmingham Branch—Mr. S. Scott Whitehouse, 71, Colmore Row, Birmingham.

The Gramophone and Radio Dealers' Association was founded in 1920 and incorporated in 1930. Its objects are—to organise the Retail Trade ; protect and promote the interests of Dealers ; to negotiate with Manufacturers, Wholesalers and others ; to stop price-cutting ; to assist in redressing wrongs or grievances ; to obtain and furnish information on all matters incidental to the Retail Trade and generally to assist its Members with advice as required.

The financial year commences October 1, and the annual subscription is as follows :—

| | |
|---|---|
| One establishment | £1 1 0 |
| Two establishments | £1 11 6 |
| Three or four establishments | £2 2 0 |
| Over four and under ten establishments | £2 12 6 |
| Ten or over | £5 5 0 |

The business is controlled by an Executive Committee of 16 members elected from the Council, and meets monthly. The Council itself meets quarterly.

### Trading Schemes

The Council have lost no opportunity of opposing the many "trading schemes" which have so multiplied as to constitute a menace to honest trading through the recognised channels.

## SCOTTISH MUSIC MERCHANTS ASSOCIATION

President, Mr. George Campbell, 79, George Street, Edinburgh.

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

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

## 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 has for its President the Rt. Hon. Edward Shortt, P.C., K.C., and 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, W. A. Brown, W. Darwen, A. J. Davis, L. J. Donovan, R. R. Goding, K. G. Stacy Hatfield, M.I.Mech.E., S. D. Hull, A.C.A., E. B. Lewis, Major H. MacCullum, B.Sc. (London.), Messrs. J. Muscutt, A. D. Thomas, C. W. Watson, J. D. Williams, J. W. C. Robinson, and Capt. W. W. Wakefield.

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.)

## Scottish Radio Retailers' Association

*President :* Mr. R. B. Donaldson.

*Past Presidents :* Mr. James Plucknett, A.M.I.E.E. (1927-1931), Mr. Alexander Steuart (1931-1932). Mr. Robert Morrison (1932-1933).

*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.

## 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 7196). 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. All meetings are held in the Club Rooms of the Association at Donegall Chambers, Donegall Place, Belfast.

The Social Club which was formed about one year ago has achieved considerable popularity with members.

The Association Council organise an annual exhibition under the auspices of the Radio Manufacturers' Association. This exhibition is confined to members of the Radio Manufacturers' Association and members of at least one year's standing in the Ulster Association.

# 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. J. Cleaver ; *Hon. Secretary*, Mr. G. H. Parsons, 201, Broad Lane, Coventry (office : 7 Warwick Row) ; *Hon. Treasurer*, Mr. H. H. Spicer ; *Committee :* Mrs. Mackereth, Messrs. M. G. Dent, H. Payne, J. Fennell, H. Crane, A. Salmon, F. W. Nicholls, J. T. E. Brown (Rugby), and W. Johnson.

## HANTS. SOUTHERN

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

Mr. J. A. Halpin was appointed Secretary ; Mr. E. A. Woods, Chairman ; Mr. L. Apsey, Vice-Chairman ; and Mr. Clifford Lister, Treasurer.

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

## LOCAL ASSOCIATIONS.

National Chairman of the Cycle Association, and J. A. Halpin is Secretary and Council Member of the W.R.A. This started the Association on broadminded lines.

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

After four months secretaryship, Mr. J. A. Halpin retired, and Mr. L. C. Latch of Wm. Dale, Andover, was appointed Secretary.

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. E. J. Turner; *Vice-chairman:* Mr. S. May; *Hon. Treasurer:* Mr. E. Griffin; *Hon. Secretary:* Mr. F. J. Smith; *Secretary:* Mr. O. Holmes.

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 each other which is of value in the technical sides of their businesses.

Membership comprises about 20 firms. The entrance fee is 10s. 6d. and the annual subscription also 10s. 6d.

## 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.

The West Herts. Radio Retailers' Association was formed in May, 1934, from the resigning members of West Herts. W.R.A.

The annual subscription to the Association is 7s. 6d.

Meeting place, Carlton Tea Rooms, Queen's Road, Watford. Area covered: Watford Bushey, Rickmansworth, Radlett, Edgware.

The officers are as follows:—Chairman, H. D. White.

Hon. Secretary, G. Alan Gray, 57, Queens Road, Watford.

Hon. Treasurer, E. E. Sirett, 40, Market Street, Watford.

Assistant Hon. Secretary, W. H. Hoather, 26, High Road, Bushey Heath.

# 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 700.

Meetings are on Wednesdays at 6 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. S. R. Mullard, M.B.E., is the chairman of the Wireless Section Committee, and Mr. T. Wadsworth, M.Sc., is the vice-chairman. The immediate past-chairman is Mr. G. Shearing, O.B.E., B.Sc.

Ordinary members of Committee are: Mr. N. Ashbridge, B.Sc. (Eng.), Mr. A. J. Gill, B.Sc. (Eng.), Mr. N. F. S. Hecht, Mr. J. Joseph, Mr. N. Lea, B.Sc., Major S. H. Long, O.B.E., D.Sc., Mr. F. Murphy, B.Sc. (Eng.), Mr. F. E. Nancarrow, Dr. W. F. Rawlinson, Mr. Frederick Smith, Mr. C. E. Strong, B.A., Mr. R. A. Watson Watt, B.Sc. (Eng.).

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. G. W. Hallifax, R.N. (Admiralty), and Col. J. P. G. Worlledge. O.B.E. (War Office); while the *ex-officio* members are Professor W. M. Thornton, O.B.E., D.Sc., D.Eng. (President); the Chairman, I.E.E. Papers Committee; and a representative of I.E.E. Council.

# I.E.E. INTERFERENCE COMMITTEE

The Institution of Electrical Engineers has set up a Committee for the purpose of considering and making recommendations on the question of interference with broadcast reception arising from the operation of other electrical plant.

The Committee held its first meeting on June 16, 1933, under the chairmanship of Mr. Clifford C. Paterson, O.B.E., Past President of the I.E.E., with Lieut.-Col. A. G. Lee, O.B.E., M.C., Engineer-in-Chief of the Post Office, as Vice-Chairman.

The Committee set up initially four Sub-Committees dealing respectively with :—

*Committee* "*A.*" :—Domestic apparatus, including electric refrigerators, fans and vacuum cleaners.

*Committee* "*B.*" :—Larger electrical plant, including generators, motors, lifts and mercury rectifiers.

*Committee* "*C.*" :—Traction, including trolley buses, trams.

*Committee* "*D.*" :—Automobiles and aircraft.

A further Sub-Committee, dealing with suppression at consumers' premises, was formed subsequently.

The Sub-Committees are making investigations with a view to furnishing the main Committee with the data necessary for their further deliberations. The report of the Committee will be made to the Council of the Institution.

## The Committee.

The membership of the Committee is now as follows :—

Prof. W. M. Thornton, O.B.E., D.Sc., D.Eng., President, I.E.E. (ex-officio).

Lieut.-Col. A. G. Lee, O.B.E., M.C., and Messrs. C. C. Paterson, O.B.E., F. W. Purse, L. B. Turner, M.A., J. M. Kennedy, representing the I.E.E.

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

Mr. E. A. Barker (Incorporated Municipal Electrical Association).

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

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

Mr. Noel Ashbridge, B.Sc. (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. R. A. Watson Watt (National Physical Laboratory).

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

Mr. J. M. Kennedy (Electricity Commissioners).

Mr. Johnstone Wright (Central Electricity Board).

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

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

The Committee find it desirable to establish in the first place practical methods and instruments for appraising the interference and the apparatus causing it. With this end in view it has been found essential to agree to some standard of interferemce which, on the one hand, will represent substantial immunity for a well-designed radio set, and, on the other hand, is demonstrated as being of practical application to electrical appliances which emit interference, and to radio sets which are subject to such interference,

## Trend of Work.

The attention of the Committee is further being actively directed along two channels :—

(1) A study of methods and devices, and their effectiveness, which are within the power of the radio listener to apply, for ameliorating the effects of interference.

(2) A study of methods and devices for suppressing the emission of interference from electrical apparatus.

The interests represented on the Committee are co-operating actively to resolve all these questions as a necessary preliminary to making recommendations.

# 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 :* Alfred T. Fleming, M.I.W.T., 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 400 such members are at present co-operating in 12 groups, 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 second edition.

The membership of the Society as at November, 1934, was 2,250, representing an increase of over 1,000 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 or abroad the subscription is 10s.

The officers of the Society for the year 1935 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 exists to promote the advancement of wireless technology in all its branches, to maintain the status of the professions engaged in the science, to hold meetings and exhibitions, and to publish or circulate books or reports.

Examinations on practical and theoretical knowledge are held in May and November. For some years special papers have been set covering the requirements of service engineers taking the Associateship Examination and service managers taking the Associate Membership Examination. Papers are also set on all other branches of wireless engineering, including sound engineering and televisIon.

Membership comprises the following classes: Fellows, Members, Associate Members, Associates, and Students.

The fees are as follows: Examination: Associateship, £1 1s. for Registered Students, £2 2s. for non-members. Associate Membership, £2 2s. for Associates, £3 3s. for non-members. Entrance Fees: Fellow, £5 5s; Member, £4 4s; Associate Member, £3 3s.; Associate, £2 2s.; Student. no fee. Annual Subscriptions: Fellow, £5 5s.; Member, £4 4s.; Associate Member, £3 3s.; Associate, £2 2s.; Student, £1 1s.

The Institute publishes "The Proceedings." It has its own Benevolent Fund and Employment Register.

During the years 1933 and 1934 a great increase in membership is shown, and the total of examinees for the June, 1934, examination was double that of 1933.

Regular meetings are arranged in every Section and papers of considerable interest have been given at the Sections.

In particular has the question of Servicing received attention, and a Sub-Committee has been set up to give this matter continual attention.

The Institute has been fortunate in obtaining the co-operation of Technical Colleges and Polytechnics.

Special papers are set covering in detail the requirements of the Service Engineer.

Television is receiving attention, and papers on it are available in both the Associate Membership and Associateship Examinations.

The Institute was founded in 1925, and incorporated in 1932. Its offices are at 4, Vernon Place, Southampton Row, London, W.C.1. (Holborn 4879).

*President:* William Beresford Medlam, B.Sc., A.M.I.E.E.

*Vice-President:* H. J. Barton Chapple, B.Sc., A.M.I.E.E.; Y. W. P. Evans, M.Inst.R.E.; Charles C. Garrard, Ph.D., M.I.E.E.; Sir William Noble, M.I.E.E.; James Nelson, M.I.E.E.; E. H. Turle, M.I.E.E., A.M.I.Mech.E.

*Honorary Secretary:* Harrie J. King, F.C.C.S. *Assistant Honorary Secretary:* B. Tunbridge Hogben, A.C.C.S.

*Council:* William A. Chambers; Y. M. D. Cooper, B.Sc., B.es L.; Alfred T. Fleming; Horace W. Gambrell, M.Inst.R.E.; H. A. G. Howse, A.M.I.E.E.; Leslie H. Paddle, A.M.I.E.E.

The Institute has five Sections:

LONDON AND HOME COUNTIES.—*Chairman:* H. J. Barton Chapple, B.Sc., A.M.I.E.E. *Honorary Secretary:* Alfred T. Fleming, 36, Finborough Road, West Brompton, London, S.W.10.

MIDLAND.—*Chairman:* Charles C. Garrard, Ph.D., M.I.E.E. *Honorary Secretary:* Albert J. Selby, 12-13, Borough Road, Burton-on-Trent.

NORTH WESTERN.—*Chairman:* Jack Tilley. *Honorary Secretary:* Stanley Brown, 106, Nicolas Road, Chorlton-cum-Hardy, Manchester.

SOUTH WESTERN.—*Chairman:* Reginald C. Lawes. *Honorary Secretary:* Phillip T. Brown, "Homecroft," St. Andrew's Road, Exmouth, Devon.

YORKSHIRE.—*Chairman:* George W. Bagshaw. *Honorary Secretary:* M. C. Pickard, 43, Folds Crescent, Sheffield, 8.

# 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 Cañada. Membership is available in several grades, depending upon the qualifications and experience of the applicants. Secretary: Harold P. Westman.

# 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. Another exhibition is being held in 1935.

The Society has a membership of about 350. 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.; Sir John Samuel, K.B.E., LL.D.; 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.; Professor F. J. Cheshire, C.B.E., A.R.C.S., F.I.P.; 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.; H. H. Hope, Esq.; E. G. Lewin, Esq., M.Sc., A.Inst.P.; T. M. C. Lance, Esq., A.M.I.R.E.; W. G. W. Mitchell, Esq., B.Sc.; S. R. Mullard, Esq., M.B.E., M.I.E.E.; 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.; Capt. B. S. Tuke, Capt. R. Wilson.

*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 TRADES' LUNCHEON CLUBS

## BRISTOL

The Bristol and District Radio Social Club, with its motto of "Good Fellowship," is the result of a meeting in May, 1934, when it was decided to reform the Bristol Radio Trade Lunch Club to give it a wider basis for social intercourse.

At this meeting, Mr. J. W. Wharton (Mullard) was elected vice-president of the Club, and Messrs. R. T. Lewis (managing editor, *Bristol Evening World*), A. J. Spurll (editor, *Bristol Evening Post*), and J. Thomas (BROADCASTER) were elected honorary members, the last-named also being elected *ex-officio* member of the committee.

The President is Mr. A. G. Lewis, and the Hon. Secretary and Treasurer, Mr. S. F. Down, 14, Bath Street, Bristol, 1. (Bristol, 20271.)

The committee includes Messrs. J. W. Wharton, J. A. Uppington, J. M. Sim, A. W. Young, H. Gallop, and H. S. Phillips.

## LONDON

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

The officers are: chairman, Mr. E. S. Brown (Brown Bros.); vice-chairman, Lt.-Col. G. D. Ozanne (Wingrove and Rogers). honorary secretary, Mr. F. Brewerton, Ecco House, Princess Street, St. John's Wood, London, N.W.8. (Paddington 6735).

On the committee are Messrs. S. Wilding Cole (Kolster Brandes), H. de A. Donisthorpe (General Electric), J. C. Eastick, H. R. Harris (Edison Swan), C. H. G. Hobday (Hobday Bros.), W. A. Hunt (National Radio Service), G. G. Kent (Johnson Talking Machine), Col. T. W. Vigers (British Blue Spot).

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 bonâ-fide manufacturer or wholesaler firms or companies, or any person of standing in the Industry considered eligible by the committee are allowed to 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, showing that the work of the Committee in the organisation of the Club and the provision of subjects for discussion are appreciated by the Members.

## 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 officers are: *President*, Mr. J. H. Farthing; *Vice-chairman*, Mr. J. W. Needham; *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, J. Evans, and H. G. Jenkinson.

## MIDLANDS

The Midlands Radio Luncheon Club holds luncheon meetings every third Wednesday in the month at the Imperial Hotel, Birmingham. Its membership is about 100. Arising from the meeting of June 20, 1934, which was addressed by Mr. Edward E. Rosen, a committee was formed to set working the R.M.A. scheme sponsored by the Government for the training of technical radio engineers.

The club's officers are as follows:—

*Chairman:* Mr. Gordon Baynton.

*Vice-Chairman:* Mr. A. G. Wright.

*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 Trades Social Club was formed at a trade dinner organised by Mr. R. E. Fabian, North-East representative for Whiteley Electrical, and held in the County Hotel, Newcastle, in December 1933, when 162 members of the trade attended and the Lord Mayor presided.

It was unanimously decided to form a social club and the organisation was left to: Messrs. J. A. Roddy (Cossor), R. E. Fabian (Whiteley), E. C. Robinson (Britannia Batteries), J. Watson (Watsons Wholesale), T. Davison (Ferranti), B. Newton (Johnson Talking Machine), W. H. Bradley (retailer), A. F. Guitard (retailer), A. E. Dees (Dulcetto-Polyphon), R. Robinson (retailer), J. Mitchelhill (Beaumont), J. W. Skurr (J. Gledson), W. G. Craig (Tungsram).

This committee arranged a whist drive and dance which was the beginning of a very successful season.

On March 14, 1934, a general meeting re-elected the committee *en bloc* for the ensuing year.

The *President* is Mr. W. Horsfal, Manager of the G.E.C. Newcastle Branch.

Many interesting items have been embarked upon, including the organisation of a luncheon club (at which members meet each Wednesday), smoking concerts, motor rallies, dances, outings and a swimming club (members have the exclusive use of one of the city baths once a week).

## 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 three committee members are retailer, wholesaler and manufacturer 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.

## SHEFFIELD

The inaugural meeting of the Sheffield Radio Trades Luncheon Club was held on February 15, 1933, at the Nelson Hotel. About forty members sat down to luncheon. Afterwards it was proposed that Mr. C. O. Birtles be elected president and Mr. William A. Morton, of 71, 73, Surrey Street, Sheffield 1, the hon. secretary.

Members meet for luncheon monthly on a Wednesday at Grand Hotel.

Since the first luncheon many prominent men in the Radio Industry have been guests of the Club and have made excellent speeches on interesting subjects.

There is no doubt that the Club is serving a useful purpose in gathering together many who hitherto were unknown to each other.

# GOLFING SOCIETIES

## RIGS

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

*Vice-Presidents* : W. W. Burnham and J. H. Williams.

*Captain :* H. Howitt.

*Vice-Captain :* J. G. G. Noble.

*Hon. Treasurer* : S. R. Mullard.

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

*Committee :* Gordon Baynton, H. Boon, Ernest Brown, S. Wilding Cole, O.B.E., R. Milward Ellis, 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, 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 1933-34 season, which ended on October 31, were as follows : Wednesday, March 21, St. George's Hill ; Tuesday, April 17, Hartsbourne Manor ; Tuesday, June 5, West Herts. ; Tuesday, July 10, Hendon ; Wednesday, August 22, Oxhey ; Monday, September 3, Gleneagles ; Monday, September 17, Didsbury ; Wednesday, October 17, Sidcup.

The Northern section of the society at the beginning of 1934 formed itself into a separate golfing organisation and is known as the Lancashire and Cheshire Radio Industry Golfing Society.

## 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.

No date can be given when these meetings became large enough to warrant the formation of a club, but a photograph is preserved of 28 members who met at Bonnyton Moor in 1931, to play for senior and junior prizes.

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.

The membership of the society is about 70. They have two cups for competition, and prizes have been offered at every meeting. Meetings are held on the first Tuesday of every month from April to October. There is an annual January dance.

## 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 follows :

*President :* V. Z. De Ferranti ; *Captain :* R. Hollingdrake ; *Vice-Captain :* H. Clarke.

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

*The Committee includes :* J. D. Morrison, L. E. Birchall, J. E. Kemp, J. Hall, C. Gadd, J. McCrea, C. S. Warde, H. Nightingale, C. P. Beardsall.

## WALLASEY AND BIRKENHEAD

Wallasey and Birkenhead Electrical Trades Golfing Society has been in existence one season.

At its first annual meeting, Mr. Mackley was elected president and Mr. C. E. Vines, captain.

The honorary secretary is Mr. R. M. Davies, of 9, Downham Drive, Heswall. (Birkenhead 2917).

# 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. Born August 17th, 1900. Recreations: motoring, tennis. Private address: Home Lea, Nightingale Lane, Bromley, Kent.

**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. Born 1895. Recreation: motoring. Private address: 9, New Cavendish Street, W.1.

**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: 470.

**AMCOTTS, Major Weston Cracroft.**—Managing Director, Vee-Cee Dry Cell Co. (1927) Ltd., Northwold Road, Stoke Newington, London, N.16. Born 1888. Private address: Hackthorn Hall, Lincoln.

**ARBIB, Richard.**—Manager of Press Department, "His Master's Voice," 98–108, Clerkenwell Road, London, E.C. After sales experience in various export firms, joined The Gramophone Co., Ltd., in 1928, Electrical Reproducer Dept.; after conducting H.M.V.'s publicity for Maurice Chevalier's English visit in 1930, took up present position in 1932. Recreations: motoring, swimming, golf, darts. Private address: 35, Farm Avenue, London, N.W.2. (Gladstone 4114.) Club: Royal Automobile.

**ASHBRIDGE, Noel.**—Chief Engineer, B.B.C., Broadcasting House, London, W.1. B.Sc., A.M.I.C.E., M.I.E.E.

**BAGGS, John.**—Radio Sales Manager's Chief Publicity Assistant, Ferranti, Ltd., Hollinwood, Lancs; 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, Electric Clock and Electric Fire Publicity. Born November 30, 1898. Recreations: literature, boating, fishing, motoring. Private address: 2, Ash Walk, Alkrington, nr. Middleton, Manchester.

**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. Member, Broadcasting Committee of Critics Circle. From 1918–9, O.C. Exhibitions; Photographic Section of Ministry of Information, and Imperial War Museum. 1926–7, Manager of Publicity and Trade Section of the Wireless Association of Great Britain. Joined "Daily Mirror" 1927. Club: Press. Recreations: motoring, golf, photography.

**BAKER, Percy William.**—Director, Climax Radio Electric, Ltd., Haverstock Works,

## WHO'S WHO IN RADIO

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, golf. Private address: 34, Craignish Avenue, Norbury, London, S.W.16.

**BARRETT, Ferberd Sessions.**—Advertisement Manager "The Broadcaster and Wireless Retailer," "Electrical Trading," "Hotel and Catering Weekly," Odhams Press Ltd., 29, Bedford St., Strand, W.C.2. Born February 27, 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. Born October 1, 1895. Recreation : golf. 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. In wholesale electrical business 30 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' F.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.

**BEARDSALL, Charles Poynter.**—Radio Sales Manager, Ferranti, Ltd., Hollinwood, Lancs ; member of council, R.M.A. from January, 1929 ; 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, motoring. Private address : Alton, Sheepfoot Lane, Heaton Park, Manchester.

**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 : Rugby football, swimming. Private address : 45, Colebrooke Avenue, Ealing, W. 13.

**BETAMBEAU, Albert Edward.**—Proprietor A. E. Betambeau & Co., 101a, High Street, Penge, London, S.E.20, and 20–22, Anerley Station Road, S.E.20. Member of Council W.R.A. since August, 1923 ; Chairman W.R.A. 1929–31 ; Vice-President, 1932–34 ; 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.**—Managing Director, Itonia Ltd., 58, City Road, London E.C.1. Vice - 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. On special Advisory Committee, R.W.F., Scottish Section. 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. 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.J.Inst.E.**—Until 1934 Managing Director, 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; designed cycles, motors, etc., 1900-22, joined present firm, 1932. Born February 27th, 1883. Recreations: motoring, photography, clock-making. Private address: Veloce, South View, Letchworth, Herts.

**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; 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 Gt. Britain & U.S.A. Recreations: shooting, ski-ing, golf, caravanning. Private address: 2, Cowley Street, London, S.W.1, and 13, King's Bench Walk, Temple, London, E.C.4.

**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. Specialist on organisation, costing, administration, etc. Recreations: zoology, botany, swimming, writing, dancing, travelling. Private addresses: 64, Northgate, Regents Park, London, N.W.8, and "Brownlands," Shepperton-on-Thames.

**BROWN, Harold Ernest.**—Sales Manager, Halcyon Radio, Ltd., Valetta Road, London, W.3. 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.; Vice-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: orchid growing, inventing, travelling. Private addresses: 64, Northgate, Regents Park, London, N.W.8, and "Brownlands," Shepperton-on-Thames.

**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. Captain of M.I.G.S. Has had 30 years' association with gramophone and music trades. Born: March 21st, 1893. Recreations: golf, swimming, tennis. Private address: 13, Strathbrook Road, London, S.W.16.

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

**BULGIN, Arthur Frederick, M.I.R.E., F.R.S.A.**—Governing Director, A. F. Bulgin & Co., Ltd., Abbey Road, Barking, Essex. Member R.M.A. Council, 1934. Vice-Chairman R.C.M.F., 1934. 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 Road, Wanstead.

**BURNE-JONES, David.**—Managing Director, Burne-Jones & Co., Ltd., Magnum House, 296, Borough High Street, London,

## WHO'S WHO IN RADIO

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.; Majestic Electric Co., Ltd., The Majestic Electric Co. (I.F.S.), Ltd. Director, Hazelpat, Ltd. Private address: "Ingleborough," The Ridgeway, Enfield, Middlx.

**CARTER, Harley Autton.**—Diplomatist City and Guilds Technical College, Finsbury, London. Technical liaison with press, Mullard Wireless Service, Ltd., Mullard House, Charing Cross Road, London, W.C.2. Commercial Depts., various electrical manufacturers, 1910-1914; Publicity Dept., G.E.C., Ltd., 1919; Technical Editor, "British Engineers Export Journal," 1925. Joined Mullards, 1929. Born May 29th, 1889. Recreation: gardening. Private address: "Rosegarth," The Avenue, Ickenham, Uxbridge.

**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. Born: August 15th, 1887. 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., Cie. Francaise du Gramophone; Director, Columbia Graphophone Co., Ltd., Marconiphone Co., Ltd., Skandinavisk Grammophon Aktieselskab, Gramophone Buildings, Hayes, Middlesex, Marconi-E.M.I. Television Co., Ltd. Director, Covent Garden Opera Syndicate (1930), Ltd. Born: December 19th, 1873. Recreation: golf. Private address; Warren House, Iver Heath, Bucks.

**CLARKE, Arthur.**—Northern Sales Manager, 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.

**CLAYTON, Charles Lawrence.**—Director, Bowyer Lowe & A.E.D., Ltd., 10, Prince Albert Street, Brighton. A.R.I.B.A.; practising in architecture and surveying and interested in motor engineering. Born 1892. Recreations: motoring, gardening. Private address: Badger Wood, Henfield, Sussex.

**COBB, Frederick Arthur, A.I.E.E., M.I.R.E.**—Manager Radio Merchandising Dept., Standard Telephones & Cables,

Ltd , 864, Gray's Inn Road, London, W.C.1. 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 and General Manager Loewe Radio Co., Ltd., Fountayne Road, Tottenham, London, N.15. Born February 26th, 1893. Private address : 23, Exeter Road, Southgate, London, N.14.

**COLE, Eric Kirkham.**—Technical and Works Director, E. K. Cole, Ltd., Ekco Works, Southend-on-Sea. Private address : Leeways, Marine Parade, Leigh-on-Sea, 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 ; Chairman, R.M.A. Executive Council, N.U.M. ; Managing Director, Burney Blackburn, Ltd., 1918–1921 ; Chairman, S. Wilding Cole, Ltd., 1921 onwards ; Director, Kolster-Brandes, Ltd., 1927 onwards. Chairman, Heating Installations, Ltd. Born February 14, 1880. Recreations : golf, tennis. Private address : The Turret, Footscray Lane, Sidcup, Kent.

**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 Merchant's 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 : 8, Leopold Road, Ealing Common, London, W.5.

**DAVIS, Leslie Waring Westacott, Captain.**—Director, Automobile Accessories (Bristol), Ltd., Clifton Terrace, Sion Road, Bedminster, Bristol ; Express Engineering Co., Ltd., Poole, Bristol Radio Distributors, 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 : 143, Sefton Park Road, Bristol, N.7.

**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. Born March 5, 1894.

**DICKINSON, Reginald Gordon.**—Export Manager, Kolster-Brandes, Ltd., Cray Works, Sidcup, Kent. Recreations : tennis, badminton. Private address : "Beechwood," Oaklands Road, 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. Born September 9, 1893. Private address : Uphanger, Shep herds Lane, Chorley Wood, Herts.

**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

## WHO'S WHO IN RADIO

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, 700/710, 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. A.M.I.R.E. Interested in house furnishing trade. Born July 5, 1895. Recreation: music. Private address: Highlands, Champion Hill, Camberwell, London, S.E.5.

**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; has written "All about your Wireless Set" (Hodder & Stoughton), many B.B.C. publications and technical papers in the I.E.E. and I.R.E. proceedings. Born January 6, 1892. Private address: 82, Swan Court, Chelsea, London, S.W.3.

**EDWARDS, Frederick William.**—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. Recreations: 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.; Member of Committee

of Radio Industry Luncheon Club; 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., Erskine Road, Chalk Farm, London, N.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.

**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., 254, Vauxhall Bridge Road, London, S.W.1. B.A. (Cantab). Director, Autoveyors, Ltd., 1925-27. Recreations: tennis, motoring. Private address: 9, Kensington Hall Gardens, London, W.14.

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

**FLEMING, Alfred T., M.I.W.T.**—Incorporated Wireless Engineer. General Secreary, The Wireless League. Hon. Sec., I.W.T. (London Section). Member of Council I.W.T. Asst. Editor "Proceedings of the I.W.T." Late Hon. Sec., Edinburgh Branch of S.R.R.A. Late Member of Council S.R.R.A. Recreations: Mah Jong, photography, journalism. Private address: 327, Fulham Road, London, S.W.10.

**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, 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.**—Managing Director, Celestion, Ltd., Kingston-on-Thames. Director of Electrical Mfg. and Plating Co. Kingston and Staines Press, Ltd. Responsible for designs of all types of speakers and cabinet work marketed by Celestion since 1926. 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

## WHO'S WHO IN RADIO

Court Road, London, W.1. Born August 2nd, 1898. Recreations: golf, cricket, tennis. Private address: Bedford, Swakeley's Road, Ickenham, Middlesex. (Ruislip 483.)

**GAMBRELL, Horace William.**—Radio Publicist and Exhibitions Organiser. The Edison Swan Electric Co., Ltd., 123, Queen Victoria Street, London, E.C.4. 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, Woburn Advertising; Willing & Co., Ltd., 356-364, Grays Inn Road, London, W.C.1.; Advertising Consultant to British Radio Cabinet Manufacturers Association; 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.; and Société des Condensateurs de Trevoux, France. 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.**—Director (in charge of purchases and production), Burgoyne Wireless (1930), Ltd., Great West Road, Brentford, Middlesex. Has been commercially connected with radio since its inception. Recreations: motors, motor-racing and dog-breeding. Private address: 47, Highfield Gardens, Golders Green, N.W.11.

**GORRINGE, Rupert Clement.**—Dry Battery Contracts Manager, Lissen, Ltd., Worple Road, Isleworth, Middlesex, formerly Sales Manager, Dry Battery Dept., The Edison-Swan Electric Co., Ltd., 1932–34. Born March 30th, 1898. Recreation: motoring. Private address: 32, Compton Road, Wimbledon, London, S.W.19.

**GREEN, George Frederick.**—Publicity Manager, The Mullard Wireless Service Co., Ltd., 111, Charing Cross Road, London, W.C.2. Life interest and work in publicity in U.S.A. and Great Britain. Recreations: cinematography, motoring. 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.—Manager and General Sales 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. Clubs: Oxford and Cambridge.

**HARRIS, Charles Lynton.**—Press Representative, 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. Private address: 38, Byron Road, N. Wembley, Middlx.

**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.

**HART-COLLINS, Cyril.**—Managing Director, Hart-Collins, Ltd., 28–30, Medway Street, London, S.W.1. Executive Council, R.M.A., until 1930. Was Radio Sales Manager, Westinghouse Electrical Manufacturing Co., New York. Born August 10, 1896. Recreations: golf, fishing. Private address: 55, Cumberland Court, London, W.

**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, 57, Hatton Garden, London, E.C.1. 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.

**HEATHORN, Frank Leslie.**—Advertising Manager, The Gramophone Co., Ltd., 98–108, Clerkenwell Road, London, E.C.1. Articled and qualified as structural engineer, 1909–15; war service 1915–1919; joined the "Times," 1919, then passing through Lever Bros., Ltd., to Gramophone Co., Ltd., 1931. Recreations: motoring, music, literature, carpentry and light mechanics. Private address: One Oak, Radlett Road, Boreham Wood, Herts.

**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.

## WHO'S WHO IN RADIO

**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.

**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 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 and Wolverhampton. Managing Director, Express Radio Factors, Ltd., Furnival Street, Sheffield. Council Member, R.W.F. Chairman, Phoenix Tileries, Ltd., and John Dancer, Ltd. Born September 18, 1899. Private adress: Forest House, Chigwell, Essex.

**HODSON, John Curran.**—General Manager, United Radio Manufacturers. Ltd., and Orr Radio, Ltd., 79a, Parkhurst Road, London, N.7. Valve sales manager of Mullard Wireless Service Co., Ltd., 1924–1931; sales manager, Audiovisor, Ltd., 1931–1932. Born June 1, 1900. Recreations: golf, cricket, swimming. Private address: 8, Highfield Crescent, Northwood, Middlx.

**HOGBEN, Bernard Tunbridge, A.C.C.S. A.M.I.W.T.**, Managing Director, B.H. Radio Service and Television, Ltd., 272, High Road, London, N.15. Asst. Hon. Secretary, Institute of Wireless Technology, 1934. 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., Howard Works, Billet Road, Walthamstow, London, E.17. Vice-Chairman and Founder-Member, British Radio Cabinet Manufacturers' Association, 1932. President, Walthamstow Rotary Club, 1931–2. Born September 12, 1875. Recreations: motoring, gardening. Private address: Heathcote, Chelmsford Road, Woodford, London, E.18.

**HOLMES, Ronald Herbert.**—Director and Sales Manager, Holmes Bros. (London), Ltd., 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. President of the Radio Wholesalers' Federation, 1933-4; Chairman since its formation, 1928. Born February 6th, 1870. Private address: Denehurst, West Heath Road, Hampstead, London, N.W.

**HOWITT, Harry.**—Director of British Radio Valve Manufacturers Association, 59, Russell Square, London, W.C.1. Recreation: golf. Private address: Fountain Court, Buckingham Palace Road, S.W.1. (Sloane 0171). 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. Chairman of Committee of Management, Phonographic Performance, Ltd. Private address: "Homeleigh," Harlington, Mdx.

**HUNT, Cyril Harvey.**—Managing Director, Hellesens, Ltd., Hellesen Works, Morden Road, South Wimbledon, London, S.W.19; also Director, A. H. Hunt, Ltd., Born 1897. Recreations: tennis, golf, badminton, squash. Private address: 12, Normanton Road, South Croydon.

**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.

**HURFORD, George.**—Managing Director, Kolster Brandes, Ltd., Cray Works, Sidcup, Kent. Director of manufacture and telephone manager, Standard Telephones & Cables, Ltd. Member of

[*Continued on page 44.*]

## WHO'S WHO IN RADIO

[*Continued from page 42.*]

Institution of Electrical Engineers, and of American Society of Mechanical Engineers, Chairman, British Works' Managers Association. Member of Institute of Industrial Psychology. Twenty-seven years experience of works management in England, Belgium and France. Has several times visited America to investigate manufacturing methods. Born August 22, 1885. Private address :— "Milhurst," chislehurst Road, Chislehurst, Kent.

**HUTCHINS**, Maurice A., A.M.I.W.T.—Incorporated Wireless Engineer, Technical Secretary, the Wireless League. Late of Burndept Wireless, Ltd., and late Assistant Hon. Secretary, I.W.T. (London Section) Recreation : music. 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 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.

**JONES**, Bernard Edward.—Managing Director, Bernard Jones Publications, Ltd., 58-61, Fetter Lane, London, E.C.4. Editor, "Amateur Wireless" and "Wireless Magazine"; from 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.

**JONES**, Stewart E. Leslie, A.M.I.W.T. A.M.I.R.E.—Incorporated Wireless Engineer. Technical Inspector, the Wireless League. Late Hon. Secretary, I.W.T. (London Section), Late Siemens Research Laboratory ; G.E.C. (Final Test Dept.) ; Post Office Engineering Dept. Recreations: camping, journalism. Private address : 30, High Street, London, S.W.17.

**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. Private address : "Gippeswyk," Chalkwell Esplanade, Westcliff-on-Sea. (Leigh 75524.)

**KAY**, Henry Graeme Aytoun.—Director and General Sales Manager, 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 : Royal Automobile Club, Pall Mall, S.W.1.

**KING**, Harrie John.—Consultant, 48, Mountview Road, North Chingford, London, E.4. Founder-Member of the Institute of Wireless Technology, Assistant Secretary 1925, Secretary 1927 to date ; Editor of Institute's publications 1926 to date ; F.C.C.S., F.R.Econ.S., M.I.W.T. 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. Spare-time interests : music, dietetics, psychology, eugenics, economics, engineering.

**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., later A.D.C. to Lord Lloyd, the Governor-General of the Sudan and 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: 29, Graham Street, Eaton Terrace, S.W.1.

KOHN, Louis.—Manager of Leeds Branch, Ward & Goldstone, Ltd., 49a, Briggate, Leeds.

LATHAM, Charles, F.L.A.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. 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, Burgoyne Wireless (1930), Ltd., Great West Road, Brentford, Mdx. Has intimate knowledge of business and commerce in the Near East due to many years' residence in Persia, Egypt and the Balkan States. Recreations: motoring, gardening. 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., Hon. Treasurer 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. Recreations: gymnasium, swimming, tennis, golf.

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: 8, Monksdene Gardens, Sutton, Surrey.

LEVER, Eric Joseph.—Director, Eric J. Lever (Trix) Ltd., 8-9, Clerkenwell Green, London, E.C.1.

LEWIS, Harold Victor.—Sales Manager, Philco Radio and Television Corporation of Great Britain, Ltd., Aintree Road, Perivale, Middlx. Born August 20th, 1897. Recreations: golf, shooting. Private address: 48, Meadway Court, London, N.W.11.

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.

LOWTHORPE-LUTWIDGE, Hubert Frederick Skeffington.—Director, National Radio Service Co., 15-16, Alfred Place, London, W.C.1., 1920-22, Indigo Plantation Manager; 1923-33, Cotton Plantation Manager. Born: December 6th, 1898. Recreations: tennis, philately. Private address: 44, Clarges Street, London, W.1.

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

McCREA, Frederick Harold.—Deputy Managing Director, Dubilier Condenser Co. (1925), Ltd.; Ducon Works, Victoria Road, North Acton, London, W.3; Director, Mansbridge Condenser Co., Ltd., and Isenthal, Ltd. Member of R.M.A. Council and Component Makers Federation Council. In 1922 formed Manchester Radio Co., Ltd.; joined Dubilier 1929 as sales manager. Born October 5, 1895. Recreation: golf. Private address, 26, Sedgecombe Avenue, Kenton, Middlesex.

MACFARLANE, James.—Secretary, Radio Wholesalers Federation, 26, Hart Street,

## WHO'S WHO IN RADIO

London, W.C.1. From 1898-1928 connected with motor trade press; Appointed to present position 1928. Recreations: golf, literature. Private address: Guildford Lodge, Clarendon Road, Watford, Herts.

**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.

**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, Montague Radio Inventions & Development Co., Ltd., Beethoven Works, Gt. College Street, N.W.1. 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, Guglielmo, Marchese.**—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. Amongst 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.**—Assistant 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.

**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. Hon. Treasurer Institute of Wireless Technology. With the Cambridge Instrument Co., Ltd., 1924. Joined "Wireless Trader," 1925. Born June 5th, 1902. Private address: 42, Hunters Grove, Kenton, Middlesex (Wordsworth 2803).

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

**MONTAGUE, David.**—Director and Technical and Research Adviser, Beethoven Radio, Ltd., Beethoven Works, Great College Street, Camden Town, London, N.W.1.

**MONTAGUE, Sidney.**—Director and Sales Manager, Beethoven Radio, Ltd., Beethoven Works, Great College Street, Camden Town, London, N.W.1.

**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.**—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., and Kodak, 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; Vice President, R.M.A. from 1928 to date. Chairman, B.R.V.M.A., 1933-34; Chairman, Wireless Section, I.E.E., 1934–35.; from 1910–15 head of Research Dept., Ediswan; during war, Lieut., R.N.V.R. and Capt. R.A.F.; after war founded Mullard Companies. Recreations: hunting, golf.

**MULVEY, Richard G.**—Advertisement Manager, "The Wireless 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.

**NECK, Leslie T.**—Managing Director, Columbia Graphophone Co., Ltd., 98-108, Clerkenwell Road, London, E.C.1. Director, E.M.I. Service, Ltd., Retailers Trust, Ltd., H.M.V. Household Appliances, Ltd., Phonographic Performance, Ltd. Chairman of Executive Federation of British Music Industries, 1930-32. Formerly Manager, English Branch, Gramophone Co., Ltd., up to 1931.

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

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

**NOBLE, James George Gillbard, M.C.**—Director, Dulcetto-Polyphon, Ltd., 2-3, Newman Street, W.1. Born April 16,

## WHO'S WHO IN RADIO

1890. Recreation: golf. Private address: 18, Green Moor Link, Winchmore Hill, N.21.

**NUNN, Robert Henry.**—Managing Director, Regentone, Ltd., Worton Road, Isleworth, Middlesex. 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 15th, 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: 7, Chalcot Gardens, London, N.W.3.

**OZANNE, Guy Durand, M.C.**—Manager, Wingrove & Rogers, Ltd., 188-9, Strand, London, W.C.2. M.I.E.E. Joined Indian Army, 1909. Captain 1915, Major 1917. Entered Sandhurst 1908; Member of Council, R.M.A. 1932–33–34; First Chairman, Radio Component Manufacturers Federation, 1933, Vice-President, 1934, Vice-Chairman, Electrical Vehicle Committee of Great Britain, and Radio Industry Luncheon Club, 1934; served during the war in East Africa, 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, Roehampton.

**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.**—Managing Director, Partridge & Mee, Ltd., 74, New Oxford Street, London, W.C.1. Born February 21st, 1900. Private address: 50, Litchfield Way, Hampstead Garden Suburb, London, N.W.11.

**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., 149, Queen Victoria Street, London, E.C.4. 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.**—Staple House, 51-52, Chancery Lane, London, W.C.1. B.R.V.M.A. With Mullards 1922-32, now acting as agent. Born April 15th, 1889. Recreations: 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: 20, Woodchurch Road, West Hampstead, London, N.W.6.

**PHILIPS, Dr. Anton Frederick.**—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. R.M.A. Council. 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., LL.D., A.M.I.C.E., M.Sc. (Lafayette). 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.**—Proprietor Frank Riddiough & Son, 8-12, Simes Street, Bradford. Councillor Radio Wholesalers' Federation 1928 to date. Chairman, North Midland Section R.W.F., Assoc.Inst.R.E., Born February 12, 1889. Recreations: motoring, 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.

**RIDOUT, Herbert C.**—Advertising Manager, Columbia Graphophone Co., Ltd., 98-108, Clerkenwell Road, London, E.C.1. 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: Willow Bank, Greasby Road, Upton, Cheshire.

**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.** Editor and Manager "The Broadcaster," and associated trade publications, Odhams Press, Ltd., 29, Bedford Street, Strand, London, W.C.2. Hon. Sec., Radio Industry Golfing Society. Formerly with Marconi's Wireless Telegraph Co., Ltd. Born May 6, 1900. Recreation: golf. Private address: 28, Vernon Road, Leigh-on-Sea, Essex.

**ROBINSON, Thomas Allen White.**—Joint Managing Director, Pye Radio, Ltd., Radio Works, Cambridge. Director Lissen, 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., Erskine Road, Chalk Farm, London, N.W.3. Member R.M.A. Council 1930–34, entered Marconi's Wireless Telegraph Co., Ltd., before the war; served in Flying Corp, Radio Section, 1915–18; founded firm of Edward E. Rosen & Co. in 1919; converted to limited company 1927; has

## WHO'S WHO IN RADIO

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 : farming. Private address : Olde Butterbox, Scaynes Hill, Sussex.

**RYAN, Percy Hector.**—Sales Manager, Tungsram Electric Lamp Works (G.B.) Ltd., 72, Oxford Street, London, W.1. ; 1924-26, Cleartron Radio, Ltd. ; 1926-27, S.T. Valve Co., Ltd. ; 1927-29, Lissen, Ltd. ; 1929-34, Tungsram. Born : July 2nd, 1894. Private address : 8, Columbia Avenue, Worcester Park, Surrey.

**SALAMAN, Walter John.**—Sales Manager, Carrington Manufacturing Co., Ltd., 24, Hatton Garden, London, E.C.1. 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, Queens 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. Vice-chairman, Ulster Radio Traders' Association. Started Eirco (Wholesale), Ltd., who are also electrical factors, in 1921. Born : November 18th, 1893. Recreations : golf, bridge. Private address : 17, Downview Avenue, Belfast.

**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 ; proprietor, G. C. Shore & Co., Newman Street, London, W.1, 1928 ; general sales manager, Symphony Gramophone Co., Ltd., and National Electric Co., Ltd., 1929-30. Was Sales Manager of Flinders (Wholesale), Ltd., up to 1932. Born August 26th, 1899. Private address : Broad Lane, Bradmore, Wolverhampton.

**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, Leslie Sydney, B.Sc., A.M.I.R.E.**—Sales and Service Manager, Sunbeam Electric, Ltd., Park Royal Road, North Acton, London, N.W.10.; 1928-30, with Philips Lamps, Ltd. ; 1930-33, with Johnson Talking Machine Co., Ltd. Born : December 16th, 1905. Recreation : golf. Private address : 207, Pitshanger Lane, Ealing, London, W.

**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

[*Continued on page 53.*]

## WHO'S WHO IN RADIO

[*Continued from page* 50.]

address: Ravenswood, Gordon Avenue, Highams Park, Essex.

**STANLEY, Charles Orr.**—Joint Managing Director, Pye Radio, Ltd., Africa House, Kingsway, London, W.C.2. Director, Ever Ready Co. (Gt. Britain), Ltd. Recreations: yachting, hockey, golf, fishing. 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, 205–31, Shaftesbury Avenue, London, W.C.2. With Exide since 1920. Two years' Service Manager; 1923–4, Sales Engineer, South-West area; 1924–31, Manager, Bristol and West of England Depot; 1931 to date, as above. Born: June 7th, 1892. Recreations: shooting, golf, fishing. Private address: "Craigard," Ridge Park, Purley, Surrey.

**STRACHAN, David Grant.**—Secretary, 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.

**STREETON, William Laundon.**—Artistes and Recording Manager, Gramophone Co., Ltd., 98, Clerkenwell Road, London, E.C.1. Recreations: music, reading, swimming, walking. Private address: 103, Fordwych Road, West Hampstead, London, N.W.

**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. During war R.F.C. and R.A.F. Wireless Section; Radio Communication Co., Ltd., 1922-27. Born April 23rd, 1898. Recreations: golf, yachting. 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.**—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.

**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 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. Chairman Middlesbrough Branch W.R.A., secretary N.E. Area, W.R.A., and National

## WHO'S WHO IN RADIO

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: "Southlands," Walton Avenue, Linthorpe, Middlesbrough.

**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. 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.

**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).

**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.

**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, completioners of advertising. 1912-14, with Rembrandt Intaglio Printing Co. (Showcard 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.

**WEESE, George Rodolph, B.Sc., M.I.R.E.** — Member Veteran Wireless Operators' Association, Managing Director, Erie Resistor, Ltd., Waterloo Road, Cricklewood, London, N.W.2. Chairman, Standardisation Committee, Canadian R.M.A., about 1927–31. At present Vice-President, Erie Resistor Co., of Canada, Ltd., and Director, Erie Resistor Corporation, Erie, Penna; 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. Private address: "Toronto House," Russell Road, Moor Park, Northwood, Middlesex.

**WHEELDON, Douglas Parker.**—Asst. 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.

**WHEELER, Ralph Edmund.**—Secretary and Manager, Hart Collins, Ltd., 28–30, Medway Street, London, S.W.1. On Executive Council R.M.A. 1930 ; Assistant Works Manager and Organiser, British School of Motoring 1913 ; Machine Gun Corps 1916 ; since 1920 present company. Born March 18th, 1886. Recreations : billiards, motoring. Private address : Not The Towers, Manor Road, Mitcham.

**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, Middlesex.

**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, Ltd., 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. Vice-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 : 20, Blenheim Gardens, Wembley Park, Middlesex.

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

**WILLIS, Robert Gordon.**—Joint Managing Director, Dulcetto-Polyphon, Ltd., 2-3, Newman Street, Oxford Street, London, W.1. ; Member R.W.F. Council. Born May 20, 1901.

**WILLMOTT, Charles William.**—Proprietor, Philco East Anglian Distributors, Britannia Road, Norwich ; Aerodyne Distributing Co., Norwich ; Willmotts, 43-51, Prince of Wales Road, Norwich, and Market Place, Diss. Chairman, Eastern Counties W.R.A., and National Councillor. 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.

**WINKLES, Wallace Frederick.**—Managing Director and Chief Engineer, Lamplugh Radio Ltd., "Silver Ghost" Works, Coventry. Created the radio department of S. A. Lamplugh, Ltd., and commenced manufacturing radio products in 1923 ; previously interested in electrical engineering connected with kinema projection and studio work ; an early aurelian radio enthusiast, gained knowledge and experience during active war and Army service, 1914-21. Born December 26th, 1894. Recreations : motoring. Private address : 151, Robin Hood Lane, Hall Green, Birmingham.

**WRAGGE, Alfred.**—Until 1933 manager, Radio Department, Selfridge & Co., Ltd., 1909-18, worked in Japan and China for Asiatic Petroleum Co. Born April 30th, 1882. Recreations : golf, fishing, bridge. Private address : 8, Campden Hill Mansions, London, W. 8. (Park, 1987).

**WYBORN, Edward John.**—Chief Engineer, E. K. Cole, Ltd., Ekco Works, Southend-on-Sea, Essex. B.Sc. (Engineering) ; A.C.G.I. Born July 9th, 1902. Private address : "Roy 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.

# QUICK TESTS for Tracing Faults in Sets

*Compiled from "The Service Engineer"*

The correct operating voltages measurable at readily accessible points in approximately 100 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 paragraph for each receiver 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 66.

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**Aerodyne Curlew Universal.**—Caution: On both A.C. and D.C. chassis is "live" with regard to earth. Voltages between chassis and terminals on output transformer panel: top (blue), 190v. (output valve anode); second (blue), 225v. (H.T. smoothed); third (black), 0v.; bottom (red), 235v. (H.T. unsmoothed).

VP13A (H.F.) anode, 160v., 4.8 m.a.; aux. grid, 73v. SP13 (detector) anode, 35v., .6 m.a.; aux. grid, 22v. Pen.26 (output) anode, 190v., 34 m.a.; aux. grid, 130v.

**Aerodyne Swallow.**—Voltages between chassis and tags at right side of panel on speaker transformer: top (1) blue, 212v., output valve anode; (2) connected to (4); (3) black, 400v., H.T. unsmoothed; (4) red, 250v., H.T. smoothed.

15A2 or FC4 (frequency-changer) anode, 250v., 1.25 m.a. (.75 for FC4); aux. grid, 70v.; osc. anode, 135v. VP4 (I.F. [125 K.C.]) anode, 250v., 3.5 m.a.; aux. grid, 66v. TDD4 (second detector) anode, 90v., 1.9 m.a. Pen.4VA (output) 212v., 32 m.a.; aux. grid, 250v., 4 m.a.

**Aerodyne Swan "Straight" Mains Three.**—Voltage on speaker transformer to chassis from right: (1) H.T. unsmoothed, 370v. (2) output valve anode, 240v. (3) and (4) H.T. smoothed, 255v.

VP4 (H.F.) anode, 220v., 3.5 m.a.; screen, 105v. 354V (detector) 150v., 3 m.a. Pen. 4VA (output) anode, 240v. 30 m.a.; aux. grid, 255v., 5 m.a.

**Aerodyne "Raven."**—PM1HL (detector) 80v., 2 m.a. PM1LF (L.F.) 120v., 4.1 m.a. PM2A (output) 118v., 4 m.a.

**Alba A.C. Mains Superhet Five.**—SP4 (detector-oscillator) anode, 250v., 1.1 m.a.; aux. grid, 65v. V.P.4 met. (I.F.) anode 250v., 2.5 m.a.; aux. grid, 65v. S4VB met. (detector) anode, 80–90v., 2 m.a.; screen, 2 meg. resistan in lead gives erroneous readings. PM24M (output) anode, 240v., 32 m.a.; aux. grid. 255v., 6m.a.

**Alba 52 A.C. Mains Three.**—Between chassis and following points on speaker transformer (looking from back and counting from right): (1) red, 114v. negative, H.T.—; (2) white, 235v. positive, output valve anode; (3) black, 250v. positive, H.T. + smoothed; (4) blue, 0v. (1) and (4) are field terminals and (2) and (3) are output transformer primary.

VP4 met. (H.F.) anode 234v., 2.5 m.a.; aux. grid, 102v. SP4 met. (detector) anode 94v., .2 m.a.; aux. grid, 28v. PT41 (output) anode, 234v., 31 m.a.; aux. grid, 250v., 6 m.a.

**Alba Model 21.**—Battery connections (Drydex S49): H.T. +, 108v.; G.B.—, —3v.

SP2 met. (H.F.) anode, 107v., 1.8 m.a.; aux. grid, 106v. PM1HL (detector) anode, 48v., 1 m.a. PM22A (output) anode, 102v., 6.2 m.a. aux. grid, 116v., 1.8 m.a.

**Atlas 334 Mains Three.**—Voltages at power pack terminals (from output valve end towards first valve): (1) output valve anode, 215v.; (2) H.T. + smoothed, 220v.; (3) feed to detector, 150v.; (4) screen of first valve, 110v.; (5) output valve bias, 8v. negative; (6) pick-up, 0v.; (7) bias for first valve, .75v.; (8) aerial, 0v.; (9) chassis.

A.C./SG/VM (H.F.) anode, 185v., 15 m.a. A.C.2HL (detector) 90v., 3.5 m.a. 41MP (output) 215v., 20 m.a.

**Atlas 758.**—Voltages between chassis and green speaker field terminals on mains adjustment panel behind rectifier: outer terminal (H.T. unsmoothed) 390v.; inner terminal, 240v.

FC4 (frequency-changer) anode, 234v., .9 m.a.; aux. grid, 65v.; osc. anode, 65v., 1.9 m.a. VP4

## QUICK TESTS

(I.F. [117.5 K.C.]) anode, 138v. 4.8 m.a.; aux. grid., 108v. TDD4 (second detector) triode anode, 114v., 1.4 m.a. ACO44 (output) anode 230v., 43 m.a.

**Beethoven S.G.4 Transportable.**—Battery connections: Red, 120v.; green, 96v.; white, G.B.+; blue, 1.5 negative; yellow, 3v. negative. PM12M (H.F.) anode, 118v., 1.8 m.a.; screen, 80v. PM1HL (detector) 38v., .8 m.a. PM1HL (L.F.) 95v., .65 m.a. PM22A (output) anode, 118v., 4.2. m.a.; aux, grid 95v., 1 m.a.

**Blue Spot Class B Four.**—Current in negative H.T. lead; with no signal, 7.5–8 m.a. Operating voltages: H.T.+1, 70–75v.; H.T.+2, 120v.; G.B.—1, —1.5v.; G.B.—2, —4.5 or —6v.; G.B.—3, —16v.

VS2 (H.F.) anode, 116v., 1.6m.a.; screen, 70v. HL2 (detector), 75v., 2.1. m.a. 215P (driver), 73v., 2.1 m.a. (with —4.5v. bias). PM2B (Class B output), 120v. each anode.

**Burgoyne Class B Three.**—H.T., 120v.; G.B. —1, —1.5v.; G.B.—2, —3v.

H2 (detector), 82v., 1.2 m.a. L2 (driver), 118v., 2.4 m.a. PD220 (Class B output) 120v., 1 m.a. each anode.

**Burgoyne De Luxe Class B.**—Battery connections (Drydex S48): large black plug, H.T.—. small black plug, —3 or —4.5v.; red plug, 120v. PM1HL (detector) anode 72v., 1.7 m.a. PM2DX (driver) anode, 120v., 2.8 m.a. PM2BA (Class B output), each anode, 120v., 2.2. m.a.

**Burgoyne Five-Valve Battery Superhet.**—Battery connections (Drydex S.48) H.T.+1, 85v.; H.T.+2, 120v.; G.B.—1, 1.5v.; G.B.—2, 9v.

SP2 (frequency-changer) anode, 120v., 1 m.a.; aux. grid, 83v. VP2 (I.F. [117.5 K.C.]) anode, 120v., 1 m.a.; aux. grid, 83v. PM1HL (second detector) anode, 65v., 2 m.a. PM2DX (driver) anode, 118v., 4.7 m.a. PM2B (class B output) each anode, 118v., .85 m.a.

**Burgoyne Five-valve Portable.**—Battery connections: H.T.+1, 36–54v.; H.T.+2, 45–54v.; H.T.+3, 99v.; G.B.—1, —4.5v.; G.B.—2, —9v. PM1HF (H.F.) 54v., 1 m.a. PM1HL (detector) 50v., .9 m.a. PM1LF (L.F.) 98v., 1 m.a. PM2 (output) 93v., 2.1 m.a.

**Burndept 210 Universal Superhet.**—Between chassis and terminals on speaker transformer: top (1) green, 0v.; (2) black, 204v., H.T. smoothed; (3) blue, 182v., output valve anode; (4) red, 226v., H.T. unsmoothed.

FO13 (frequency-changer) anode, 208v., .6 m.a.; aux. grid, 76v., 4.3 m.a.; osc. anode, 76v., 1.6 m.a. VP13A (I.F. [473 K.C.]) anode, 204v., 3.2 m.a.; aux. grid, 100v., 1.4 m.a. SP13 (second detector) anode, 49v., .3 m.a.; aux. grid, 55v., .1 m.a. Pen. 26 (output) anode 182v., 33 m.a.; aux. grid, 110v., 4.8 m.a.

**Bush S.A.C. 4 Mains Superhet.**—Voltages between rear terminals of speaker transformer and chassis: top, valve anode, 250v.+; bottom, H.T. smoothed, 265v.+. Rear electrolytic condenser case, 85v. Front electrolytic condenser case, 110v. negative.

SP4 (first-detector-oscillator) anode, 240v., .7 m.a.; aux. grid, 60v. VP4 (I.F. [123 K.C.]) anode, 217v., 2.4 m.a.; aux. grid, 105v. 354V (anode bend second detector) .2-.3 m.a. PM24M (output) anode, 250v., 29 m.a.; aux. grid, 265v., 4·5 m.a.

**C.A.C. Austin Battery Set.**—Battery connections (Drydex H.1073 combined H.T. and G.B.): H.T.+1, 123v.; H.T.+2, 75v.; G.B.—1, 1.5v.; G.B.—2, 3v.; G.B.—3, 4.5v.; G.B.—4, 9v. Total current measured in negative lead, approximately 10 m.a.

VHT2 met. (frequency-changer) anode, 123v., 1.4 m.a.; screen, 75v.; osc. anode, 82v. VP215 (I.F. [110 K.C.]) anode, 123v., 2 m.a.; aux. grid, 80v. L2DD met. (detector) anode, 88v., 1.5 m.a. P220 (driver) anode, 102v., 2.6 m.a. PD220A (class B) each anode, 121v., 1.35 m.a.

**City Accumulator Co.'s "Austin Super."**—Voltages between terminals on speaker transformer and chassis, looking from back and counting from left:—(1) red, H.T. unsmoothed, 355v. positive. (2) maroon, output valve anode, 225v. positive, (3) yellow, H.T. smoothed, 235v. positive, (4) black, 102v. positive.

MX40 (first-detector oscillator) anode, 235v., 3.5 m.a.; screen, 70v.; oscillator anode, 140v., 2 m.a. VMP4 (I.F. [frequency 110 K.C.]) anode, 235v., 7.5 m.a.; aux. grid, 100v., 2 m.a. MHD4 (second detector and L.F.) 135v., 2.5 m.a. MPT4 Cat (output) anode, 225v., 30 m.a.; aux. grid, 235v., 7 m.a.

**Cossor 353 Battery Set.**—Battery connections are: green (power) 120v.; yellow (screen) 60v.; G.B.—1, 3–6v. negative; G.B.—2, 9v. negative.

220VS (H.F.) anode, 120v., .9 m.a.; screen, 60v. 210SPT (detector) anode, 57v., .9 m.a.; aux. grid, —. 220HPT (output) anode, 117v., 3.5. m.a.; aux. grid, 120v., .8 m.a.

**Cossor 3468 Mains Three.**—Between chassis and terminals on speaker transformer: R, pink, 200v., output valve anode; Y, yellow, 208v., H.T. smoothed; B, Black, 310v., H.T. unsmoothed. R and Y are transformer primary, Y and B, field.

MVSG met. (H.F.) anode 200v., 8 m.a.; screen, 65v. 41MH (detector) anode 130v., 2 m.a. 41MP (output) anode, 200v., 24 m.a.

**Cossor 435 Mains Three.**—Voltages between terminals on output transformer and chassis, counting from inside: (1) H.T.+ unsmoothed, 300v. (2) output valve anode, 180v. (3) and (4) H.T.+ smoothed, 200v.

MVSG (H.F.) anode, 200v., 4.5 m.a.; screen, 62v. MS Pen. (detector) anode, 85v., 2.25 m.a.; aux. grid, 30v. MP Pen (Output) anode, 185v., 24 m.a.; aux. grid, 200v., 4 m.a.

**Cossor 635 Superhet.**—Voltages to chassis:—Speaker transformer, left-hand terminal, 200v.; centre, 220 v.; right-hand, 350v.

Valve readings with volume control at maximum and no signal:—MVS/Pen (first detector) anode, 220v., 2 m.a.; aux. grid, 85–125v., .5–2 m.a. 41MP (oscillator) anode, 50–90v., 6–10 m.a. MVS/Pen (I.F. [134 K.C.]), anode 220v., 3 m.a.; aux. grid, 85–125v., — m.a. MSG/HA (detector), anode, 110v., .1 m.a.; screen, 50v.; — m.a. MP/Pen (output) anode, 200v., 30 m.a.; aux. grid, 200v., 6 m.a. 442BU (rectifier).

**Climax T.C.111 Mains Three.**—Voltages between speaker transformer terminals and chassis, looking from back and counting from left: (1) H.T. unsmoothed, 360v. (2) output valve anode, 218v. (3) and (4) H.T. smoothed, 230v.

MM4V (H.F.) anode, 230v., 1.8 m.a.; screen, 85v. 354V. (detector) anode, 102v., 3.4 m.a. Pen. 4V (output) anode, 218v., 26 m.a.; aux. grid, 230v., 10 m.a.

**Climax S4 Superhet.**—Voltages to chassis: speaker transformer, left-hand tag, 350v.; 2nd tag from left (brown and white), 260v.

SP4 plain (detector-oscillator), anode 270v., 1.15 m.a.; screen, 110v., .5 m.a. MM4V (I.F. [121 K.C.]), anode, 270v., 2.3 m.a.; screen 110v., — m.a. 354V. (detector) anode, 90v., 4.2 m.a. Pen. 4V (output) anode, 260v., 25 m.a.; aux. grid, 275v., 10 m.a. 442BU (rectifier), anodes, 340–0–340 A.C.

**Decca Six-valve Superhet.**—Voltage between casing of outer electrolytic (—) and chassis (+), 135v. Between second terminal from inside on speaker transformer (—) and chasis (+), 135v. Between third terminal tag (+) and chassis (—), 287v. (H.T. smoothed). Between fourth terminal and chassis, 275v. (output valve anode).

VP4 (H.F.) anode, 200v., .5 m.a.; aux. grid 80v. A.C./S.G. (first detector oscillator) anode, 200v., .5 m.a.; screen, 80v. VP4 (I.F. [frequency 183 K.C.]) anode, 200v., 3.5 m.a.; aux. grid 80v. A.C./HL/DD (second detector) 130v., 3.25 m.a. A.C./Pen. (output) anode, 275v., 38-40 m.a.; aux. grid 275v., 5–6 m.a.

**Ekco A.C.74 Superhet.**—Voltages between speaker transformer terminals and chassis (top to bottom):—(1) and (2) joined, H.T. + smoothed,

275v., (3) output valve anode, 255v. (4) H.T. + unsmoothed, 365v.

SP4 (first-detector oscillator) anode, 225v., .8 m.a.; aux. grid, 90v. VP4 met (I.F. [frequency 110 K.C.]) anode, 225v., 2.2 m.a.; screen, 90v. A.C./HL/DD (second-detector and L.F.) 110v., 1.8 m.a. AC/Pen (output) anode, 250v., 30 m.a.; aux. grid, 250v. 5 m.a.

**Ekco S.H.25 A.C. Superhet.**—Voltages between speaker transformer and chassis counting from the top: (1) green, 118v. negative (power pack negative), (2) red and white, 226v. (output valve anode). (3) blank, (4) red, 240v., H.T. + smoothed.

MSG/LA (first detector), anode, 200v., 1.6 m.a.; screen, 85v. 354V (oscillator), anode 55v., 1.25 m.a. VM4V (I.F. [frequency 110 K.C.]), anode, 200v., 4.3 m.a.; screen, 85v. A.C./H.L. (second detector) anode, 80v., 2.6 m.a. PM24M (output) anode, 226v., 24 m.a.; aux. grid, 240v., 6 m.a.

**Ferranti 1933 Gloria.**—Voltages between terminals on speaker transformer and chassis, counting from left and looking from rear: (1) green, H.T. + smoothed, 250v. (2) black, LP4 anode, 235v.; (3) blue, H.T.—unsmoothed, 155 negative; (4) red, chassis.

VPT4 (H.F.) anode, 240v., 2 m.a. D4 (oscillator) anode, 170v., 7–8 m.a. VPT4 (first detector) anode, 220v., 1 m.a. VPT4 (I.F. [125 K.C.]) anode, 220v., 4.5 m.a. H4D (second detector) anode, 125v., .9 m.a. LP4 (output) anode, 235v., 48 m.a.

**Ferranti 1933 Lancastria Parva.**—VHT4 (first detector oscillator) anode, 160v., 1.3 m.a.; oscillator anode, 60v., 1 m.a.; screen, 80v. VPT4 (I.F. [125 K.C.]) anode, 172v., 2.9 m.a.: screen, 80v. H4D (second detector and L.F.) 80v., 2.5 m.a. LP4 (output) 200v., 52 m.a.

**Ferranti Arcadia (1934 model).**—Between chassis and terminals (left to right) forming upper (front) row on panel above mains transformer: (1) blue, 110v. negative, H.T.—; (2) green, 230v. positive, output valve anode; (3) red, 240v. positive, H.T. + smoothed; (4) chassis.

VHT4 (frequency-changer) anode, 168v., 1.7 m.a.; screen, 62v.; osc. anode, 82v., 1.4 m.a. VPT4 (I.F. [125 K.C.]) anode, 165v., 3.3 m.a.; aux. grid, 82v. H4D (detector) triode anode, 145v., 1.7 m.a. LP4 (output) anode 223v., 46 m.a.

**Ferranti Lancastria (1934-5 model).**—Between chassis and terminals on speaker transformer (looking from back and from left to right): (1) black to smoothing condenser, blue to H.T.—105v. negative; (2) green to output valve anode, 240v., positive; (3) red to smoothing condenser, H.T. + smoothed, 250v.

VHT4 (frequency-changer) anode 200v., 3 m.a.; screen, 100v.; osc. anode, 100v., 1.5 m.a. VPT4 (I.F. [125 K.C.]) anode, 200v., 5 m.a.; aux. grid, 100v. PT4D (output) anode 240v., 28 m.a.; aux. grid, 250v., 8 m.a.

**G.E.C. A.C.-D.C. Three.**—Between chassis and following terminals on speaker transformer (looking from back): bottom right-hand (H.T. unsmoothed) 200v.; second from right on top (red) (H.T. smoothed) 185v.; second from left (orange) (output valve anode) 173v.

Valve readings, 250v., A.C. supply: H30 (detector) anode, 85v., 2 m.a. N30K (output) anode, 215v., 33 m.a.; aux. grid, 190v., 7 m.a.

Valve readings, 250v. D.C. supply: H30. anode, 82v., 1.8 m.a. N30K, anode 200v., 32 m.a.; aux. grid, 180v., 6.5 m.a.

**General Electric Co.'s A.V.C.5.**—Between chassis and terminals on speaker transformer (counting from left to right): (1) black, chassis; (2) orange, output valve anode, 245v.; (3) red, to switch, 0v.; (4) grey, to switch, 0v.; (5) black, to switch, 0v.; (6) red, H.T. + smoothed, 260v.: (7) grey, H.T. —, 75v.

X30 (frequency-changer) anode, 260v., 2 m.a.; screen, 75v.; osc. anode, 160v., 3 m.a. W30 (I.F. [125 K.C.]) anode, 260v., 7 m.a.; screen, 260v. DH30 (second detector) anode, 105v. 2 m.a. N30 (output) anode, 235v., 32 m.a.; aux. grid, 250v.

**G.E.C. Eight-valve Superhet.**—Voltages between terminals on speaker transformer and chassis. Top terminal, 110v. negative; next below, H.T. + smoothed, 260v. positive; bottom terminal, output valve anode, 240v.

VMS4 Cat. can. (H.F.) anode, 250v., 2–3 m.a.; screen, 80v. VMS4 Cat. can. (first detector) anode, 250v., 1–1.5 m.a.; screen, 80v. ML4 (oscillator) 150v., 10 m.a. VMP4 (I.F. [frequency 125 K.C.]) 250v., 5-6 m.a. MHD4 (second detector and L.F.) 190v., 1 m.a. MH4 (muting valve) 0v., 0 m.a. MPT 4 (output) anode, 240v., 32 m.a.; aux. grid, 250v.

**G.E.C. Five-valve Mains Superhet.**—MS4B (first detector oscillator) anode, 240v., 1.2 m.a.; screen 85v. VMS4 (I.F [frequency 107 K.C.]) anode, 250v., 7 m.a.; screen, 85v. MS4B (second detector) 90–100v., .4 m.a. MPT4 (output) anode, 235v., 31 m.a.; aux. grid, 250v., 6 m.a.

**General Electric Co.'s G.B.4.**—Battery connections (G.E.C., combined H.T. and G.B. unit, No. L.259, 150v.): H.T. + 1, red, + 141v.; H.T. + 2, light blue, 68v.; H.T.—, G.B +, dark blue, to corresponding socket; G.B.—1, yellow, —9v.; G.B.—2, orange, —6v.

VS24 met. (H.F.) anode, 140v., 2.3 m.a.; screen, 58v. VP21 met. (detector) anode, 50v., 2.5 m.a.; aux. grid, 58v. L21 (driver) anode, 140v., 1.75 m.a. B21 (class B output) each anode, 140v., 1 m.a.

**General Electric Co.'s M.C.3.**—Operating voltages: H.T., 120v.; G.B.1, —1.5v.; G.B.2, —9v. H.L.2 (detector) —v., .25–.5 m.a. H.L.2 (L.F.) 107v., 1.5–2 m.a. P.2 (output) 107v. 7–9 m.a.

**Halcyon 4501 Universal Superhet.**—Voltage between top terminal on speaker panel and chassis, 250v.

FC13 (frequency-changer) anode, 222v., 3.8 m.a.; aux. grid 100v., 4.2 m.a.; osc. anode, 100v. 1.9 m.a. VP13A met. (I.F. [110 K.C.]) anode, 210v., 4.8 m.a.; aux. grid, 125v., 1.8 m.a. WM26 Westector (detector). HL1320 met. (L.F.) anode, 90v., 2.4 m.a. Pen.3520 (output) anode, 214v., 38 m.a.; aux. grid, 223v., 6.7 m.a.

**Kolster-Brandes A.C. "New Pup."**—Voltages between chassis and terminals on top of speaker transformer (looking from back and counting from left): (2) 210v. positive (output valve anode); (5) 230v. positive (H.T. smoothed); (6) 70v. negative (voltage drop across field coil).

41MH (detector) anode, 100v., 3.5 m.a. AC2Pen. (output) anode, 210v., 28 m.a.; aux. grid, 230v., 6 m.a.

**Kolster-Brandes 333 and 333A Battery Receivers.**—Battery connections: H.T.— and G.B. +, black H.T. + 1 (light blue) 60v.; H.T. + 2 (brown) 72v.; H.T. + 3 (royal blue) 120v.; G.B. —1 (green) —4.5v.; G.B. —2 (yellow) —6v. or —9v.

VS24 (H.F.) anode, 120v., .4 m.a.; screen, 99v. S23 (detector) anode, 60v., 2 m.a.; screen, 60v. PT2 (output) anode, 115v., 3.2 m.a.; aux. grid, 120v., .8 m.a.

**Kolster-Brandes 381 Superhet.**—Voltages between chassis and following leads: Red and black, H.T. unsmoothed, 230v.; black, H.T. smoothed by choke, 220v.; blue, output valve anode, 140v.; red, H.T. smoothed, 150v.

15D1 or 13PGA (frequency-changer) anode, 125v., 5 m.a.; screen, 55v., 4.5 m.a.; osc. anode, 120v., 5 m.a. 9D2 or 13VPA (I.F. [130 K.C.]) anode, 140v., 8 m.a.; aux. grid, 100v., 2 m.a. 11D3 or 13DHA (second detector) anode, 80v., .1 m.a. 7D3 or 40PPA (output) anode, 140v., 35 m.a.; aux. grid, 140v., 8 m.a.

**Kolster-Brandes 666 Superhet.**—Between terminals on speaker transformer and chassis: top row, left to right: black, 0v.; blue (V. 5 anode) 220v.; red (H.T. +) 232v.; red and black, 80v. negative.

Valve readings with no signal:—9A1 (H.F.), anode, 200v., .8 m.a.; aux. grid, 44v., .4 m.a. MSPen. (detector oscillator) anode, 200v., .8 m.a.; aux. grid 30v., .3 m.a. 9A1 (I.F. [130 K.C.]), anode, 200v., 4 m.a.; aux. grid 80v., 1.5 m.a. 11A2 (detector), 100v., 1 m.a. MP Pen. (output) anode, 220v. 30 m.a.; aux. grid, 230v., 4 m.a.

## QUICK TESTS

**Lissen 8093 All-mains Band-pass Three.**—Between chassis and speaker transformer terminals: Left (1) white 275v., H.T. unsmoothed; (2) blue, 252v., H.T. smoothed; (3) blue, 245v., output valve anode.

AC/SGV met. (H.F.) anode, 250v., 6 m.a.; screen, 70v. AC/HL (detector) anode, 82v., 3.6 m.a. AC/PT (output) anode, 245v., 30 m.a.; aux. grid, 200v., 4.5 m.a.

**Lissen All-Electric Three-valve Receiver.**—Voltages between output transformer terminals and chassis:—175v. and 185v.

A.C./SGV (H.F.) anode, 183v., 2.9 m.a.; screen, 75v. A.C./HL (detector) 60v., 2.4. m.a. PT4 (output) anode, 175v., 17 m.a.; aux. grid, 185v., 2.3 m.a.

**Lissen Skyscraper Seven.**—SG215 (first detector) anode, 100v., 1.5 m.a.; screen, 72v. HL2 (oscillator) 100v., 3.9 m.a. SG215 (I.F. [126 K.C.]) anode 120v., 1.8 m.a.; screen, 72v. AVC2 (single-diode-pentode second detector) anode 75v., 3.6 m.a.; aux. grid, 72v. L2 (driver) anode 120v., 1.2 m.a. B2 (Class B output valves) anode, 120v., .85 m.a.

**Lissen 8073 Three Valve Battery Set.**—Battery connections (Lissen 120v.), yellow plug, negative; white, 4½v.; black (L.T. — and H.T. —) 9v.; mauve, 60v.; pink, 120v.

SG2V (H.F.) anode, 100v., 2.4 m.a.; screen 60v. L2 (detector) anode, 39v., 1.9 m.a. PT225 (output) anode 113v., 5.4 m.a.; aux. grid, 117v., 1.1 m.a.

**McMichael A.C. Mains Superhet.**—Voltages between terminals on speaker transformer and chassis counting from top: (1) black, H.T. unsmoothed, 365v.; (2) blue, output valve anode, 232v.; (3) green, H.T. smoothed, 243v.; (4) red, joined to (3). (1) and (4) are speaker field, (2) and (3) transformer primary. Between case of front electrolytic condenser and chassis, 182v. (half rectified voltage).

AC/TP (first-detector oscillator) anode, 215v., 1.1 m.a.; aux. grid, 115v.; oscillator anode, 130v., 1.6 m.a. AC/SG/VM (I.F. [frequency 406 K.C.]) anode, 242v., 7.7 m.a.; screen, 115v. AC/HL/DD (second detector and L.F.) 100v., 1.5 m.a. AC/Pen. (output) anode, 232v., 25 m.a.; aux. grid, 243v., 5 m.a.

**McMichael Duplex Transportable.**—Battery connections (special Grosvenor SR490DL): H.T.+99v.; G.B.—, —6v.

215SG (H.F.) anode, 98v., 1.5 m.a.; screen, 35v. HL2 (detector) anode, 50v., .5 m.a. HL2 (L.F.) anode, 30v., .5 m.a. 215P (driver) anode, 100v., 3.5 m.a. 240B (class B output) each anode, 100v., 1 m.a.

**McMichael Lodex Battery Five.**—Two-battery type set:—H.T.1, +, 120v.; —, 0v. H.T.2, +, 120v.; —, 0v. Single battery type:—H.T.+2, 120v.; H.T.+1, 70v.; G.B., —4½v.

Measurements with 130v. H.T. and volume control maximum: S.G.215A (H.F.) anode 120v., 1.1 m.a.; screen, 75v., — m.a. (H.F.) anode 120v., 1.1 m.a.; screen, 120v., — m.a. HL2 (detector), 100v., 2.6 m.a. P220 (driver), 120v., 4.4 m.a. PD220 (Class B output), 125v. each anode.

**McMichael S.M.C. Four Portable.**—215 S.G. (H.F.) anode 103v., .85 m.a.; screen, 60v. HL210 (detector) anode, 38v., .7 m.a. HL210 (L.F.) anode, 88v., .9 m.a. Pen.220 (output) anode, 116v., 4 m.a.; aux. grid, 120v., .8 m.a.

**McMichael Twin Supervox.**—Voltages between terminals of left-hand speaker transformer and chassis counting from outside: (1) H.T. unsmoothed, 370v.; (2) output valve anode, 235v.; (3) and (4) speech winding; (5) H.T.+ smoothed, 252v.

MS4B (H.F.) anode, 220v., 4.5 m.a.; screen, 112v., 1.25 m.a. MS4B (H.F.) anode, 215v., 4.5 m.a.; screen, 112v., 1.25 m.a. MH4 (detector) 90v., 3.6 m.a. MPT4 (output) anode, 240v., 24 m.a.; aux. grid, 205v., 4 m.a.

**Majestic Midget.**—6A7S (detector-oscillator), anode, 255v.; aux. grid, 92v.; osc. anode, 92v. 6F7S (I.F. and second detector), H.F. pentode anode, 255v.; aux. grid, 92v.; detector anode, 100v. 41(output), anode, 240v.; aux. grid, 255v.

**Marconiphone 269 Portable.**—Battery connections: H.T.+1, 60v.; H.T.+2 (for P.T.2 aux. grids) 155v.; H.T.+3, 176v.; G.B.—1, —1.5v; G.B.—2, —9v.

Valve readings, new batteries, no signal, and set switched to long waves:—S21 met. (H.F.) anode, 105v., .6 ma.; screen, 60v. S21 (first-detector-oscillator) anode 108v., 1 m.a.; screen 48v. VS2 met. (I.F. [frequency 125 K.C.]) anode 140v., 1 m.a.; screen, 60v. HL2 met. (second detector) 70v., .7 m.a. PT2 (output pentodes) anodes, 170v., .6 m.a.; aux. grids, 170v., .6 m.a.

**Marconiphone 272 Receiver and 274 Radiogram.**—MS4B met. (detector-oscillator) anode, 180v., 4 m.a.; screen, 70v., 1 m.a.

VMS4 (I.F. [125 K.C.]): anode, 190v., 5.5 m.a.; screen, 70v., 2.4 m.a.; MH4 met. (detector), anode 75v., 2.8 m.a. MPT4 (output) anode 220v., 30 m.a.; aux. grid, 175 v., 6 m.a.

**Marconiphone 279 Portable.**—Between chassis and following terminals on speaker transformer: F. (green and yellow) 113v. negative, H.T.—; Tap (green) 10v. negative, MPT4 bias; O.P. (red), 250v. positive, H.T.+ unsmoothed; O.P. (red and yellow), 225v. positive, output valve anode.

VMS4B (H.F.) anode, 140v., 2.4 m.a.; screen, 55v. MS4B (frequency-changer) anode, 140v., .3 m.a.; screen, 30v. VMS4B (I.F. [125 K.C.]) anode, 130v., 2.7 m.a., screen, 55v. MHD4 (detector) anode, 80v., 1.2 m.a. MPT4 (output) anode, 225v., 33 m.a.; aux. grid, 225v., 6 m.a.

**Marconiphone 296 Five-valve Mains Superhet.**—Between the labelled terminals on speaker transformer and chassis (volume control maximum and noise suppressor knob in): green, 32v. negative, bias for output valve; yellow, 210v. positive, output valve anode; red, 215v., H.T.+ smoothed; grey, 140v. negative. Yellow and red are primary of output transformer; grey and green are speaker field; full H.T. unsmoothed exists between red and grey.

MX40 (first-detector oscillator) anode, 200v., 1 m.a.; screen, 70v.; oscillator anode, 90v., 2 m.a. VMS4B (I.F. [frequency 125 K.C.]) anode, 200v., 3 m.a.; screen, 70v. MHD4 (second detector and L.F.) 70v., 1.7 m.a. PX4 (anode) 210v., 43 m.a.

**Mullard M.B.3.**—Battery connections (Siemens' Full o' Power, 135v.): plug +B in 135v. H.T. socket; —B in —H.T. +G.B. socket; —C1 in —6v.; —C2 in —9v. After H.T. voltage has dropped place —C1 in 4½v. socket.

VP2 (H.F.) anode, 135v., 2.7 m.a.; aux. grid, 135v. SP2 (detector) anode 30v., 1 m.a.; aux. grid, 65v. PM22A (output) anode, 130v., 3.8 m.a.; aux. grid. 135v., .8 m.a.

**Murphy A4 Superhet.**—Voltages between containers of two electrolytic condensers, 120v.

AC/Pen. (first-detector oscillator) anode 100v., 1.5–2 m.a.; aux. grid, 40v. AC/SG/VM (I.F. [120 K.C.]) anode, 200v., 7–8 m.a.; screen, 80v. AC/HL (second detector) 140v. AC/Pen. (output) anode, 190v., 30 m.a.; aux. grid, 210v., 5.5. m.a.

**Murphy A8.**—Between chassis and points on speaker transformer (looking from rear and counting from the left): (1) 0v.; (2) 200v. positive (H.T. smoothed); (3) 182v. positive (output valve anode); (4) 70v. negative (voltage drop across speaker field). Note that cases of two electrolytics nearest speaker are at potential of (4).

VMS4 plain (H.F.) anode 200v., 4 m.a.; screen 50v. AC/HL met. (oscillator) anode, 60v., 2.5 m.a. AC/SI/VM (first detector) anode 200v., 4 m.a.; screen 50v. AC/SI/VM (I.F. [frequency 120 K.C.]) anode, 200v., 4 m.a.; screen 50v. AC/DD (detector) no readings, VMS4 met (L.F.) anode, 110v., 2 m.a.; screen, 40v. AC/Pen. (output) anode, 180v., 25 m.a.; aux. grid, 4 m.a.

**Orr Radio Model S.F. Superhet.**—Between terminals on speaker transformer and chassis:—Inside terminal, H.T. unsmoothed, 345v.; next terminal, 248v.; middle terminal, blank; two outer terminals (joined) H.T. smoothed, 260v.

SP4 (detector-oscillator) anode 258v., .5 m.a.; aux. grid, 104v. VP4 (I.F. [frequency 119 K.C.]) anode, 258v., 2.7 m.a.; aux. grid, 104v. 354v. (detector) 90v., 3 m.a. Pen.4V (output), anode, 248v., 35 m.a.; aux. grid, 260v., 10 m.a.

**Philco 237 Battery Superhet.**—Battery connections: yellow with black tracer, +67½v.; yellow, +126v.; blue, —3v. G.B.; green, —9v. G.B.

Type 15 valve (first-detector oscillator) anode 120v.; aux. grid, 70v. Type 32 (I.F. [frequency 125 K.C.]) anode 120v.; screen 70v. Type 32 (anode-bend second detector) anode —; screen 50v. Type 30 (driver) anode 110v. Type 19 (Class B output) each anode 120v.

**Philco 260-261 Five-Star Chassis.**—6A7E (first-detector oscillator) anode 240v.; oscillator anode 247v.; screen grid 51v. 78E (I.F. [frequency 125 K.C.]) anode 240v.; screen 88v. 75E (second detector and L.F.) 153v. 42E (output) 230v.; aux. grid 245v.

**Philco 263 Universal Superhet.**—There is a condenser between H.T.— and chassis and so voltage tests should be made to the case of the smaller of the two electrolytic condensers. Voltages between this condenser case and the following points (on 230v. A.C. mains) are: top two right-hand terminals (green), 165v. (output valve anode); left (white) terminal, 175v. (H.T.+ smoothed); lower (green and white) terminal, 60v. (screen potential).

6A7 (oscillator first detector) anode, 175v.; screen 60v.; osc. anode 170v. 78E (I.F. [125 K.C.]) anode 175v.; screen 60v. 75 (detector) triode anode 100v. 18E (output) anode 165v.; aux. grid 175v.

**Philips 634 A Five-valve A.C. Mains Receiver.**—S4VB(H.F.) anode 215v., 2.5 m.a.; screen 95v. S4VB (H.F.) anode 215v., 5.5 m.a.; screen 95v. S4D (detector) 70v., .5 m.a. PM24A (output) anode 210v., 15 m.a.; aux. grid 208v., 4.5 m.a.

**Philips 834A "Straight" Mains Five.**—Voltages between primary terminals on speaker transformer and chassis: (1) 220v.; (2) 200v. (output valve anode).

MM4V (H.F.) anode 220v., 2.5 m.a.; screen 60–65v. S4VB (H.F.) anode 220v., 2.2 m.a.; screen 95–110v. 994V (detector) 80–90v., .15 m.a. PM24 (output) anode 200v., 18 m.a.; aux. grid 220v.

**Philips 834B.**—Battery connections (Drydex H1088) to screws on panel (counting from inside): top row (1) +B1, 63v.; (2) +B2 130v.; (3) +A L.T.+; bottom row: (1) —C1 0v. (G.B.—); (2) —B 9v. (H.T.—); (3) —A L.T.—

PM12A (H.F.) anode 122v., .6 m.a.; screen 60v. PM12A (H.F.) anode 122v., .5 m.a.; screen 54v. PM2DX (detector) anode 52v., 1.85 m.a. PM22A (output) anode 123v., .7 m.a.; aux. grid 125v., .2 m.a. PM1HL (current control valve) anode 10v., .1 m.a.

**Philips 834C Four-Stage D.C. Receiver.**—To test filament circuit for continuity remove detector valve and switch on. Approximately full mains voltage should exist between rear filament socket and chassis. Practically same voltage should exist between anode socket and chassis if H.T. circuit is in order.

SP20 (H.F.) anode, 175–210v., .75–1 m.a.; aux. grid, 78–88v. SP20 (H.F.) anode, 175–210v., 2–2.5 m.a.; aux, 94–115v. H20 (detector) 165–200v., 1.7–2.1 m.a. Pen. 20 (output valves) anodes, 150–180v., 15–19 m.a.; aux. grids, 165-200v.

**Philips 588A Superhet.**—Between chassis and speaker transformer; top (red) H.T.+ smoothed, 228v.; bottom (black), output valve anode, 220v. Between terminals on smoothing choke (on top of mains transformer); front, H.T.+ smoothed, 228v.; back, H.T.+ unsmoothed, 245v.

F.C.4 (frequency-changer) anode, 245v., .35 m.a.; aux. grid. 66v.; osc. anode, 66v. VP4A (I.F. [115 K.C.]) anode, 245v., 1.3 m.a.; aux. grid, 66v. 2D4 (second detector), no readings. S.P.4 (L.F.) anode, 160v., .325 m.a.; aux. grid, 67v. PM24M (output) anode, 220v., 22 m.a.; aux. grid, 228v., 4.2 m.a.

**Portadyne B72 Class B Superhet.**—Battery connections (C.A.V., HTD112 combined H.T. and G.B.); G.B.—½, 3v.; G.B.—2, 4.5v.; G.B.—3, 13.5v.; H.T.+1, 40v.; H.T.+2, 60v.; H.T.+3, 123v.

PM12M (first detector-oscillator) anode, 120v., 1 m.a., screen, as H.T.+1. SG215VM (I.F. [112 K.C.]) anode, 120v., 1 m.a.; screen, as H.T. +1. L2DD (second detector) triode anode, 85v., 1 m.a. PM2DX (driver) anode, 115v., 2 m.a. PM2BA (class B output) each anode, 120v., 2 m.a.

**Portadyne P.A.6.**—Between chassis and terminals on speaker transformer (counting from top): (1) Maroon, 335v. H.T. unsmoothed; (2) and (3) joined, buff, 230v. H.T. smoothed; (4) 200v. output valve anode.

VP4 met. (H.F.) anode, 165v., 1.6 m.a.; aux. grid, 45v. ACS2Pen. (frequency changer) anode, 165v., 1.3 m.a.; screen, 35v. VP4 met. (I.F. [112 K.C.]) anode, 165v., 3.5 m.a., aux. grid, 70v. TDD4 (second detector) anode, 110v., 1.6 m.a. AC2Pen. (output) anode, 200v., 29 m.a.; aux. grid, 230v., 5.8 m.a.

**Portadyne P.B.5 Portable.**—With m.a. meter in negative H.T. lead: current with no signal, 7 m.a.; with moderate signal, 8 m.a.; with loud signal, 10–12 m.a.

PM12A (H.F.) anode, 117v., .8 m.a.; screen, 55v. PM2DX (detector) 38v., .9 m.a. PM2DX (L.F.) 90v., 1.2 m.a. PM2DX (driver) 118v., 1.9 m.a. B21 (class B output) each anode 130v.

**Portadyne S/A.C. Five-valve Superhet.**—Voltage between speaker transformer terminals and chassis:—(1) (top), 350v. (full rectified voltage); (2) 250v. (output valve anode); (3) 270v. (H.T.+ of set).

AC/S2/Pen. met (first-detector oscillator) anode 240v., 2.7 m.a.; aux. grid, 65v. SP4 met (I.F. [frequency 112 K.C.]) anode, 230v., 1.8 m.a.; aux. grid, 110v. AC/HL/DD (second detector and L.F.) 140v., 2.7 m.a. AC2/Pen. (output) anode, 250v., 20 m.a.; aux. grid, 205v., 6 m.a.

**Pye Cambridge C.R./A.C.**—Voltage between positive end plate of rectifier and chassis, (H.T. smoothed), 280v.

AC/SG/VM (H.F.) anode, 145v., 6.6 m.a.; screen, 45v., 2 m.a. AC/S2/Pen. (first-detector oscillator) anode, 185v., 4.8 m.a.; screen, 186v. AC/S1/VM (I.F. [frequency, 114 K.C.]) anode, 200v., 5.3 m.a.; screen, 63v., 2 m.a. AC/HL/DD met (second detector and L.F.) 146v., 7.7 m.a. PP3/250 (output) 275v., 25 m.a.

**Pye P/A.C. Mains Transportable.**—Voltages between following points and chassis: Positive end of rectifier, 230v.; case of middle electrolytic condenser —95V.

VMS4 met (H.F.) anode, 140v., 3.3 m.a.; screen, 51v., .9 m.a. AC/S2/Pen. (first-detector oscillator) anode, 125v., 2.3 m.a.; aux. grid, 116v., 1.4 m.a. VMS4 (I.F. [frequency 114 K.C.]), anode, 132v., 4 m.a.; screen, 50v., 1.3 m.a. DDT (second detector) 127v., 3.9 m.a. MPT4 (output) anode, 172v., 26 m.a.; aux. grid, 180v., 4.4 m.a.

**Pye P/B Portable.**—Battery connections: 130v. and 100v. Current of PD220 (meter in H.T.+3 lead, all other valves removed), 1 m.a. at 130v., .7 m.a. at 100v.

S215VM (H.F.) anode. 127 or 98v., 1.1 or .8 m.a.; screen, 66 or 51v. S215VM (detector-oscillator) anode, 127 or 98v., 1 or .7 m.a.; screen, —v. S215VM (I.F. [frequency 114 K.C.]) anode, 130 or 100v., 1.1 or .8 m.a.; screen, 66 or 51v. L2 (driver) 129 or 99v., 1.5 or 1.2. PD220 (class B output) 129 or 99v., 1 or .7 m.a.

**Radio Instruments Madrigal Three.**—Between one terminal on speaker transformer and chassis, 220v. Between other terminal and chassis, 200v. (V3 anode).

A.C./S.G. (H.F.) anode, 218v. 4.5 m.a.; screen, 95v., —m.a. A.C./H.L. (detector), 95v., 2.9 m.a. AC/Pen. (output) anode, 200v., 30 m.a.; aux. grid, 220v., 5.5 m.a. UU60/250, 225-0-225v. A.C.

## QUICK TESTS

**Regentone Quadradyne Straight Four.**—Voltages to chassis between, (1) joined top terminals of output transformer, 230v. ; (2) third terminal, 210v. (output valve anode) ; and, (3) lowest terminal, 330v. (H.T.+ unsmoothed).

VM4V (H.F.) anode, 225v., 4 m.a. ; screen, 90v. VM4V (H.F.) anode, 230v., 4 m.a. ; screen, 90v. SP4 (anode-bend detector) —v., .1–.2 m.a. Pen.4VA (output) anode, 207v., 30 m.a. ; aux. grid, 230v., 5 m.a.

**R.G.D. 702 Six-valve Radiogram.**—Voltages between following points and chassis :—Pin of red wander plug (H.T.+ smoothed by choke), 380v.; pin of blue wander plug (H.T.+ smoothed by choke and 1,000 ohm field) 310v.; pin of purple plug, 245v.

VMS4B (H.F.) anode, 220v., 1.8 m.a.; screen, 60v. MHL4 (oscillator) 60v., 2.4 m.a. VMS4 (first detector) anode, 220v., 1.7 m.a.; screen, 60v. VMS4B (I.F. [frequency 110 K.C.]) anode, 220v., 1.5 m.a. ; screen, 60v. MHD4 (second detector and first L.F.) 200v., 3.5 m.a. PP3/250 (output) 290v., 34 m.a.

**Standard Telephones Model 40.**—Voltages between side terminals on speaker transformer and chassis (counting from top) :—(1) H.T.—, 130v. negative (drop across field) ; (2) output valve anode, 180v. ; (3) H.T.+ smoothed, 195v. ; (4) chassis.

MS/Pen. (H.F.) anode, 160v., .75–1 m.a. ; screen, 50v. MS/Pen. (anode bend detector), 100v., .2 m.a. 7A2 (output) anode, 180v., 26 m.a. ; aux. grid, 195v., 4 m.a.

**Sunbeam U.35 Universal Receiver.**—Voltages between speaker transformer terminals and chassis from right, looking from back :—(1) H.T.+ unsmoothed, 210v. : (2) output valve anode, 186v. ; (3) blank ; (4) H.T. smoothed, 195v. ; (5) chassis. Speaker field is between (1) and (5).

Valve readings with 245v. A.C. : SE 2018 (H.F.) anode, 195v., 8.6 m.a. ; screen, 105v., 1.5 m.a. R2018 (detector) 72v., 2.6 m.a. PP2018 (output) anode, 190v., 18 m.a. ; aux. grid, 200v., 5.5. m.a.

**Telsen 464.**—Voltages at top ends of resistances mounted on panel beginning from the left looking from back : first resistance (bias on first valve) 1.5v. negative ; second (aux. grid of first valve), 95v.; third, (aux. grid of first valve) 95v.; fourth, (first valve anode) 198v.; fifth (anode second valve) 70v.; sixth (H.T.+ smoothed) 270v.; seventh (bias on output valve) 12v. negative.

AC/S2/Pen. (H.F.) anode, 198v., 4.5 m.a.; screen, 95v. MH4 cat. (detector) 70v., 2.7 m.a. AC/Pen. (output) anode, 262v., 36 m.a.; aux. grid, 270v. 7 m.a.

**Telsen 474.**—SP4 met (H.F.) anode, 183v., 3.2 m.a.; aux. grid, 85v. SP4 met. (detector) anode, 48v., .5 m.a.; aux. grid, 20v. AC/S2/Pen. (output) anode, 222v., 30 m.a.; aux. grid, 243v., 7 m.a.

**Ultra Lynx A.C. Three.**—Voltages between terminals on speaker transformer and chassis : (1) outer terminal, 250v. (2) inner, 260v.

AC/SG/VM (H.F.) anode, 260v., 5.8 m.a.; screen, 130v. AC/SG (anode-bend detector) 120v., .1 m.a. AC/Pen. (output) anode, 260v., 30 m.a.; aux. grid, 260v., 5 m.a.

**Ultra Panther Superhet.**—Voltages between chassis and following points : end (red) terminal on speaker (negative), 100 volts ; case electrolytic condenser nearest back of chassis and to mains transformer, 100v. (drop across speaker field).

AC/SG/VM (first detector) anode, 265v., 1.1 m.a.; screen, 92v. AC/HL (oscillator) anode. 180v. AC/SG/VM (I.F. [frequency 456 K.C.]) anode, 265v.; screen, 92v. AC/SG/VM (second I.F.) anode, 265v.; screen, 92v. AC/HL/DD (second detector) triode anode, 143v., 2.3 m.a. AC/Pen. (output) anode, 270v., 29 m.a.; aux. grid, 260v., 5 m.a.

**Ultra Tiger Mains Superhet.**—Voltages to chassis : top (H.T. unsmoothed), 340v.; bottom (H.T. smoothed), 270v. Between container of rear (insulated) electrolytic condenser and chassis, 170v. This represents half rectified voltage.

AC/SG (detector-oscillator) anode, 250v.; screen, 33v. AC/SG/VM (I.F. [456 K.C.]) anode 250v.; screen, 62v. AC/SG (anode-bend second detector) anode, —v.; screen, 15v. AC/Pen. (output) anode 235v., 30 m.a.; aux. grid, 252v., 5.5 m.a.

**Ultra "22."**—Between chassis and terminals of speaker transformer (looking from behind and counting from left) : (1) red, H.T.+ unsmoothed 365v.; (5) green with black tracer, H.T. smoothed, 274v.

AC/TP (frequency-changer) anode 274v., 7.5 m.a.; aux. grid, 200v., 2 m.a.; osc. anode, 110v., 2 m.a. AC/VP1 (I.F. [456 K.C.]) anode, 274v., 10 m.a.; aux. grid, 195v., 2.5 m.a. AC/2 Pen. DD (output) anode, 260v., 38 m.a., aux. grid, 274v., 6 m.a.

**Ultra Model 55.**—Voltages between chassis and other terminals on strip under speaker hood : Left, red, H.T. smoothed, 228v.; right, black with white tracer, H.T. unsmoothed, 400v.

AC/TP (detector-oscillator) anode, 224v. ; aux. grid, 160v. ; osc. anode, 100v. AC/VP1 (I.F. [456 K.C.]) anode, 146v., 7 m.a. ; aux. grid, 150v. AC2Pen.DD (combined diode detector and output valve) anode, 219v., 22 m.a. ; aux. grid, 228v., 5 m.a.

**Varley AP48 Five-valve Superhet.**—Voltages between terminals on speaker transformer and chassis looking from back and counting from left : (1) H.T.+ smoothed by choke, 345v. (2) H.T.+ smoothed by choke and L.S. field. 210v. (3) output valve anode, 190v. (4) connected to (2) inside chassis. Terminals on smoothing choke : top, 345v., bottom, 370v.

VP4 met. (H.F.) anode, 150v., 2.9 m.a.: aux. grid, 90v. SP4 met. (first detector oscillator) anode, 170v., 3.6 m.a.: aux. grid, 90v. VP4 met. (I.F. [frequency, 110 K.C.]) anode, 185v., 3.5 m.a.; aux. grid, 80v. 354v. (second detector) anode, 90v., 3.4 m.a. AC/Pen. (output) anode, 187v. 22.5 m.a.; aux. grid, 160v., 4.5 m.a.

**Varley Superhet Four.**—VP4 met. (H.F.) anode, 180v., 3.5 m.a.: screen, 100v. SP4 (detector-oscillator) anode, 180v., 1 m.a.; screen, 70v. [I.F. frequency 110 K.C.] 354V. (second detector) anode 105v., 3.75 m.a. A.C./Pen. (output) anode, 205v., 26 m.a.; aux. grid, 175v., 4.5 m.a.

**Vidor Battery Three.**—Battery connections : H.T.1, 80v. ; H.T.2, 50–60v. ; H.T. max. 120v. ; G.B.—, 3–4v. negative.

SP2 met. (H.F.) anode, 120v., 1.1 m.a. ; aux. grid. as H.T.1. PM12A met. (detector), anode, 67v., .5 m.a. ; screen, as H.T.1. PM22A (output) anode, 116v., 5.5 m.a. ; aux. grid, 120v., 1.3 m.a.

**Zetavox S.T. Superhet.**—Between speaker transformer terminals and chassis counting from top : (1) H.T.+ unsmoothed, 290v. ; (2) output valve anode, 190v. ; (4) and (5) H.T.+ smoothed, 210v.; between casing of electrolytic condensers (—) and chassis (+) 90v. negative, full H.T. between (1) and condenser casing, 380v.

VMS4 Cat. (H.F.) anode, 155v., 9.3 m.a. ; screen, 80v. AC/S2 (first detector) anode, 208v., .5 m.a. ; screen, 80v. MHL4 (oscillator) anode, 80v., 5.5 m.a. VMS4 Cat. (I.F.) anode, 208v., 9.3 m.a. : screen, 80v. MSG/LA (anode bend, second detector) anode, .35 m.a. MPT4 Cat. (output), anode, 190v., 34 m.a. ; aux. grid, 180v., 4.5 m.a.

There are two negative A.C. sections, one for the first four valves and the other for the last three. A difference of 80–85v. exists between H.T.— for the last valves and chassis. Therefore output valve voltages are 80–85v. higher than measurements to chassis indicate and the screen of MSG/LA although connected to chassis is 80–85v.+.

# RADIO SERVICING

For receiver testing it is necessary to know the meaning of the common electrical terms and how to use Ohm's Law, to have certain equipment and know how to use it and, finally, to understand something of how receivers operate.

This section supplies information on all these points and for accessibility is divided into four " chapters " :—



" Circuit Details " contains practical, theoretical and testing notes on individual parts of receivers, P.A., accumulators, and charging. To aid reference it is presented in encyclopædic form.

## 1.—Terms, Units and Ohm's Law

When a battery or dynamo is functioning an Electro Motive Force occurs between the two poles of the apparatus. If the two poles are joined by electrically conductive substances, a circuit is said to be formed and the E.M.F. drives a current from the positive or high-potential pole of the generating apparatus to the negative or low-potential pole.

Negative potential should not be confused with zero potential. The earth, which can be used as a link common to all circuits, is accepted as zero potential. When a circuit is earthed the connection from the earth may be made to a point hitherto considered either positive or negative. With relation to the circuit itself the point will remain positive or negative, but it will, in fact, be at zero potential.

In practical radio, this fact means that when a plus or minus sign is encountered in a receiver, it cannot be assumed that the point is positive or negative with regard to the set as a whole (that is, the chassis). The indication may relate only to the particular component.

Any circuit, however short and however conductive the materials used, offers some opposition or resistance to the passage of a current. In fact, the greater the resistance the less current can a particular E.M.F. drive through a circuit. E.M.F., current and resistance are, therefore, interdependent and the relationship is expressed (by Ohm's Law) as follows :—

$$I = \frac{E}{R}$$

(where I stands for current, E for E.M.F., and R for resistance).

This law can also be given in equivalent mathematical forms as

$$R = \frac{E}{I} \text{ and } E = RI$$

Obviously if any two of the three factors, E.M.F., current and resistance, are known, Ohm's Law enables the value of the third to be found. It is essential when using the law, however, to state the values in the correct units.

The unit in which E.M.F. is measured is the volt. The unit of current is the ampere and the unit of resistance is the ohm.

In radio E.M.F.s are frequently measured in millivolts (thousandths of a volt) and sometimes in microvolts (millionths of a volt). Similarly, currents, of so many milliamperes or microamperes are met with. Resistances often amount to megohms (millions of ohms).

As stated above, the correct units, *i.e.*, volts, amperes and ohms, must be employed when applying Ohm's Law. The reason is obvious. If, for example, a current was to be found

by using the formula, the statement of the voltage as 50 when actually it was 50 millivolts or .05 volt would result in the current figure being a thousand times too great.

Mental calculations involving voltage, current and resistance are often done easily if it is remembered that one milliamp passing through 1,000 ohms drops one volt.

There is one further unit frequently met with in servicing. This is the watt or unit of power. When, for example, an E.M.F. drives a current through a resistance, power is expended in the resistance (usually taking the form of heat). The current flowing in amperes multiplied by the E.M.F. drop in volts gives the power dissipated in watts. That is :—

$$P\,(\text{watts}) = I\,(\text{amps.}) \times E\,(\text{volts})$$

$$\text{or } P = \frac{E^2}{R} = RI^2$$

# 2.—Service Equipment

A receiver is composed entirely of a number of separate circuits. Any particular receiver can only operate correctly when the correct number of circuits exist, and *only* the correct number exist. When a receiver fails, apart from valve trouble, which will be dealt with later, it is either because one of the circuits has become incomplete, or because a new circuit has developed.

Fault testing is, therefore, almost entirely a matter of testing for continuity. It consists of looking for continuity where it is required and of finding if continuity exists where it is not required. This is the basic and fundamental idea underlying every servicing or testing operation.

All tuning coils, high-frequency chokes, low-frequency chokes, and resistances, must be electrically continuous in the circuits in which they are included. If they are not, then a fault exists. In the case of a condenser, there must be no continuity in so far as direct currents are concerned. If there is continuity then the condenser is faulty.

In the case of a resistance, choke or transformer which consists of a winding of a large number of turns, there must still be continuity but there must be what is called a high-resistance path. The value of this resistance, which can be measured extremely simply, and can be regarded as the extent or degree of continuity, is an indication of the correct condition or otherwise of a particular component.

For radio testing, then, some means is required for discovering (1) continuity or complete circuit, (2) discontinuity or open circuit, (3) extent of continuity or resistance.

This means is provided by a large number of meters and "test-sets" on the market. Meters may measure current, voltage and resistance, and as the mechanism is basically the same in each case, single "multi-range" instruments which give all three kinds of reading are obtainable.

### Using Meters.

To measure current a meter must be inserted in the path taken by the current. On the other hand, voltages are taken by connecting the meter across any two points between which there is a resistance.

Resistance is ascertained by measuring the current passed at a certain voltage and applying Ohm's Law. When the meter-scale is calibrated in ohms, the instrument is connected as if to measure current (which it will actually do) and a particular voltage depending on the calibration applied by means of a battery included in the circuit.

### Choosing Meters.

When measuring either current or E.M.F., meters take power from the circuits to which they are applied (because the indicating mechanism has to be moved) and usually this extra load on a circuit slightly alters the factors which are being measured. The more efficient a meter, therefore—that is, the smaller current it passes at full scale deflection—the nearer will the values measured correspond to those actually obtaining when the meter is not in use.

Good meters pass only a few milliamps, for example, 1 m.a. or 5 m.a. Two meters actually requiring these currents, when used as voltmeters, would require resistances of 1,000 and 200 ohms respectively for every volt full-scale deflection. They would be described as 1,000-ohm-per-volt and 200-ohm-per-volt instruments. The ohm per-volt "figure of merit" is, of course, a direct gauge of the efficiency of a meter—the higher the figure the less being the current passed.

However, the figure of merit should be considered in conjunction with the length of the scale and the accuracy with which readings can be made. For example, if the scale of a 200-ohm-per-volt meter is so legible that 50 volts can be read as accurately as on a 500-ohm-per-volt instrument the scale of which reads up to 500 volts, the efficiency is the same in each case—both meters take 5 m.a.

### Moving-Iron and Moving-Coil.

There are two principles on which meters are made. In the moving-iron type, the indicator is attached to a small magnet suspended in a coil through which the currents

to be measured are passed. The magnetic field set up by a current causes the magnet and consequently the pointer to take up a new position.

Due to the mass of the magnet, moving-iron meters generally take a relatively large power from circuits to which they are connected and, because of the inertia, are also slow to respond.

In moving-coil meters the construction is just the opposite. A light coil, with the pointer attached, is movably mounted in the field of a large fixed magnet. This type is the more efficient and is also more dead-beat—that is, the pointer comes to rest quicker.

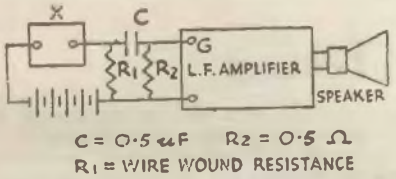
### A.C. Meters.

To measure A.C. currents and voltages with the accuracy obtainable with moving-coil movements, a rectifier has to be employed to convert the current to D.C. Usually, this rectifier takes the form of a small metal rectifier.

### Extending Ranges.

The range of readings obtainable with a current meter can be extended by connecting parallel resistances so that when the meter and its associated resistance is connected in a circuit it is known that a certain multiple of the current passed by the meter is at the same time passing through the resistance.

The value of shunt resistance required is given by $\frac{R}{X-I}$ 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.




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.

meter is to read 50 m.a. the parallel resistance must be a ninth (10—1) of the resistance of the meter.

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 m.f.d. 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

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

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

These figures for over 80 of the receivers dealt with in "Service Engineer" are given on pages 57–62 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 trouble.

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 71–93.

### Mains Receivers.

Having checked the aerial, earth and mains connections and ascertained that the mains supply is "on," it is advisable to proceed at once to the checking of voltages. In most sets the tags on the speaker transformer provide accessible means for this. The voltages obtained should be compared with those given under "Quick Tests" in "Service Engineer" data or those issued by the makers of the receiver.

To ensure that the measurements are secured under the same conditions as the ideal, the volume control should be set at maximum (unless it is ganged with reaction, in which case it should be set just below oscillation point) and the receiver should be tuned away from transmissions. Except with D.C. sets, it is often advisable to short the aerial and earth terminals.

Usually the connections on the speaker transformer give H.T. + unsmoothed, H.T. + smoothed and output valve anode. The field winding of the speaker lies between H.T. + unsmoothed and smoothed, and the primary of the output transformer between H.T. + smoothed and output valve anode.

Occasionally the speaker field is connected in the negative side of the receiver as in Fig. 3.

If no readings at all are obtained, the service engineer should proceed as outlined below, but if measurements are obtained it is advis-

## RADIO SERVICING—3

able at this stage to apply a little mental arithmetic. By subtracting the H.T smoothed voltage from the H.T. unsmoothed and dividing the voltage drop thereby indicated by the resistance of the field in 1,000 ohm units, the total H.T. current drawn by the set is obtained. Similarly by dividing the voltage drop across the output transformer primary (obtained by subtracting output valve anode voltage from H.T. smoothed) by the resistance of the winding in 1,000 ohm units, one can obtain the current taken by the output valve alone.

Suppose for example, that the voltage drop across the field is 100 volts and the resistance is 2,500 ohms. The total current drawn by the set is 100 divided by 2.5, that is 40 ma. If the voltage across the speaker transformer primary is 10 and the resistance is 400 ohms the current is 10 divided by .4, that is 25 ma.

If both these current readings are smaller than they should be and the voltages are high, there is a high resistance connection associated with the output valve, this valve has lost its emission or, thirdly, it is overbiased. If the voltages are low and the current is also low, a fault in the rectifier or mains transformer is indicated.

High current and low voltages suggest a faulty smoothing condenser (on the receiver side of the field), a partial H.T. short, too low a bias on the output valve or, possibly, trouble in the valve itself.

The current through the field should be greater than that through the speaker transformer by the amount of current taken by the rest of the set. If not normal the difference will suggest either a short or a discontinuity in the H.T. circuits to all parts of the set except output valve anode.

When no H.T. voltage is obtained examine the transformer and rectifier wiring for continuity and then, taking out the valve, measure the A.C. voltages across the anode and filament sockets. If no readings are obtained the transformer should be taken out and tested for continuity of the windings.

A resistance measurement between the rectifier filament sockets and chassis should give a reading of 20,000 ohms or more (caused by H.T. potentiometers for screen and auxiliary grid voltages). An instantaneous low reading may be caused by the electrolytic condensers, but a constant low or zero voltage shows there is a short circuit of H.T. to chassis.

A zero reading shows that the short occurs on the rectifier side of the smoothing choke and the smoothing condenser is chiefly suspect. Often a low resistance reading by its value suggests where the short exists. For example, if the speaker field or smoothing choke has a resistance of 2,500 ohms and this is the reading obtained between rectified filament and chassis it is clear that the short is situated at the " H.T. smoothed " end of the choke.

When a short circuit has occurred it is possible that the rectifier filament will be found to be burnt out since it will have been in the " path " of the short.

Between the anode sockets and chassis, a resistance test should give the resistance of each half of the H.T. winding or, if the speaker field is in the negative lead, half the winding plus the field resistance.

Testing of the L.T. secondary winding can be carried out by measuring the resistance between the centre point and each filament socket. Each pair of windings on the transformer should be tested for insulation and

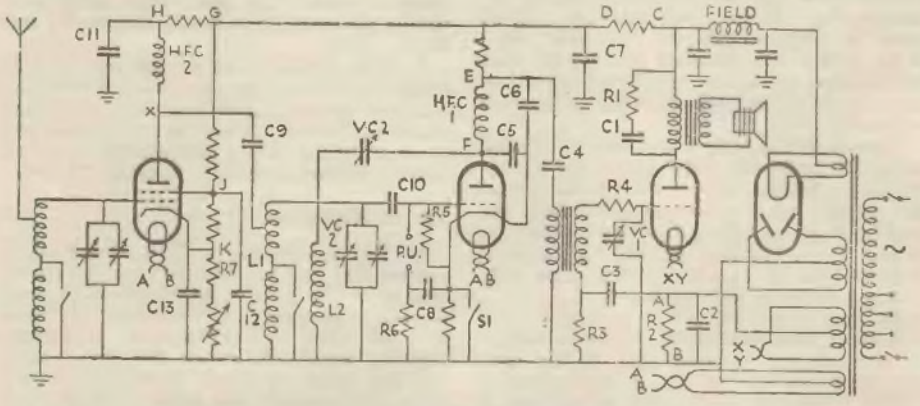



FIG. 1.—A typical A.C. mains receiver circuit incorporating a screen-grid H.F. valve (an H.F. pentode might just as well be used), a leaky grid detector and a directly heated output triode which obtains its filament current from a separate L.T. winding. Tuned grid H.F. coupling and resistance-fed transformer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

the primary should be measured to see if a partial short has occurred.

When the current supply arrangements are known to be correct, the valves should each be checked, first in the receiver with the aid of adaptors (and then, if necessary, in a special test panel).

This will probably immediately disclose any circuit discontinuities and eliminate the need for all the tests given below except the few appropriate ones. Assuming no fault becomes obvious, the speaker itself must be suspected and quickly checked by connecting another across it. (See also "Speaker" under "Circuit Details.") Shunt tone correction components such as R.1 and C.1 in Fig. 1 must also be examined.

If the output valve has been proved to be sound but its anode current is too high or too low when it is placed in the receiver, tone correction devices such as R.1 and C.1 (Fig. 2) should be inspected. Next the grid and bias circuits must be checked. The bias can be measured (using a high resistance range) across the bias resistance.

### Bias Circuits

Different circuits are involved according to whether the valve is directly or indirectly heated. In the former case (see Fig. 1) the resistance, R.2, is situated between the centre point of the filament winding and chassis. With indirectly-heated valves (Fig.2) the resistance is connected between cathode and chassis.

Sometimes the bias resistance forms part of the circuit carrying the total H.T. current of the receiver and may be part of the speaker field which is connected in the negative lead as in Fig. 3. In these sets the bias for the output valve is not correct unless all the other valves are operating properly.

Absence of bias voltage (across points A and B in diagrams) although current is flowing shows that the condenser C.2 across the resistance is shorting.

Presence of a bias voltage does not mean that it is applied to the valve. The grid circuit must be complete for this to be so. With the aid of a circuit diagram the grid path should be tested section by section. When a nickel-alloy transformer is used a current should not be passed through the secondary, however, and, as a last resource, another transformer should be substituted. The grid circuit usually obtains 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.

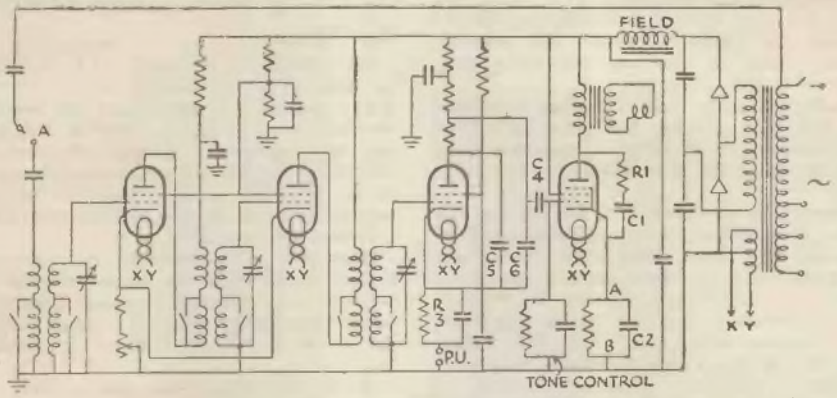



FIG. 2.—A circuit of a receiver employing H.F. transformer coupling between the H.F. valves, an anode bend detector, an indirectly heated output pentode and metal rectification of the H.T. supply. The pick-up connection, the use of a resistance as an H.F. stopper in the detector anode circuit and resistance-capacity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

Bias may be made faulty by a leakage from the anode circuit of the preceding valve through the coupling condenser C.4, and/or the L.F. transformer. The voltage drop caused by this current passing through the resistance in the grid circuit tends to produce a positive bias.

Proceeding to the previous stage, usually the detector, test for voltages point by point (C, D, E, F in Fig. 1) to the anode and then, if necessary, for continuity or resistance. It is as necessary to see that the correct resistance exists across transformers, H.F. chokes and resistances as it is to see that the connecting leads are continuous. A short circuit through a component is, of course, as serious as a broken circuit. If the voltages are low or, alternatively, touching the grid of the detector does not produce noises, although anode current is flowing, see that the H.F. by-pass condensers, C.5 and C.6, reaction condenser V.C.2, coupling condenser C.4, and decoupling condensers C.7, are not leaking.

In anode bend detector stages screen-

## RADIO SERVICING—3

grid and H.F pentodes are often used. These necessitate high anode resistances which make it impossible to obtain accurate voltage readings. The current has to be measured and then Ohm's Law applied.

Bias tests in this stage are carried out as with the output valve. If the circuit is like that in Fig. 1, leaky grid detection is employed, and the bias resistor may be shorted by a suitable switch S.1 on radio. It is not necessary for the resistance to be shortened when the grid leak R.5 is returned to the cathode. If pick-up results are unsatisfactory, test the pick-up decoupling condenser C.8 and resistance R.6.

In Fig. 2 anode bend detection is utilised and the bias resistor R.3 provides a bias, applied during radio reception, and amounting to about twice the normal bias for the valve used.

When, with a receiver in which the detector is the first valve, no reception is obtained although the above tests have proved the valve itself and the subsequent stages to be correct, the blocking condenser C.9, tuning-coil L.1, reaction coil L.2, tuning condenser V.C.3, reaction condenser V.C.2, grid condenser C.10 and grid leak R.5, must be examined.

With "straight" receivers employing H.F. stages the aerial should be tapped back to the anode connection (X) of the previous valve. In the case of tuned anode coupling (Fig. 3) a .0001 m.f.d. condenser should be included in the aerial lead while in a tuned grid circuit (Fig. 1) the H.F. choke (H.F.C.2) must first be tested for satisfactory resistance (a few hundred ohms).

L.1 and L.2 should now be tested for continuity (a resistance of a few ohms, which is increased a little by operation of the wavechange switch, should be obtained). V.C.3 and V.C.2 should be isolated from the circuit and should give a practically infinite resistance. R.5 should have its rated value and the quickest check for C.9 and C.10 is to substitute other condensers of the same capacities.

### Diode Detection and Automatic Volume Control.

The only tests for diode detectors and diode circuits providing voltages which control the amplification of the H.F. stages, lie in seeing that the circuits themselves and the values of the components are correct. (See respective headings under "Circuit Details.")

### H.F. Stages

The first step in testing an H.F. stage is the checking of anode, screen (or auxiliary grid in the case of H.F. pentodes) and bias voltages (at points G, H, X, J and K) and to see that the resistances of decoupling resistors, coils or H.F. chokes are approximately correct. As in the other anode circuits it should be seen that the decoupling condensers C.11 and C.12 are not shorting.

Observing bias voltage changes across K and chassis while the volume control V.R. is varied will ascertain the soundness of the potentiometer and show if C.13 is shorting. R.7 it should be noted fixes the minimum bias.

As in L.F. stages the grid returns must be checked for continuity and in A.V.C. receivers this will involve a check of the decoupling resistances.

All that remains to be checked now is the aerial tuning circuit which may consist of a single coil and condenser as in Fig. 1, or as a band-pass circuit as in Fig. 3. (See respective headings under "Circuit Details.")

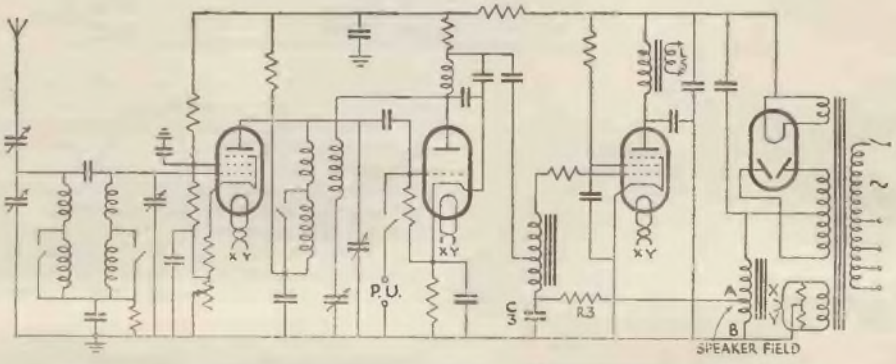



FIG. 3.—Here the speaker field winding is in the negative lead and a tapping provides the bias for the output valve. Band pass coupling precedes an H.F. pentode, which is tuned-anode coupled to a leaky grid detector.

### Superheterodyne Receivers.

As far as the low-frequency, detector and input tuning arrangements are concerned superhets are no different from "straight"

receivers. It is only when troubles occur in the oscillator and I.F. stages that special problems arise.

One can discover if the oscillator is oscillating by connecting headphones in the anode circuit. Heterodyne whistles should be heard. Alternatively a meter in the anode circuit should show a change in current when one of the oscillator coils is shorted.

If it is thought that the valve oscillates over only a part of the waveband, a change in the anode current as the tuning condenser is swung will show that this is so. Another valve should be tried or the screen (and perhaps, anode) voltage increased.

If the valve refuses to oscillate the oscillator coils should be tested for continuity (too high a resistance will indicate a bad switch contact or badly soldered Litz wire).

Intermediate-frequency transformers are easily checked by connecting the output of a modulated oscillator (set to the correct intermediate frequency) to the primary of each transformer in turn.

# 4.—Circuit and Miscellaneous Details

## Accumulators

Accumulator charging and service forms a very important branch of practically every dealer's business.

There are three golden rules which if properly carried out will result in the minimum of trouble, and the maximum of efficient service. Here they are: The maximum life will be obtained from an accumulator if (1) it is regularly charged at the correct rate, (2) it receives regular attention as regards acid level and strength, and (3) it is kept clean.

Accumulators should be charged at their correct rates, not only in fairness to the batteries themselves, but also to the manufacturers and the owners. Nothing does more harm to a battery, and particularly a mass type battery, than charging it at too high a rate.

Acid strength should be checked by means of a hydrometer. The necessity of using a first-class instrument cannot be too strongly urged. Dealers should buy a thoroughly reliable float type hydrometer. The battery maker's recommendation as to specific gravity must be adhered to rigidly. While most cells operate correctly at about the same S.G., certain are designed to work at higher or lower values.

Great care must be taken to remove every trace of free acid from every part of the outside of an accumulator case, and particularly the terminals. It is a good plan to wipe the terminals over after charging, with water containing a little ammonia. Terminals should be well vaselined and, before handing a cell to a customer, the case should be given a good polish with a duster. Nothing is more revolting than an accumulator with an acid-covered top, and any charging station which sends out cells in this condition stamps itself as inefficient.

The keeping of spare accumulators in good condition is a problem that faces many dealers. There are three methods which may be used.

When a cell is charged and may be wanted at any time, it is sound practice to keep a continuous current passing through it of ½ to 2 per cent. of the normal charging rate.

If the accumulator is to be out of use a matter of weeks or months, and only occasional attention can be given it, it should be put in a dark place where there is no danger of either frost or excessive heat.

The case and terminals should be cleaned with a cloth dipped in ammonia, and metal parts should be liberally treated with vaseline.

Every two months the level of the electrolyte should be checked and the battery given a normal charge until fully up.

Where it will prove impossible to give any attention to a battery and it will be laid aside for some time, the following is the best course to follow:—

Charge the cell fully and then empty out and fill with distilled water. After fifteen minutes, remove the positive plates, and after twenty-four hours—not less—take out the negatives.

Both plates should be drained and, if necessary, flattened out by pliers or putting between boards in a vice.

For some time after this, the negative plates should be periodically examined. If they tend to heat, they should be repeatedly plunged in water until a cure is effected.

Plates should be stored in darkness and safe from extreme temperatures.

In extreme cases of sulphation, cells have to be scrapped, but cures can usually be effected if tried in time.

The first method consists of repeated charging and discharging. On beginning to charge, half the normal rate should be employed; after an hour increase this to a normal rate, and then, after a further hour, to the maximum rate.

After not more than an hour of this reduce the rate to normal once more and continue charging until the cell gases. The half-normal rate is then employed again.

Repeat the whole process of charging and discharging until the cell is in a healthy condition.

The alternative system is as follows: draw

## RADIO SERVICING—4

off the acid and clean the plates in distilled water. Then fill the cell with a 5 per cent., by weight, solution of caustic soda and put the cell on charge.

Repeatedly test the electrolyte with litmus paper, and if it gives at any time an acid reaction, add caustic soda until an alkaline reaction is obtained.

Continue charging until the plates are healthy ; then draw off the solution, replace the acid and give a gassing charge.

Practically the whole story of a battery's life can be learned from a study of its plates. Here are some of the symptoms that indicate the most common troubles.

Positive plates almost black, accumulation of spongy lead on the top edges of the negatives, and a thick deposit, chiefly of chocolate coloured positive material : the cell is being charged too much.

Positives light in colour, whitish sediment and blotchy negatives : not enough charging.

Negatives darkened, positives sulphated and scaling, grey sediment : cell over-discharged.

Negatives bulging, scrubbed appearance of positives, positive and negative material under the respective plates : charging at too high a rate.

Buckling of plates, chiefly the positive : charging or discharging at too high a rate.

### Automatic Volume Control.

The two popular forms of automatic volume control encountered in superhets are "delayed" and "amplified and delayed."

Though no appreciable current flows through the components involved, a knowledge of the circuit employed is often essential in diagnosing troubles in the H.F., or even L.F., sections of a receiver.

The simplest form of the delayed A.V.C. circuit is given in Fig. 4, in which the diode anode used for L.F. purposes is coupled to the A.V.C. diode anode through an H.F. feed condenser C1.

The signal is rectified and the resultant D.C. is allowed to flow through the load resistance R2 and the bias resistance R1 back to cathode.

Due to the steady D.C. of the triode section flowing through the bias resistance R1 the point B is always positive with relation to A (or A is negative to B), and consequently, when a signal is impressed on the A.V.C. diode anode the anode circuit will remain unaffected until the signal reaches a rectified value greater than the original voltage drop across R1.

In this case it is customary to apply an initial bias (by cathode resistance) to the valves that are to be controlled.

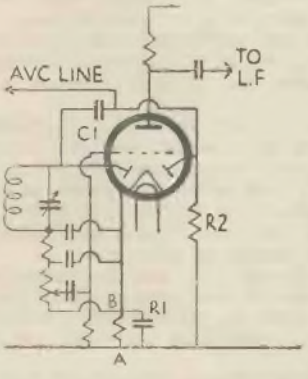
Another method of applying the delay voltage as an initial voltage to the diode A.V.C. anode and the controlled valves is to connect the lower end of R2 to some point on the H.T. system that is negative to the point A.

This is usually done by connecting a small resistance of from 30 to 100 ohms, depending on the current taken by the set, in the common H.T. negative lead.

The application of amplified A.V.C. is much more complicated.

The most popular form is illustrated in Fig. 5. The anode A1 is used for rectification for L.F. purposes, and the L.F. signal is taken from the low H.F. potential end of the coil (usually secondary of IFT2) through the H.F. stopper R3.

From that point it is fed to the grid of the triode section, which has as its grid leak R5,



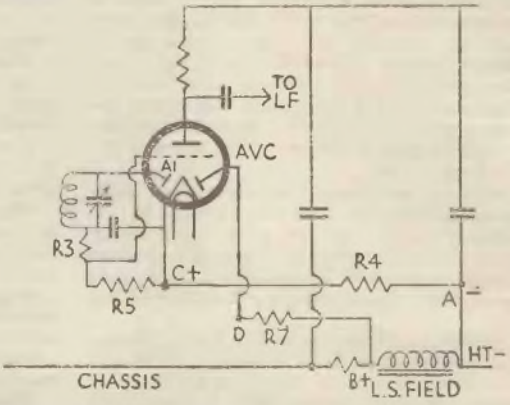




FIG. 4 (on the left) shows the simplest delayed A.V.C. circuit, and FIG. 5 (right) gives the most popular arrangement for amplified A.V.C. The A.V.C. line to the H.F. valves is taken from D in FIG. 5.

also the diode load resistance. When the signal is rectified, both L.F. and D.C. are impressed on to the triode grid.

The D.C. potential applies bias to the valve in proportion to the strength of the signal, but as the triode section has not variable mu characteristics the bias for operating conditions cannot be allowed to depend entirely on the strength of the signal. For this reason the other diode anode is used to compensate this to a certain extent.

To do this it is necessary to utilise the A.V.C. diode as a separate valve with only the cathode circuit common to the other elements and to depend on the fact that as long as the anode is negative with relation to the cathode no current can flow in the return circuit, but that whenever the anode is positive current will flow in the resistances connecting the two.

If, for example, in a set in which the speaker field is in the negative lead the A.V.C. diode were connected through a resistance to chassis and the cathode were connected to the H.T.—side of the field, the A.V.C. anode could be maintained positive with relation to the cathode, there would be a constant large bias applied to the A.V.C. line. To counteract this and to make the bias dependent on the signal the cathode is connected through a fairly high value of resistance (usually between 30,000 and 100,000 ohms depending on the mutual conductance of the valve) to a point on the smoothing choke or field that is negative to the chassis, and the A.V.C. diode anode is connected to the chassis through a decoupling resistance.

In Fig. 5 the cathode resistance is R4 and the A.V.C. decoupling resistance is R7. The circuit of the A.V.C. diode consists of R7, speaker field, and R4.

The relative potentials in these are balanced as follows : With no signal and, consequently, no bias on the triode grid the greater current through R4 causes the point C to be positive with relation to A, and B is positive with relation to A by the voltage drop across the L.S. field.

In practice the value of R4 is such that the voltage drop across it with no signal is slightly greater than the voltage drop across the choke ; a resistance in the common H.T. negative lead to the previous valves causes these to be biased with an initial bias which acts as a "delay" on the action of the A.V.C. diode.

Under no signal conditions the A.V.C. diode is negative with relation to cathode, but whenever a signal is applied to the diode A the triode is biased and less current flows through R4. Whenever this causes a voltage drop less than that across the speaker field the A.V.C. anode becomes positive with relation to the cathode and current flows in the circuit R7, making the point D negative with relation to B.

This voltage is considerably greater than the initial D.C. voltage applied to the grid of the triode section or of any that could be produced from the direct rectification of the I.F. or H.F. signal. The value of R4 in relation to the choke is chosen so that when the correct bias for good reproduction is applied to the triode the full A.V.C. voltage is applied to the control valves.

### Band Pass 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 excessive 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.

### Charging Plants.

The type and size of plant which is installed must be determined entirely by the estimated amount of charging which will have to be carried out per week.

Where only direct-current mains are available, there are only two suitable systems. The first consists of charging the cells directly from the mains and the second involves the use of a motor driving a dynamo or a combined motor generator set.

Direct charging from the mains can only be economical when the total number of cells connected in series gives a voltage of about the same value as that of the supply. This means that at least 60 or 70 cells should be available for charging at the same time. It must also be remembered that the charging current must be cut down to the value required for the smallest cell. It is obvious, therefore, that charging by this method will only be economical in a few isolated

## RADIO SERVICING—4

cases. Those who have D.C. supplies are recommended to install a suitable motor generator set.

Where A.C. supplies are available some form of rectifying device or motor generator is immediately necessary. These can be classified under four headings : Motor generators, or motors driving dynamos, synchronous rectifiers, metal rectifiers, and valve or mercury rectifiers.

Valve, mercury, and metal rectifiers have practically no upkeep cost, since there are no moving parts. Replacements of the actual rectifying units are only necessary at long intervals. Motor generator sets, providing they are well made, run for long periods with little attention. Regular cleaning of the commutator and maintenance of the brush gear is of vital necessity for efficient operation of motor generator sets and synchronous rectifiers. Motor generators and synchronous rectifiers should not be installed without perfectly foolproof automatic cut outs.

The manufacturer's instructions regarding the correct method of installing any form of rectifying arrangement or generator set, and also the maximum outputs, should be strictly adhered to. No attempt should be made to overload any charging device.

Before carrying out any charging, dealers should make quite sure that their charging arrangements comply with fire insurance regulations. Cells should preferably be placed on glass sheets during charging. Meters should not be anywhere near the cells during charging operations because of fumes, and adequate ventilation should be provided. The ideal device, of course, is a fan extractor.

Providing the cells are carefully connected and arranged in a tidy manner there is practically no fire risk. A tangled mass of half-corroded wires lying haphazard on a heap of accumulators should never be tolerated. A proper system of time-keeping, and charging currents must be adopted, while careful inspection of all the cells during charging is invaluable. If a cell does not charge up in the correct time, there is something radically wrong, and it should be investigated as much in the dealer's as the customer's interest.

If there is no obvious cause, the dealer should communicate immediately with the manufacturers. Prompt action in this manner will save a tremendous amount of subsequent trouble between dealer, customer and manufacturer, while the dealer will do much to gain the confidence of both customer and manufacturer.

### Chokes, High-Frequency

Desirable qualities in a high-frequency choke are a large inductance, a low self-capacity, and a small, concentrated field. A binocular arrangement helps to limit the field. Slots and fine wire limit the self-capacity and a large number of turns gives a high inductance. The resistance of a high-frequency choke varies very considerably with various makes. This does not matter, since the other factors are the most important.

There is no easy method of testing a high frequency choke, since it is really necessary to measure its impedance when connected in the anode circuit of a valve which is amplifying at all frequencies over the broadcast range. As a rough test, however, a choke can be connected in series with the aerial lead of a fairly sensitive receiver. If it is found that fairly loud signals are obtained when the choke is connected, it is usually an indication that it is not too effective.

An essential mechanical feature of a good high-frequency choke is a positive mounting of the former at the base so that it cannot rotate and so break the fine connecting wires taken to the terminals.

### Chokes, Low-Frequency

Many of the statements made with respect to low-frequency transformers apply equally to chokes. When an ordinary alloy is used for the core, a large cross section and a large number of turns are required for a high inductance. In the case of special alloys, the overall dimensions can be reduced for the same inductance.

Faults likely to develop in chokes are intermittent contacts due to a breakage, short circuited turns and leakage to frame.

Most chokes intended to carry large steady anode currents have an air gap in the core. This air gap is only a matter of a few thousandths of an inch, and if any repairs are carried out to the choke, great care should be taken not to disturb the gap as may be done if the clamping frame is removed. Most air gaps, however, are filled with a thin sheet of insulating material against which the core stampings are firmly pressed.

There is no easy method of measuring the inductance of an iron core choke, particularly in the case of one carrying a D.C. current. A rough idea can be obtained by connecting the choke in series with a small battery and a milliammeter of the moving-coil type, watching the rate at which the needle rises to its maximum value. If the needle comes to this point very slowly, it indicates that the inductance is large. The quicker it reaches this value, the lower is the inductance of the choke.

### Class B.

Class B amplification is the name applied to a quiescent system utilising a special double valve. The current consumed is

proportional to the signal strength, but the mode of operation is totally different from that of Q.P.P. and totally different components are necessary.

The basic feature of Class B lies in the fact that the Class B valve draws power from the preceding stage, and is not a voltage operated device, like an ordinary valve.

A Class B valve consists of two triodes of special construction in a common bulb, fitted with a seven-pin base. Each half is similar to an HL type of valve.

The valve is operated by a driver transformer, which in construction is similar to a small output transformer. It has, however, a step-down ratio of the order of 2–1 or 3–1, and a centre-tapped secondary.

The primary is connected directly in the anode of a small power valve or 10,000 ohms general purpose valve. The secondary delivers current into the grid circuit of the valve and it must, therefore, have a very low resistance.

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 applied to the grid circuit. 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

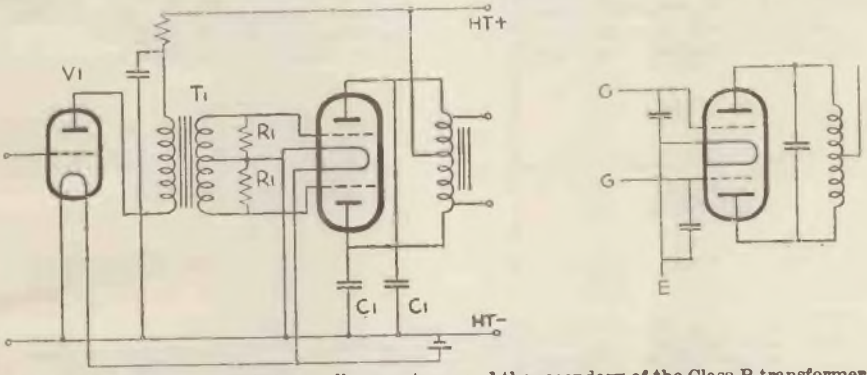



FIG. 6.—V1 is a driver valve of the small power type, and the secondary of the Class B transformer T1 is connected to the two grids and negative filament of the B valve without bias. Two condensers C1 between the anodes and earth give stability and correct tone, while fixed resistances R1 prevent parasitic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

## 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

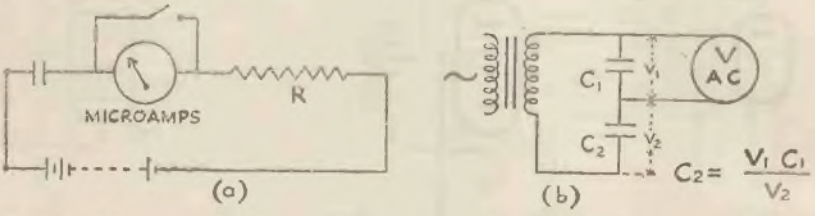



FIG. 7A.—When measuring the insulation of a condenser, a safety resistance R must be included in the circuit, the microammeter being shorted by a switch, while the condenser charges. How the capacity of a condenser can be checked is shown in (B).

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 65. 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

seconds when the circuit is first connected, as a comparatively heavy charging current flows into the condenser.

The capacity of a large fixed condenser can be checked roughly by the arrangement shown in Fig. 7B. It is connected in series with a condenser of known value. A high resistance A.C. voltmeter such as a rectifier instrument is connected across both condensers. The capacity of the unknown condenser is given by the formula shown in the diagram. It is, of course, a matter of proportion.

In electrolytic condensers the electrodes are an electrolyte and aluminium, and the dielectric is a fine chemical film on the aluminium. The construction provides high capacity in small space.

The normal electrolytic requires a polarising voltage which must be applied in one "direction" only. The steady voltage combined with any ripple voltage must not exceed the rated peak value.

In D.C. and universal sets where the voltage may be applied in either direction, reversible electrolytics should be used. These, like the ordinary type, need a polarising current and must not be used only on A.C.

### Condensers, Variable

Modern variable condensers are made so accurately that there is rarely occasion to question the capacity. Points to look for in a condenser are: sound bearings with an even "feel" throughout the entire movement, and absence of hard or slack spots; a good connection to the rotor, preferably by a pigtail; and firm anchoring of the stator assembly on a reasonable amount of insulating material which does not lie in the field of the condenser.

Accurate alignment of the plates is necessary. When a condenser is full-in the spacing should appear even. In particular, the spacing should appear the same when viewed from either side.

Scrapiness is the chief trouble caused by variable condensers. It is usually due to a bad friction connection to the rotor. Tightening and lubrication of bearings usually effects a cure.

If a fault persists the condenser should be returned to the makers. The slightest suspicion of scraping in a condenser used in a powerful receiver is the cause of intermittent background noise which is sometimes extremely difficult to trace.

### Fuses.

For the main fuses of an A.C. set it is usual to use types capable of carrying twice the current normally required by the set.

As fuses are usually rated to blow at twice their carrying capacity, an ample factor of safety over the initial heavy current taken when switching on the set is provided.

The standard colour code for fuses is:—

Black, 60 m.a.; grey, 100 m.a.; red, 150 m.a.; brown, 250; yellow, 500; green, 750; dark blue, 1 amp.; light blue, 1.5 amps.; purple, 2 amps.; white, 3 amps.

### Grid Bias Supply.

Grid bias can be derived either from a separate metal rectifier and smoothing circuit, or from the main high-tension supply in which the high-tension voltage is robbed of a few volts for the grid bias.

Fig. 8 shows one of the most convenient methods to employ, particularly in a multi-valve receiver, since the arrangement of wiring is considerably simplified and the

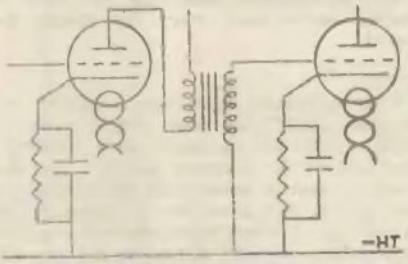



FIG. 8.—The most usual auto-bias arrangement with separate resistances and condensers in each cathode lead.

adjustment of grid bias for any particular valve is easily accomplished. The system consists in placing a resistance, shunted by a condenser, between the cathode of any particular valve and the negative high-tension terminal. The grid returns, of course, are taken to the negative high-tension terminal which is the main earth busbar, and not to the cathode.

An alternative arrangement is shown in Fig. 9 in which a main bias resistance is included in the negative high-tension lead, and is tapped off at various points for the respective bias voltages. In some cases, it is found necessary to decouple the grid circuits in a similar manner to that used for high-tension supplies, and separate high resistances and condensers shown at $R_1$, $C_1$, and $R_2$, $C_2$ respectively are included.

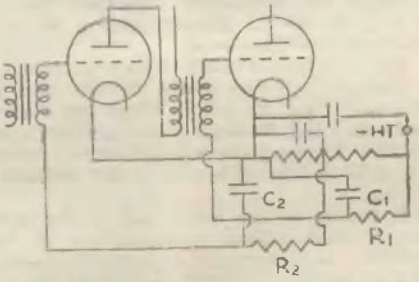



FIG. 9.—A common auto-bias resistance in series with the main negative high-tension lead tapped off for various bias voltages. Decoupling resistances and condensers are also shown.

## RADIO SERVICING—4

The circuits given in Figs. 1, 2 and 3 show how these principles are applied in practice.

When testing automatic bias voltages it is essential to use an exceptionally high resistance voltmeter, as otherwise the load imposed will totally unbalance the voltage and give a false reading. It is best to check the bias voltage by measuring the resistance and measuring the current which passes through the resistance with a milliammeter, working out the actual voltage from the simple Ohm's Law equation.

The components used for auto-bias can readily be isolated from the circuit and tested.

### Hum.

Pure inductive hum can originate in a receiver itself and also outside the set. Hum which has its origin in a receiver is due entirely to incorrect design. The most prolific cause is inadequate smoothing, and the cure is just a matter of increasing the smoothing by using more efficient chokes of high inductance and increasing the capacity.

Hum which still persists is then invariably due to induction caused by relatively strong fields adjacent to grid wires, or even interaction amongst the low-frequency components and the mains transformer or smoothing chokes. This is easily detected by moving any components or leads which are suspected of causing trouble, and seeing if this has the effect of increasing or diminishing the hum.

Care must be taken particularly with regard to long leads connected to the input of the amplifying portion, as, for example, the pick-up connection. An earthed screen lead will usually cure the trouble. It sometimes happens on a set with which an external pick-up is used that the mains lead is brought too near to the pick-up or even to the aerial or earth lead of the set. In this manner hum is sometimes introduced, and the remedy of course is obvious.

### Instability.

When uncontrollable oscillation occurs it may be due to either induction between components or feed-back.

An indication of which of these alternatives is present can frequently be obtained as follows. Tune the set to about 300 metres and reduce the efficiency of the high-frequency valves—dropping the voltage on the screening grid is advisable—until the oscillation ceases.

If tuning to the lower end of the wavelength scale causes reappearance of the trouble, more screening is required; oscillation at the top end will mean that the decoupling is inadequate.

Don't forget that H.F. interaction may be caused by wavechange switch rods and the rotors of gang condensers. These should be earthed between the different sections.

Failure of H.F. decoupling condensers, the use of inductive condensers where non-inductive are essential, and even the connection of a condenser the wrong way round are frequently responsible for trouble.

The way a condenser is connected is sometimes a deciding factor, because if the outside electrode is connected to the earthed side of the circuit screening is enhanced.

Oscillation may be caused by leads to the speaker lying near and parallel to aerial, earth or pick-up wires.

See also Motor-boating.

### Interference.

Effects which are introduced either through the mains connection or by high-frequency radiation are best dealt with together. There is practically nothing which can be done in the set itself, and the trouble has to be cured by eliminating it at its origin.

Some of the most usual sources of interference are sparking at the brushes of motors, contactors, or similar controls, and vibrating interrupters such as tremblers on induction coils.

In the majority of cases interference can be prevented simply by the use of fixed condensers which form a low impedance path between the origin of the disturbance and earth.

The simplest case is that of sparking at motor brushes. Interference of this type can be eliminated by connecting each brush to earth through a fixed condenser of 0.1 mfd. or a 0.01 mfd. can be connected between the two brushes. High insulation types must be used.

Interference is frequently increased by radiation from the supply mains. In this case the trouble can be cured by what is known as a centre point earth system. Two condensers are connected in series and placed across the leads, the junction point of the condensers being taken to earth. A centre point earth may be used at either end of a pair of leads.

On rare occasions H.F. chokes have to be inserted in the supply leads to a set. In this case the chokes are preferably placed in an earthed metal box, while the condensers are arranged on the set side of the chokes.

Interference from sparking plugs or distributors and magnetos on petrol engines can be reduced by using screening over the exposed portion of the electrical circuit. The high-tension leads may have a length of wire wrapped closely round them, the wire being earthed to the frame, while a metal screen can also be placed over the tops of the plugs and the distributors.

Adequate insulation, of course, is necessary and thick rubber cable should be used for the leads. Small apparatus which is the subject of tremendous electrical disturbance

may require to be enclosed in an earthed screen, while centre point earth condensers and even chokes may be necessary.

Gas discharge tubes used for charging rectifiers also generate oscillations which cause interference, and these can easily be prevented by a fixed condenser from 0.001 mfd. to 0.01 mfd. connected between the anodes and earth. Each particular example of interference usually requires individual treatment, and the simplest remedy should be tried first until a complete cure is effected.

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 almost absent without the aerial must be eliminated at its source.

Disturbances in a set which are not affected by the aerial may be purely inductive effects in the receiver, or alternatively, they may be introduced through the supply mains.

### 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.

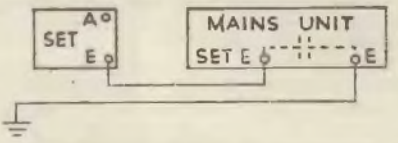



FIG. 12.—Essential safety condenser for the earth connection of a D.C. mains unit.

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 C3. 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

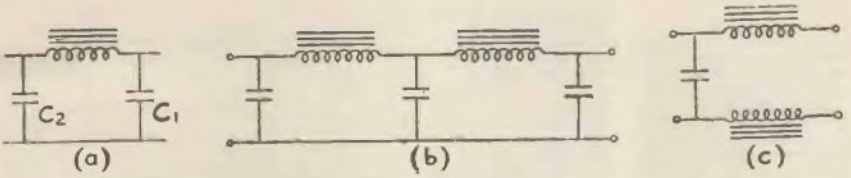



FIG. 10.—Three examples of fundamental smoothing circuits comprising Iron cored chokes and large condensers.

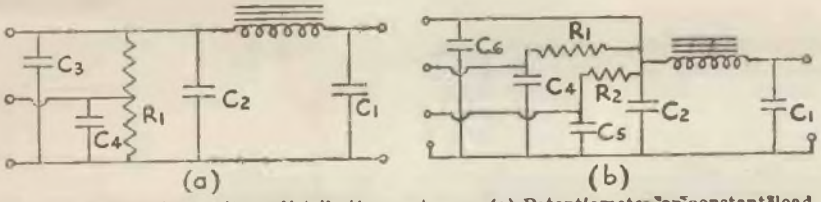



FIG. 11.—Shows two voltage distribution systems. (a) Potentiometer or constant load method. (b) Series resistance method.

## RADIO SERVICING—4

variable, taking the form of carbon composition resistances or wire-wound types. The actual values obtainable are very frequently such that they suit the normal connections of typical receivers, and the arrangement shown in Fig. 11 (b) is the basic principle of what is known as decoupling. When the values are fixed, however, it frequently happens that they do not suit a receiver, in which case additional decoupling resistances are necessary.

Scraping noises in an eliminator are sometimes caused by faults developing in the resistances, and these should be carefully checked.

The components of an A.C. mains unit can be tested as indicated in the appropriate sections. It is more important in the case of an A.C. unit than in the case of a D.C. unit not to connect it to the supply without a load on the output, since the first condenser in the filter circuit is subjected to much greater peak voltages than in the case of a comparatively smooth D.C. output on which there is only a commutator ripple.

It should be particularly noted when using a D.C. mains eliminator consisting as it does of a filter and voltage divider, that the earth connection is not made directly to the receiver, but it must be taken through a mica insulated condenser as shown in Fig. 12. This condenser is frequently incorporated in D.C. mains units. Its object is to prevent accidental short circuiting of the mains by connection to earth. It should be noted that in some cases, and particularly on a three-wire system, that the positive main is earthed.

When dealing with mains units or mains sets employing a really large output valve, it is essential not to connect the high-tension supply before the filaments and cathodes are really hot. Exceptionally large valves really require a delay action switch, examples of which are now available. Sets run from D.C. mains are identical in operation with those worked from A.C. supplies. The only difference lies in the filament circuits.

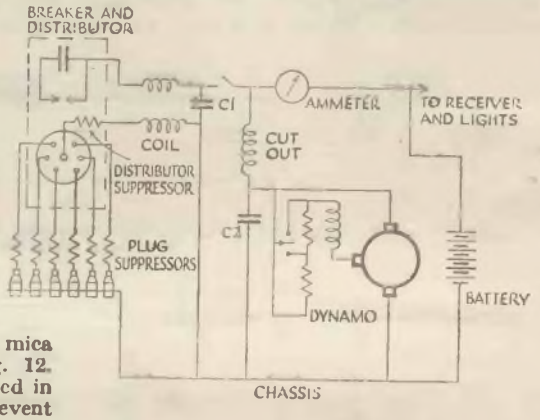



FIG. 13.—A typical car ignition circuit showing how suppressor resistances and condensers should be added to prevent interference with a receiver fitted to the car. The special heat and vibration-proof resistors should be connected as close as possible to the sparking plugs and the distributor and the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

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

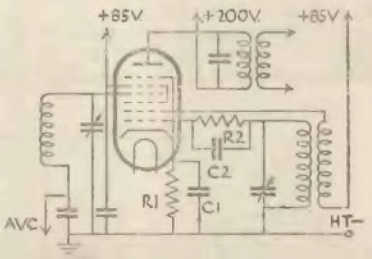



FIG. 14.—How a mains type octode valve is used as a combined first detector and oscillator with electronic coupling.

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

## RADIO SERVICING—4

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

The great advantage of these valves is that variable-mu characteristics are obtained and consequently more effective A.V.C. in small receivers is possible. Also radiation is reduced.

A typical octode circuit is given in Fig. 14.

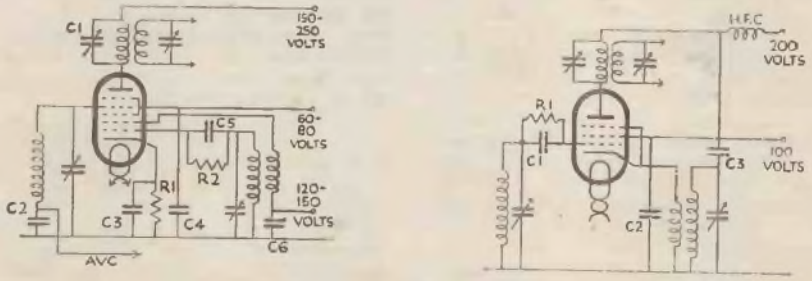



FIG. 15.—On the left is a circuit (simplified as regards coil switching) showing how a heptode is used as a combined detector-oscillator or frequency-changer. In FIG. 16 (right) the connections for using an H.F. pentode for the same purpose are indicated.

Values are R.1, 250 ohms; R.2, 12,000 ohms.; C.1, .1 mfd.; C.2, .001 mfd.

In the heptode circuit in Fig. 15 the component values are R.1, 500 ohms; R.2, 50,000 ohms; C.1, 50 mmfd.; C.2, .01 mfd.; C.3, .1 mfd.; C.4, .1 mfd.; C.5, .0001–3 mfd.; C.6, .1 mfd.

An H.F. pentode may be used for frequency changing as shown in Fig. 16. The radio signal is introduced at the normal grid while

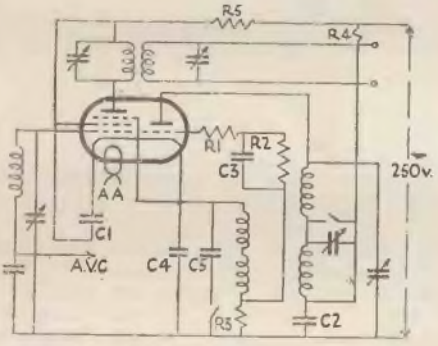



FIG. 17.—The triode-pentode which is virtually two valves with a common cathode is employed for frequency-changing in this manner.

the valve is caused to oscillate by means of the tuned circuit connected across the valve and the coupling coil in the cathode circuit. When the same system is used in connection with battery valves, small H.F. chokes are placed in the filament leads.

The triode-pentode is another popular frequency-changing valve, although it is not actually a "combined" mixer as it comprises two separate 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.

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| 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 ,, | |

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## HIVAC VALVES COMPARATIVE TABLE

### 2-VOLT BATTERY VALVES.

| HIVAC | | | MAZDA | MULLARD | COSSOR | MARCONI-OSRAM |
|---|---|---|---|---|---|---|
| H 210 | H.F. Amplifier ... ... ... | 3/9 | HL 210 | PM 1 HL | 210 HL | HL 210 |
| D 210 | Non-Microphonic Detector ... | 3/9 | L 2 | PM 2 DX | 210 Det. | HL 2 |
| DDT 220 | Duo-Diode-Triode ... ... | 7/– | L/2 DD | TDD 2 | — | HD 21 |
| L 210 | L.F. Amplifier ... ... ... | 3/9 | L 2 | PM 2 DX | 210 LF | L 210 |
| P 220 | Small Power ... ... ... | 5/6 | P 220 | PM 2 A | 220 P | LP 2 |
| PP 220 | Medium Power ... ... ... | 6/6 | P 220A | PM 202 | 220 P | P 2 |
| PX 230 | Super Power ... ... ... | 7/6 | — | PM 202 | 230 XP | P 2 |
| Y 220 | Medium Power Output Pen. Type | 10/6 | Pen 220 | PM 22 A | 220 HPT | PT 2 |
| Z 220 | Super Power Output Pen. Type | 10/6 | Pen 220 A | PM 22 | 230 PT | — |
| B 230 | Class "B" ... ... ... | 10/6 | PD 220 | PM 2 B | 220 B | B 21 |
| DB 240 | Driver Class "B" ... ... | 15/6 | — | — | — | — |
| QP 240 | Double Pen. Type for Q.P.P. ... | 19/6 | QP 240 | — | — | QP 21 |
| SG 215 | Screen Grid ... ... ... | 10/6 | SG 215 | PM 12 | 215 SG | S 21 |
| SG 220 | High Slope Screen Grid ... | 10/6 | S 215 B | PM 12 A | 220 SG | S 22 |
| VS 215 | Variable-Mu Screen Grid ... | 10/6 | S 215 VM | PM 12 M | 220 VSG | VS 24 |
| HP 215 | H.F. Pentode Type ... ... | 10/6 | SP 215 | SP 2 | 210 SPT | SP 21 |
| VP 215 | Variable-Mu H.F. Pen. Type ... | 10/6 | HP 215 | VP 2 | 210 VPT | VP 21 |

### 4-VOLT MAINS VALVES (A.C.).

| | | | | | | |
|---|---|---|---|---|---|---|
| AC/HL | Detector ... ... ... | 9/6 | AC/HL | 354 V | 41 MHL | MH 4 |
| AC/SHT | Duo-Diode-Triode ... ... | 12/6 | AC/HL-DD | TDD 4 | DDT | MHD4 |
| AC/L | Small Power ... ... ... | 12/6 | AC/P | 104 V | — | ML 4 |
| AC/Y | Output Pentode Type ... ... | 15/6 | AC Pen | Pen 4 V | MP/Pen | MPT 4 |
| AC/Z | High Slope Output Pen. Type | 15/6 | AC 2/Pen | — | 42 MP/Pen | — |
| AC/SL | Screen Grid Amplifier ... ... | 13/6 | — | S 4 VB | MSG/LA | — |
| AC/SH | High Gain S.G. Amplifier ... | 13/6 | AC/SG | S 4 VA | MSG/HA | MS 4 B |
| AC/VS | Variable-Mu Screen Grid ... | 13/6 | AC/SIVM | MM 4 V | MVSG | VMS4B |
| AC/VH | Variable-Mu High Gain S.G. ... | 13/6 | AC/SG VM | — | — | — |
| AC/HP | H.F. Pentode Type ... ... | 13/6 | AC/S2 Pen | SP 4 | MS/Pen | MSP 4 |
| AC/VP | Variable-Mu H.F. Pen. Type ... | 13/6 | AC/VP1 | VP 4 | MVS/Pen | VMP 4 |
| UU120/350 | Full Wave Rectifier (I.H.C.)... | 10/6 | UU120/350 | 1 W 3 | 442 BU | MU 12 |
| UU120/500 | Full Wave Rectifier (I.H.C.) ... | 15/– | UU120/500 | DW/4DH | 460 BU | MU 14 |

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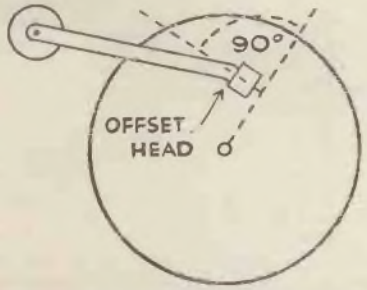
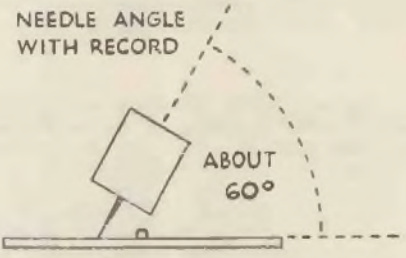
wears slack and the needle is not clamped properly. This gives rise to chatter. There is no real cure for this. Undue wear can be prevented by using less force in screwing up the needle clamp.

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



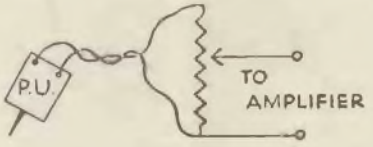




FIG. 18.—These three sketches show the correct position of a pick-up with respect to the record, and how to connect an external volume control.

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

## RADIO SERVICING—4

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

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

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

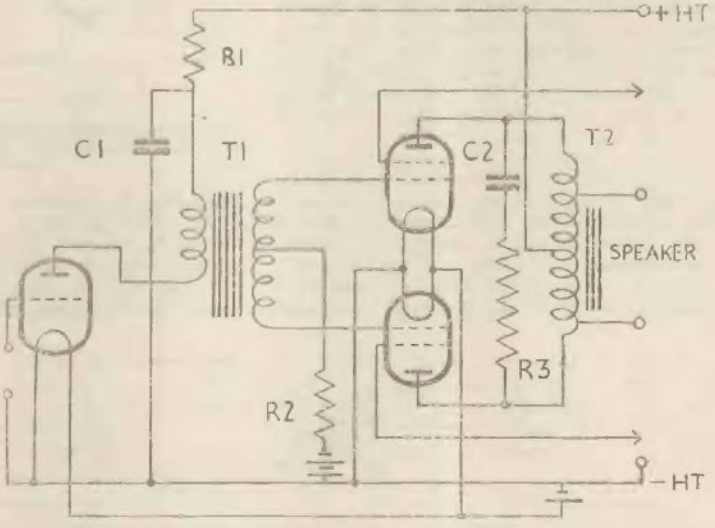



FIG. 19.—The Q.P.P. input transformer T1 is decoupled through R1 and C1. The resistance R2 in the grid bias lead prevents instability, while C2 and R3 form a tone correction to the centre tapped matching choke T2. The quiescent currents of the output pentodes are matched by individual adjustment of the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

rectifier. Fig. 20 shows the basic circuit for half and full wave rectification.

The input transformer is designed to operate from the supply mains and it is provided with two secondary windings. The first suits the filament of the valve and is frequently centre tapped. In the case of the half wave rectifier as shown in Fig. 20 (a) a single winding is used, one end going to the anode, and the other forming the main negative high-tension terminal. The positive terminal is the filament or centre tap of the filament winding.

Fig. 20 (b) shows an almost identical arrangement for a full wave rectifier, *i.e.*, a double anode valve. In this case, the high-tension secondary winding is centre tapped, the outers going to the two anodes, and the centre tap forming the main negative terminal of the high-tension supply. When a metal rectifier is employed the input trans-

## RADIO SERVICING—4

former has only one secondary winding, since there is no filament to heat.

Three forms of rectifier circuits are employed. In Fig. 21, (a) shows a simple half wave rectifier in which the rectifier is connected to one of the leads from the secondary winding, the other lead forming the negative terminal. The more general arrangement, however, is shown in (b), in which the metal rectifier has four terminals. The unit actually contains four separate elements connected on what is sometimes called the Gratz system. Some form of bridge arrangement is actually employed.

The third method is shown in Fig. 21 (c) and is known as the condenser 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

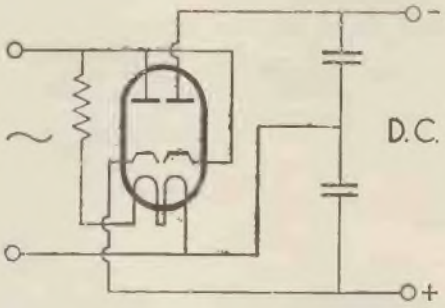



FIG. 22.—Indirectly-heated cathode rectifiers are available suitable for use in voltage-doubler circuits.

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

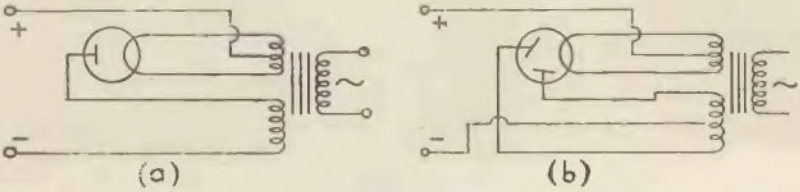



FIG. 20.—Half and full wave valve rectifier circuits.

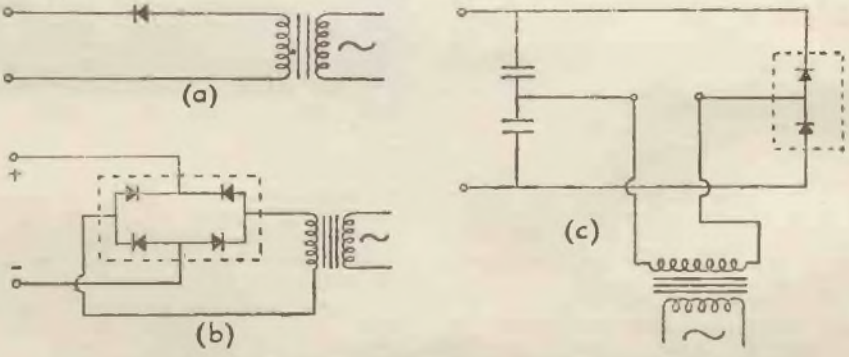



FIG. 21.—Half wave, full wave, and condenser doubling metal rectifier circuits.

should be connected to the output in series with a milliammeter. The value of this resistance is worked out, of course, from Ohm's Law, the value being given by the rated output voltage divided by the rated output current. In the example quoted, for 160 volts at 20 m.a., 8,000 ohms would be required.

The steadiness of the milliammeter needle should be carefully watched. Slight tremor may be experienced owing to the unsmoothed nature of the current, but there should be no violent needle kicks either up or down. If there are it indicates some trouble in the rectifier which should be returned to the manufacturers for their examination.

### Resistance-capacity Coupling.

In resistance-coupled amplifiers the anode resistance should be two or three times the resistance of the valve, and the following grid leak should be about four times the value of the anode resistance.

The value of the grid leak automatically gives the correct capacity of the coupling condensers.

Here are the condenser values to be used for 90 per cent. bass reproduction:—5 meg. leak, .0015 mfd. condenser; 3 meg., .002 mfd.; 2 meg., .003 mfd.; 1 meg., .0065 mfd.; .5 meg., .015 mfd.

### Resistance Feed System.

The performance of a small transformer is always improved by removing the steady anode current from the primary winding. In the case of a special nickel alloy transformer which has a high incremental permeability, it is essential.

The transformer should be connected as shown in Fig. 23. This indicates alternative arrangements which vary the ratio by making an ordinary transformer an auto transformer, in which the primary and secondary windings are electrically continuous.

The value of the anode resistance depends upon the impedance of the valve with which the transformer is used. Approximately from 20,000 to 50,000 ohms is a useful range. The higher the impedance of the valve, the higher must be the value of the resistance. The feed condenser should be from 0.5 mfd. to 1 mfd. in capacity.

If a resistance-fed stage suddenly gives trouble resulting in loss of amplification and thinness of quality, it may appear at first sight to be due to shorted turns. On the other hand, it is more likely to be caused by failure of the feed condenser. Should this develop a bad leakage path a direct current load is imposed upon the primary of the transformer, the performance of which will then be completely spoilt. This fact should be determined by isolating the condenser and testing it separately.

### Resistances.

Resistances can be divided into two classes, wire wound and composition.

The essential features of a good wire-wound resistance are sound mechanical construction with good electrical joints at the ends. Spaghetti or link resistances should preferably be connected to their tags by electrical welding, while adequate protection in the form of reinforced high-grade sleeving is essential to prevent trouble due to absorption of moisture, and mechanical breakage through bending of the tag.

The only troubles likely to arise in resistances are bad joints and intermittent internal short circuits, giving rise to noisy operation. A noisy resistance should be tested by a silence tester.

The actual value can be quite accurately determined by measuring the current which flows through the resistance at a known voltage. The resistance, it will be remembered, is given by the voltage divided by the current.

It is essential not to overload resistances. If a resistance becomes very hot in use, it should be replaced by one of a larger current-carrying capacity.

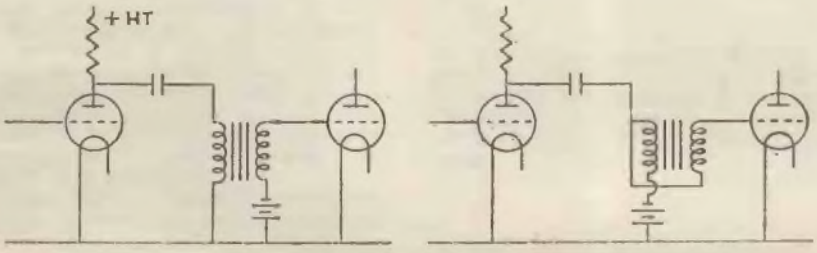



FIG. 23.—Anode feed system for a transformer giving (A) a direct connection and (B) an auto-connection, which increases the step-up ratio.

### Colour Code for Resistors.

The Radio Manufacturers' Association standard colour code for resistors entails the use of colours to each of which a number has

## RADIO SERVICING—4

been allocated. The colours and figures are :—

| Colour. | Figure. | Colour | Figure. |
|---|---|---|---|
| Black ... | 0 | Green ... | 5 |
| Brown ... | 1 | Blue ... | 6 |
| Red ... | 2 | Violet ... | 7 |
| 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.

### Speaker Matching.

For optimum volume and quality the speaker and output valve must be matched. Usually an output transformer with a suitable ratio is used for this purpose. The correct transformer ratio can be derived from the following formula :—

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

The optimum load can always be obtained from the valve makers' rating. The speaker impedance generally resolves into that of the impedance of the moving coil. This is not always known, but as a rough rule it can be taken as twice the D.C. resistance. If the optimum load of a valve is not given by the makers, this can also be taken as twice the impedance.

When two valves are used in parallel, the valve impedance is halved. With push-pull the effective impedance is doubled. The necessary alteration to the effective impedance must be made when applying the formula.

For example, to match two 2,000 ohms valves in parallel, using a speech coil with an impedance of 5 ohms, the correct transformer ratio is :—

$$2\sqrt{\frac{2{,}000}{5}} = 20$$

With a 4.2 ohms impedance coil and a pair of 8,000 ohms valves in push-pull, the ratio is :—

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

### 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.

A good moving-coil speaker should give excellent radiation at both ends of the scale, while the characteristic should be reasonably flat. The response should be fairly level in the region of 5,000 cycles and above.

Record scratch does not necessarily indicate that a moving coil speaker gives good top response, because very frequently scratch frequencies come out well, but frequencies in the neighbourhood of 4,000 to 6,000 cycles may 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.

This arrangement will pick up a large amount of 50 cycle energy which should be reproduced by the set in addition, of course, to the harmonics. A true 50 cycle note has a very deep boom, the presence of which can be almost felt. Even a 50 cycle note of low intensity produces a mild sensation of deafness. Turned up to greater volume it becomes exceedingly unpleasant. A good speaker should be capable of producing this effect. If it does not do so, it can be taken that the radiation at 50 cycles is poor.

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 centreing 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.

Faults on input transformers are rare. They should be tested like output transformers.

### 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.

Faults in moving iron speakers can be divided into two classes, electrical and mechanical. In the mechanical class come faults due to diaphragm fixings and mountings.

Dealing first with the electrical faults, defective windings, short circuited turns, or leakage to frame are all that are likely to happen. Short circuited turns cause loss of volume and thinness of quality. Defective windings give rise to scraping noises. They should be tested in the manner already described.

It is not advisable to attempt to remedy any defect associated with the adjusting mechanism unless the unit is of the simplest reed type. If the tongue or armature is definitely in contact with a pole piece, no attempt should be made to rectify this by bending it. It should be returned to the makers.

Loose cone clamps or the edge of a diaphragm in intermittent contact with the cabinet or supporting chassis will give rise to jingles. Close inspection usually reveals the exact source of the trouble. On occasions, the seat of the trouble is obscure. A small flake of mountant which has worked loose will produce quite an appreciable buzzing noise, and possibilities of this type should not be overlooked.

In the early types of speakers the adjustments usually caused the armatures to hit the pole pieces with a decided click. This is not the case in many modern speakers, and the absence of a loud click should not be regarded as a possible fault.

The resistance of the winding of a speaker varies greatly with various makes. Alone it is no guide to the suitability of a speaker for any particular valve. What matters is the effective impedance, this is a function of the winding and not the resistance alone. Many speakers have alternative tappings. Actual signal tests usually reveal the best connection.

Where separate models are available with different impedances, a low impedance speaker should be used with a low impedance or super power output valve. When a pentode is used, a high impedance is necessary. The use of a low impedance speaker with a high impedance valve usually results in thinness of quality, whereas a high impedance speaker connected to a low impedance valve usually causes a roundness of tone with a loss in the upper registers.

In fitting moving iron units with cones, it can be taken that as a general rule the best results are obtained with a large cone which is fairly deep. It is important that the cone is reasonably light. Every precaution must be taken to prevent the hard edge of a cone being in contact with any object such as the side of a case. A layer of resilient material such as rubber, felt, cotton wool, or a leather suspension ring should be employed.

### 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.

This is not sufficiently powerful to operate a speaker directly, because speakers are extremely inefficient. Further amplification is necessary, and this is carried out by means of low-frequency amplifiers. The successive stages of these are coupled either by transformers, resistance coupling units, or choke coupling units. In some cases, a mixed amplifier is used, one stage being resistance-coupled, and the others, perhaps, transformer types.

Supersonic or superheterodyne reception, however, is fundamentally different, in that amplification is carried out at an "intermediate" frequency different from the frequency of the received signal. Signals on the normal broadcast band are transmitted at frequencies in the region perhaps of, say, 1,000 kilocycles. This is a comparatively high frequency. Signals obtained at this frequency in supersonic reception are 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 valve 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

## RADIO SERVICING—4

of 2,500 metres. The output of this detector valve is then amplified by one or more screen grid 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. A very powerful and selective receiver is obtained which requires only two controls, that of the input circuit and that of the oscillator.

These two condensers are usually ganged, but this is a matter which should not be attempted by the dealer as it necessitates extremely complicated "laws" for the two condensers. These are frequently obtained by the use of series condensers connected to one of the variable condensers. For this reason, a proprietary ganged superheterodyne receiver should never be dismantled, as ganging may be upset, in which case it will be totally unbalanced.

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 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 65. 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.

### 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.

It is essential in a sensitive receiver employing valves of this type to keep the field of the heater wires as small as possible. It is general to use the shortest possible leads between the valve holders, and the wires are usually twisted together. In some cases, an earthed screen is used for the filament leads.

In re-wiring a set with mains valves, the heater circuit should certainly be kept as compact as possible. Large output valves having comparatively big filaments with a large thermal inertia can be run successfully by direct operation from the A.C. supply.

### Valves, Testing.

Complete valve failure is extremely rare. It can be instantly identified. Partial valve failure is a more common occurrence and precise testing methods are necessary in order to identify it. A valve can be tested either in a receiver while it is operating, or it can be

## RADIO SERVICING—4

more closely examined on the test bench. The latter procedure is undoubtedly the better.

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.

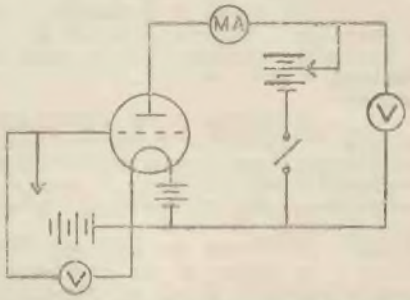



FIG. 24.—A simple circuit for obtaining a fairly accurate measurement of the amplification factor and slope, or mutual conductance, of a valve.

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 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. A composition type in which the movable contact works directly on the element is not generally satisfactory. Efficient types usually include either a very springy dished metal washer which is pressed into contact with the element, or an arm which works over adjacent turns of wire wound over the resistance element. The wire is cut at each turn, the turns forming in effect a large number of contact studs.

The resistance of the control can be measured by the 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. This can be checked, of course, by measuring the resistance between one end of the control at equal intervals of rotation.

Silence is important, and it can be checked up by the silence tester.

# GUIDE TO VALVE

## Compiled by "The Service Engineer"

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.

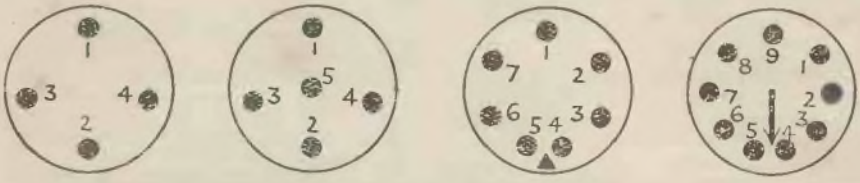
Only Continental valves with unorthodox bases, therefore, are dealt with in the separate chart and diagram below.

### 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 numering 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 | M | — | — | H | H | C | A | — | — | CG |
| Screen grid, B | SG | CG | F | F | — | — | — | — | — | A |
| " M | SG | CG | H | H | C | — | — | — | — | A |
| H.F. Pentode, B | AG | CG | F | F | — | — | — | — | — | A |
| " B | Met | CG | S | F | F | — | SG | — | — | A |
| " M | AG | CG | H | H | C | — | — | — | — | A |
| " M | Met | CG | S | H | H | C | AG | — | — | A |
| Heptode, B | OA | OG | SG* | F | F | — | A | — | — | CG |
| " M | OA | OG | SG* | H | H | C | A | — | — | CG |
| Octode, B | OA | OG | AG* | F | F | — | A | — | — | CG |
| " M | OA | OG | AG* | H | H | C | A | — | — | CG |
| H.F. pentode triode, B | AG | A | S | F | F | — | OA | OG | Met | CG |
| " M | AG | A | S | H | H | C | OA | OG | Met | CG |
| Double diode, B | DA1 | DA2 | F | F | — | — | — | — | — | — |
| " M | DA1 | DA2 | H | H | C | — | — | — | — | — |

# BASE CONNECTIONS

## B.R.V.M.A. BASES—*continued.*

| Valve type | Pin Connections. 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Top. |
|---|---|---|---|---|---|---|---|---|---|---|
| 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 |
| 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 | — | — | — |
| Double pentode, B | CG1 | CG2 | A2 | F | F | AG | A1 | — | — | — |
| ,, B | CG1 | A1 | AG1 | F | F* | — | AG2 | A2 | CG2 | — |
| ,, M | CG1 | A1 | AG1 | H | H | C* | 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 | — | — | — | — | — | — |

## CONTINENTAL BASES.

| Valve type. | Pin Connections. 1 | 2 | 3 | 4 | 5 | 6 | Top. |
|---|---|---|---|---|---|---|---|
| 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 | — |


This diagram shows the arrangement of the connections on the bases of Continental and Mullard universal type valves respectively. The bases are (left to right) four, five and six pin Continental types, and the "P" and "V" type Mullard universal side-contact bases, respectively. The chart for the Continental types is given above, and for the Mullard bases below. The code for the chart is at the top of the opposite page.

## MULLARD UNIVERSAL VALVE BASES.

| Valve type. | Base. | Contacts. 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Top. |
|---|---|---|---|---|---|---|---|---|---|---|
| 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 | — |

# CIRCUIT DESIGN SIMPLIFIED

WITH the data and charts here it is easy to find the component values of any circuit. This is how it is done in the case of a typical circuit such as that given on this page.

Several values can be obtained from the table of Standard Values in the next column. $C_1$ must be .0005 mfd. capacity, $C_2$ .00015 to .0003 mfd., according to the reaction coil; $C_3$ .0001 mfd., and $R_1$ .5 megohm. $C_4$, it is found, must be .0003 mfd. and $C_5$ 2 mfd.

For the resistance of $R_2$ the voltage drop *abac* is used (see p. 98). First, the characteristics of the valve $V_1$ must be examined, and the recommended anode voltage and the anode current—in this case with no grid bias—ascertained. Values of 150 volts and 5 m.a. respectively can be assumed.

As the H.T. voltage is 250, it is obvious that 100 volts have to be dropped across the resistance $R_2$.

Now, taking the *abac* and placing a straight edge so that it passes through the 100 volt and 5 m.a. marks, it will also be seen to cut the resistance line at 20,000 ohms. This is the required value of $R_2$.

$R_4$, the bias resistance, is found by placing the straight-edge on the anode current of 10 m.a., and the bias value of 12 volts (see *abac*, p. 97). This results in a resistance value of 1,200 ohms.

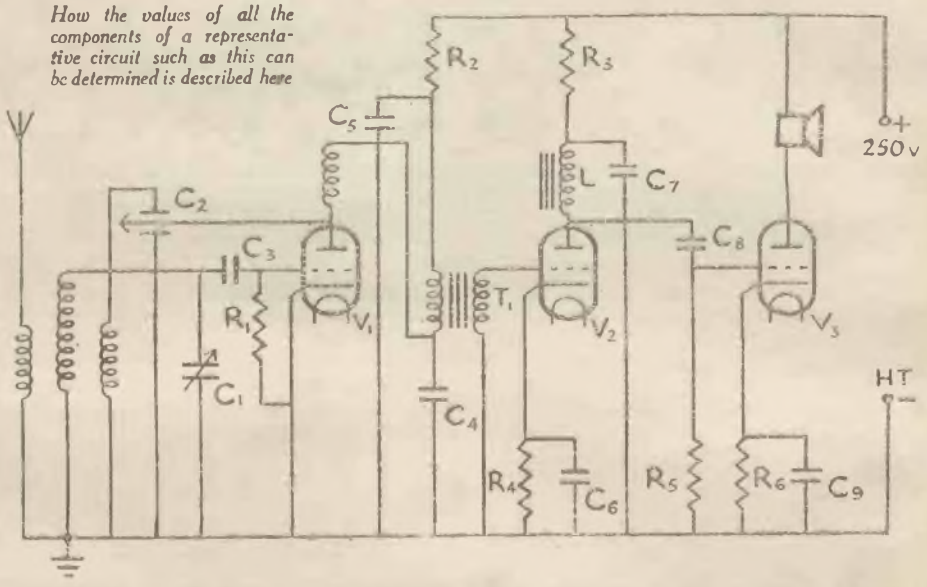
CONDENSERS.

| | |
|---|---|
| Tuning Condenser | 0.0005 mfd. |
| Reaction Condenser | 0.00015 mfd. to 0.0003 mfd. |
| Grid Rectification Condenser | 0.0003 mfd. |
| Power Grid Rectification Condenser | 0.0001 mfd. |
| H.F. By-Pass Condenser | 0.0003 mfd. |
| H.F. Shunt Condenser | 0.01 mfd. |
| L.F. Coupling Condenser | 0.025 mfd. to 0.05 mfd. |
| Decoupling Condenser | 1 mfd. to 2 mfd. |
| L.F. Shunt By-Pass Condenser | 1 mfd. |
| Band-Pass Coupling Condenser | 0.01 mfd. to 0.04 mfd. |

RESISTANCES.

| | |
|---|---|
| Coupling Grid Resistance | 0.25 megohms. |
| Grid Rectification Leak | 2 megohms. |
| Power Grid Rectification Leak | 0.5 megohms |
| H.F. Stopping Resistance | 50,000 ohms. |
| Volume Control Potentiometer | 50,000 ohms. |
| Volume Control Potentiometer in shunt with High Impedance | 250,000 ohms. |

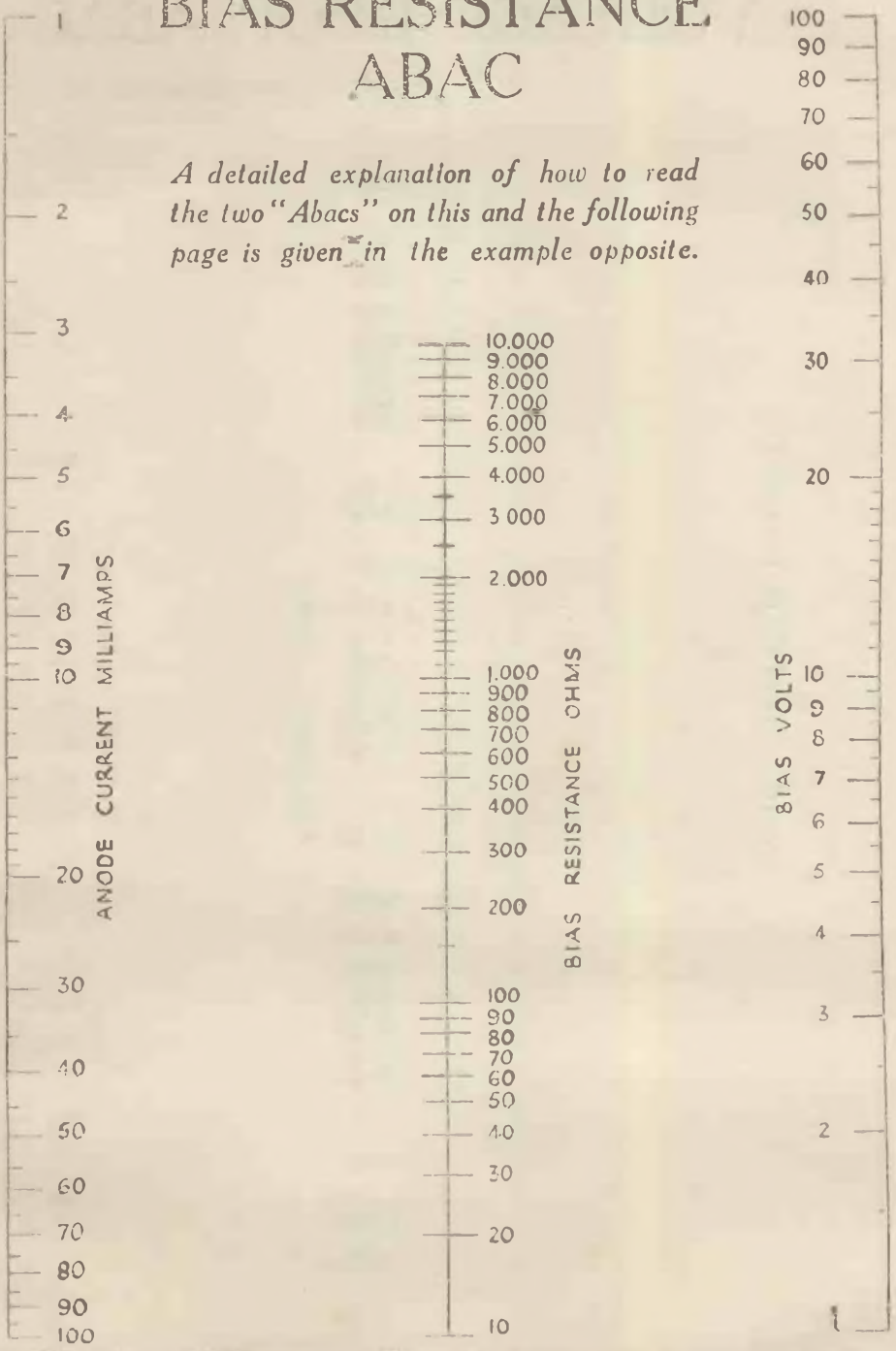
*How the values of all the components of a representative circuit such as this can be determined is described here*




**SPECIFIED IN MOST RECEIVERS**

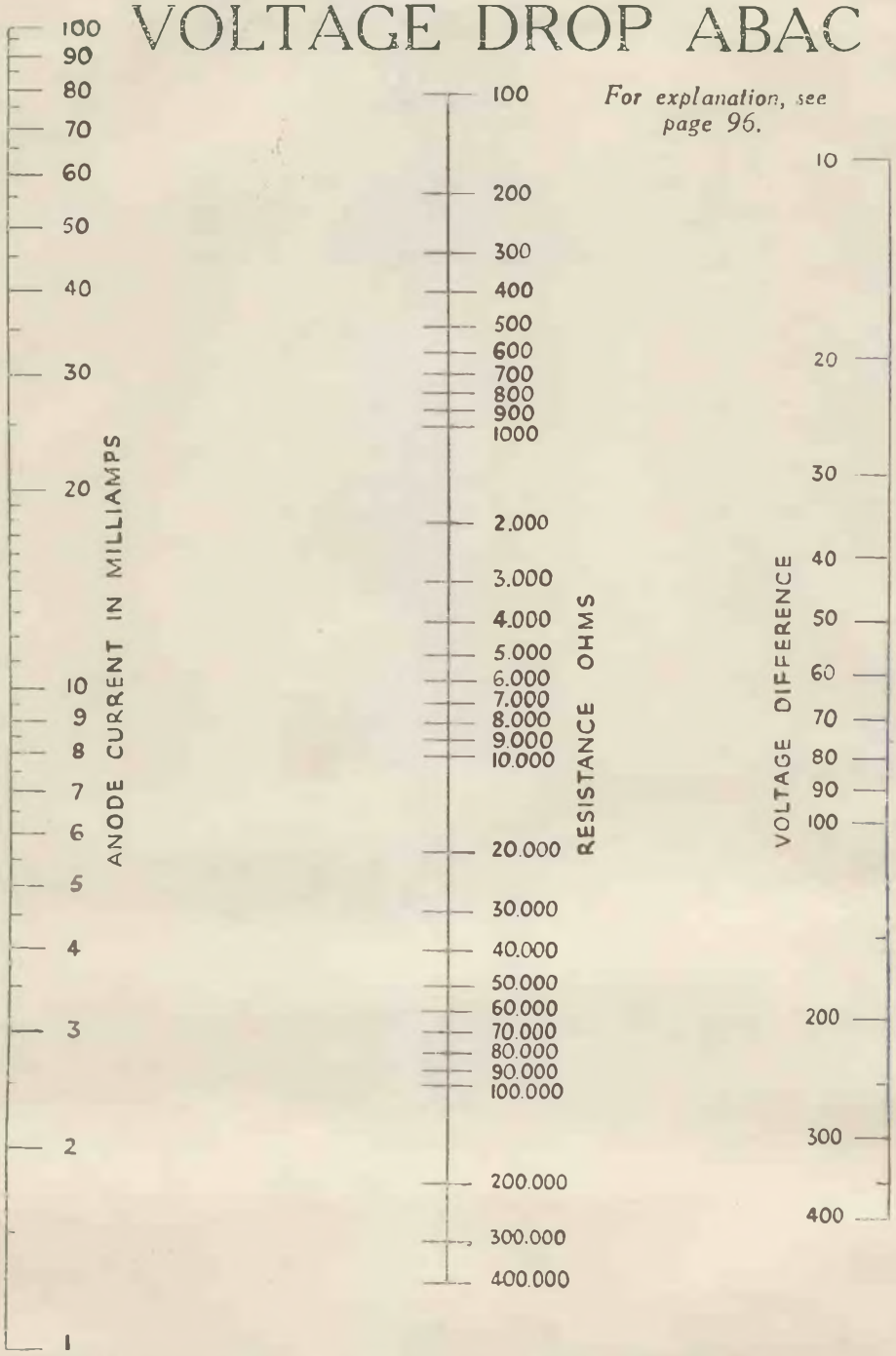
# BIAS RESISTANCE ABAC

*A detailed explanation of how to read the two "Abacs" on this and the following page is given in the example opposite.*



# VOLTAGE DROP ABAC

*For explanation, see page 96.*



# 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.

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

### FOR OSCILLATORY CIRCUITS.

Wavelength of a circuit LC is given by :—

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

where $\lambda$ 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 :—

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

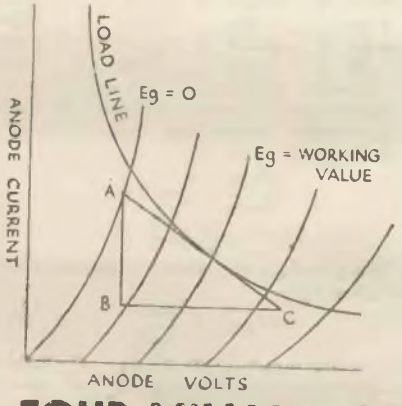
where $I_a$ equals the steady anode current in milliamps and $E_a$ is the anode voltage.

### 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 ($\mu$).

*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.*

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

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

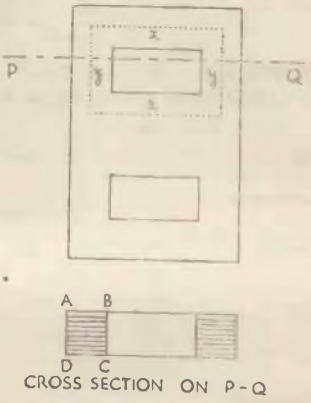
### IRON CORE INDUCTANCES.

The inductance of an iron core is given by the expression :—

$$L_{(H)} = \frac{4\pi T^2 \mu A\, 10^{-9}}{l}$$

where $\pi$ equals 3.14, $T^2$ equals the turns, $\mu$ 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 :—

$$\frac{1}{T} = 4{\cdot}44\ 10^{-5} fAB$$

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 :—

$$\sqrt[2]{\frac{\text{Valve Load}}{\text{Speaker Impedance}}}$$

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
$\rho$ = 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 | ·04 |
| Steel | 12 |

## QUANTITIES OF WATER AND ACID IN VARIOUS S.G. ELECTROLYTES.

Quantities of Water and Acid to be added to produce required specific gravity.

*Using* 1·400 acid.

| Required Specific Gravity. | Water Parts by Volume. | Acid Parts by Volume. |
|---|---|---|
| 1·300 | 4·5 | 10 |
| 1·280 | 5·5 | 10 |
| 1·275 | 6·25 | 10 |
| 1·260 | 6·5 | 10 |
| 1·250 | 6·75 | 10 |

1·835 acid.

| | | |
|---|---|---|
| 1·400 | 15·6 | 10 |
| 1·350 | 19·5 | 10 |
| 1·300 | 24·7 | 10 |
| 1·290 | 26·0 | 10 |
| 1·280 | 27·5 | 10 |
| 1·270 | 29·0 | 10 |
| 1·260 | 30·0 | 10 |
| 1·250 | 32·2 | 10 |
| 1·240 | 34·0 | 10 |
| 1·230 | 36·0 | 10 |
| 1·225 | 37·2 | 10 |

# BRITISH STANDARD WIRE TABLES

## BARE COPPER.

| S.W.G. | Diam. | Section Area. | Ohms per 1,000 yds. | Length per Ohm. | Weight per 1,000 yds. | Ohms per lb. | Approx. safe current. |
|---|---|---|---|---|---|---|---|
| | ins. | sq. in. | | ins. | ozs. | | in amps. |
| 50 | ·001 | ·00000079 | 30,570 | 1·18 | ·145 | 3,365,000 | ·003 |
| 49 | ·0012 | ·00000113 | 21,230 | 1·7 | ·209 | 1,623,000 | ·005 |
| 48 | ·0016 | ·00000201 | 11,941 | 3·02 | ·372 | 513,500 | ·008 |
| 47 | ·002 | ·00000314 | 7,642 | 4·71 | ·581 | 210,300 | ·012 |
| 46 | ·0024 | ·00000452 | 5,307 | 6·78 | ·834 | 101,440 | ·02 |
| 45 | ·0028 | ·00000616 | 3,899 | 9·24 | 1·14 | 54,750 | ·025 |
| 44 | ·0032 | ·00000804 | 2,985 | 10·77 | 1·49 | 32,090 | ·03 |
| 43 | ·0036 | ·0000102 | 2,359 | 15·26 | 1·88 | 20,040 | ·04 |
| 42 | ·004 | ·0000126 | 1,910 | 18·87 | 2.32 | 13,146 | ·05 |
| 41 | ·0044 | ·0000152 | 1,578 | 22.81 | 2·81 | 8,978 | ·06 |
| 40 | ·0048 | ·0000181 | 1,326 | 27·15 | 3·35 | 6,340 | ·07 |
| | | | | yards. | lbs. | | |
| 38 | ·006 | ·0000283 | 849 | 1·18 | ·327 | 2,597 | ·1 |
| 36 | ·0076 | ·0000454 | 529 | 1·89 | ·525 | 1,008 | ·15 |
| 34 | ·0092 | ·0000665 | 361 | 2·77 | ·769 | 469·8 | ·25 |
| 32 | ·0108 | ·0000916 | 262 | 3·82 | 1·06 | 247·4 | ·4 |
| 30 | ·0124 | ·000121 | 199 | 5·03 | 1·40 | 142·35 | ·5 |
| 28 | ·0148 | ·000172 | 139·5 | 7·18 | 1·99 | 70·14 | ·7 |
| 26 | ·018 | ·000254 | 94·3 | 10·6 | 2·94 | 32·06 | 1·0 |
| 24 | ·022 | ·000380 | 63·2 | 15·8 | 4·4 | 14·366 | 1·5 |
| 22 | ·028 | ·000616 | 39 | 25·6 | 7·12 | 5·475 | 2·5 |
| 20 | ·036 | ·00102 | 23·6 | 42·4 | 11·8 | 2·004 | 4 |
| 18 | ·048 | ·00181 | 13·27 | 75·4 | 20·9 | ·634 | 7 |
| 16 | ·064 | ·00322 | 7·46 | 134·6 | 37·2 | ·2 | 13 |
| 14 | ·08 | ·00503 | 4·78 | 208 | 58·1 | ·08216 | 19 |
| 12 | ·104 | ·0085 | 2·83 | 353 | 92·8 | ·02877 | 28 |
| 10 | ·128 | ·013 | 1·87 | 535 | 148·8 | ·012537 | 35 |

## RESISTANCE WIRES.

| | 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 | 3,450 |
| 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 | 1,000 | 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 | 20·1 |

## ENAMELLED.

| | | | | per oz. |
|---|---|---|---|---|
| 50 | ·2 | 833 | 694,000 | 6,480 |
| 49 | ·2 | 714 | 510,000 | 4,510 |
| 48 | ·3 | 526 | 277,000 | 2,540 |
| 47 | ·3 | 435 | 189,000 | 1,630 |
| 46 | ·4 | 357 | 127,500 | 1,128 |
| 45 | ·5 | 303 | 91,800 | 835 |
| 44 | ·5 | 270 | 72,900 | 642 |
| 42 | ·6 | 217 | 47,100 | 411 |
| 40 | ·7 | 182 | 33,100 | 286 |

| | | | | per lb. |
|---|---|---|---|---|
| 38 | 1·0 | 143 | 20,450 | 2,810 |
| 36 | 1·0 | 116 | 13,450 | 1,840 |
| 34 | 1·0 | 98 | 9,600 | 1,202 |
| 32 | 1·2 | 83·3 | 6,940 | 915 |
| 30 | 1·2 | 73·5 | 5,400 | 694 |
| 28 | 1·6 | 60·1 | 3,610 | 488 |
| 26 | 1·8 | 50·5 | 2,550 | 330 |
| 24 | 2·3 | 41·1 | 1,690 | 221 |
| 22 | 2·5 | 32·8 | 1,080 | 137 |
| 20 | 2·7 | 25·8 | 666 | 83·3 |
| 18 | 2·7 | 19·7 | 388 | 46·0 |
| 16 | 3·5 | 14·8 | 219 | 26·4 |

# SUPPLY VOLTAGES OF THE UNITED KINGDOM

*By courtesy of "The Practical Electrician's Pocket Book."*

Abberlady .. 230A
Abberton .. 230A
Abbey Wood .. 200A
Abbots Bromley 230A
Abbotskerswell 200A
Abbots Langley 200A
240A
Abdie .. .. 250A
Aberangell .. 230C
Aberayron .. 230A
230C
Aberbargoed .. 230A
Abercanaid .. 250A
Abercrave .. 240C
Aberdeen .. 220A
230A
Aberdour .. 250A
Aberfan .. 250A
Abergwill .. 230A
Abertillery .. 250A
Abersychan .. 230A
Aberystwyth .. 220C
Abingdon .. 230A
Abinghall .. 230A
Above Derwent 100A
200A
Abram .. .. 230A
Accrington .. 230A
Acklam .. 230A
Acomb (N'land) 250A
Acomb (Yorks) 230A
Acresford .. 230A
Acton (Ches.) .. 220A
Acton (London) 230A
230C
Acton Grange .. 250A
Addiewell .. 230A
Addington Great 230A
Addington Little 230A
Adlington (Ches.) 230A
Adlington (Lancs.) .. 230A
Adstock .. 230A
Adstone .. 230A
Adswood .. 230A
Adwick-le-Street 230A
Ailsworth .. 230A
Aingers Green .. 230A
Ainsworth .. 230A
Airedale .. 230A
Airdrie .. .. 240A
Airth .. .. 250A
Akeley .. .. 230A
Albrighton .. 230A
Albury .. .. 230A
Alby-with-Thwaite .. 230A
Aldborough .. 230A
Aldeburgh .. 210C
Aldenham .. 200A
Alderley Edge .. 230C
Aldersey .. 230A
Aldersford .. 230A
Aldershot .. 230A
210C
Alderton .. 230A
Aldford .. 230A
Aldham .. 230A
Aldridge .. 230A
Aldwark .. 230A
Aldwick .. 230A
Aldwickbury .. 240A
Aldwinkle .. 230A
Alexandria .. 240A
Aley Green .. 240A

Alfriston .. 230A
Alfynydd .. 230A
Alkham .. 230A
Allanton .. 240A
Allestree .. 200A
Allhallows .. 230A
Allithwaite .. 230A
Alltwen .. 230A
Alne .. .. 230A
Alnesbourne Priory .. 230A
Alphington .. 210A
Alresford (Essex) 230A
Altham .. .. 230A
Althorne .. 230A
Altrincham .. 100A
Alva .. .. 250A
Alvanley .. 250A
Alvaston .. 200A
Alveston .. 230A
Alwalton .. 240A
Amble .. .. 250A
Amblecote .. 200A
Ambleside .. 100A
200A
Amersham .. 200A
Amersham Hill 200A
Amesbury .. 220C
Amington .. 250A
Ammanford .. 250C
Ampthill .. 230A
Anderton .. 220A
Andover .. 230A
Anlaby .. 230A
Annables .. 240A
Annan .. .. 230A
Annfield Plain .. 250A
Anslow .. 230A
Anstey Pasture 240A
Anstrey .. 250A
Anstruther .. 250A
Appledore .. 230A
Appleton .. 250A
Apuldram .. 230A
Arbroath .. 250A
250C
Arbury .. 250A
Ardingley .. 230A
Ardleigh .. 230A
Ardrossan .. 240A
Ardsley .. 230A
Argoed .. 230A
Arkendale .. 230A
Arkley .. .. 240A
Arlesey .. 240A
Armadale .. 250A
Armitage .. 230A

Arnold (Notts) 230A
Arnold (Yorks) 230A
Arrad Foot .. 230A
Arthingworth .. 230A
Artington .. 230A
Arundel .. 230A
Ascot .. .. 220C
Ascott .. .. 240A
Ash Bank, Bucknall .. 230A
Ashburnham 230A
Ashburton .. 240A
Ashby-de-la-Zouch .. 240A
Ashford .. 230A
Ashill .. .. 230A
Ashington .. 230A

Ashington .. 230A
Ashley (Ches.) .. 220A
Ashley (Salop) 230A
Ashley Green .. 200A
Ashton (Ches.) 230A
Ashton (Lancs.) 230A
Ashton-in-Makerfield .. 230A
Ashton-on-Mersey .. 100A
Ashton-on-Ribble .. 230A
Ashton-under-Lyne .. 240C
Ashurst .. 220A
Ashurst Wood .. 230A
Ashwell .. 240A
Ashwellthorpe 230A
Askam .. .. 220A
Askrigg .. 230A
Aspley Guise .. 230A
Aspley Heath (Beds) .. 230A
Aspley Heath (Warwicks) .. 230A
Aspull .. .. 230A
Astcote .. .. 230A
Astley .. .. 230A
Aston (Herts) .. 240A
Aston (London) 240A
Aston (Staffs.) .. 250A
Aston Clinton .. 230A
Aston Grange .. 250A
Astwick .. 240A
Atherstone .. 240A
Atherton .. 240A
Attleborough .. 230A
Auchendinny .. 230A
Auchenheath .. 240A
Auchinleck .. 240A
Auchterderran .. 250A
Auchtermuchty 250A
Audenshaw .. 230A
230C
Aughton(Lancs) 230A
Austwick .. 230A
Avonbridge .. 250A
Axminster .. 250A
Aylburton .. 230A
Aylesbury .. 220A
230C
Aylesford .. 230A
Aylesham .. 230A
Aynho .. .. 230A
Ayr .. .. 240A
240C
Aysgarth .. 230C

Babraham .. 240A
Bache .. .. 280A
Backbarrow .. 230A
Backford .. 230A
Bacton .. .. 230A
Bacup .. .. 230A
Badby .. .. 230A
Baddeley .. 230A
Baddesley .. 250A
Badgemore .. 230A
Badgeworth .. 230A
Badshot Lea .. 230A
Bagnall .. .. 230A
Bagshot .. .. 240A
Baildon .. .. 230A
Baillieston .. 240A
Bailrigg .. 230A

Balcombe .. 230A
Balderstone .. 230A
Baldock .. 240A
Baldrine .. 230A
Balerno .. 230A
Ballabeg .. 230A
Ballasalla .. 230A
Ballinger .. 230A
Balmerino .. 250A
Balmore .. 240A
Balsall Common 230A
Bampton .. 230A
Bangor .. 230A
200C
Banningham .. 230A
Bannockburn .. 250A
Banstead .. 230A
Barassie .. 240A
Barby .. .. 230A
Bardsea .. 230A
Bardsley .. 240A
Barford .. 250A
Bargeddie .. 240A
Bargoed .. 230A
Barking .. 230A
Barkley Thorpe 240A
Barkway .. 240A
Barlaston .. 230A
Barley .. .. 240A
Barnby Moor .. 230A
Barnes .. .. 210C
Barnet .. .. 240A
240C
Barnham .. 230A
Barnham Broom 230A
Barnoldby-le-Beck .. 230A
Barnoldswick .. 230A
Barnsley .. 230A
230C
Barnstaple .. 230A
Barnton .. 220A
Barnwell-All-Saints .. 230A
Barnwell St. Andrews .. 230A
Barnwood .. 230A
Barrow (Ches.) 230A
Barrowford .. 230A
Barrow-in-Furness .. 220C
Barry .. .. 220A
Barston .. 230A
Barton (Beds.) 240A
Barton (Ches.) 230A
Barton (Lancs.) 230A
Barton (Rural) 230A
Barton Mills .. 220C
Barton-on-Humber .. 220C
Barton-on-Sea 230A
Barton Seagrave 240A
Barton-under-Needwood .. 230A
Basford .. 230A
Bashall Eaves 230A
Basing .. .. 230A
Basingstoke .. 230A
220A
230C
Batcombe .. 230A
Bath .. .. 230A
230C
Bathgate .. 250A

Batley .. .. 220C
230A
Battersea .. 230A
250C
Battle .. .. 230A
Batts Corner .. 230A
Bawdeswell .. 230A
Bawdsey .. 230A
Bayford .. 240A
Beaconsfield .. 200A
Beaminster .. 230A
Beanacre .. 230A
Bearsden .. 240A
Bearstead .. 230A
Bearstones .. 230A
Beaufort .. 240C
Beaumont .. 230A
Beaumont Leys 240A
Bebington .. 230A
Beccles .. 230A
Beckenham .. 200A
Beckermet .. 230A
Beckington .. 230A
Beckley .. 230A
Beckwithshaw .. 230A
Beddingham .. 230A
Beddington .. 230A
Bedfont .. 200A
230A
Bedford .. 105A
210A
Bedlinog .. 230A
Bedwas .. 230A
Bedwelty .. 230A
Beeding .. 230A
Beer .. .. 220C
Beeston (Beds.) 210A
Beeston (Ches.) 230A
Beeston St. Andrew .. 230A
Beetley .. .. 230A
Beighton .. 200A
Beith .. .. 240A
Belgrave .. 250A
Bellshill .. 240A
Bellsquarry .. 230A
Belmont (Lancs.) .. 230A
Belstone .. 230A
Belvedere .. 200A
Bembridge 240A
Bemenden .. 230A
Benfleet .. 230A
Beningborough 230A
Benningholme 230A
Ben Rhydding 230A
Bentham .. 230A
Bentley (Surrey) 230A
Bentley (Warwicks) 200A
Bentley-with-Acksay .. 230A
Bere Alston .. 230A
Bere Ferrers .. 230A
Bergh Apton .. 230A
Berkeley .. 230A
Berkswich .. 210C
230C
Bermondsey .. 240C
(Part) .. 205A
205C
230A
Berwick-on-Tweed .. 230A
Berwick Station 230A

Besthorpe .. 230A
Bestwood .. 230A
Bethersden .. 230A
Bethseda .. 280A
Bethnal Green 240A
Betley .. .. 230A
Betsham .. 230A
Bettws .. 230A
Bettws-y-Coed 110A
250A
Beverley .. 230A
Bewerley .. 230A
Bexhill .. 220C
230A
Bexley .. 200A
Bexleyheath .. 200A
Bickenhill .. 230A
Bicker .. .. 230A
Bickerstaffe .. 230A
Bickington .. 240A
Bickley .. .. 210A
230A
Bicknoller .. 230A
Bidborough .. 220A
Biddenham .. 210A
Biddulph .. 230A
Biddulph Moor 230A
Bideford .. 230A
Biggar .. .. 240A
Biggin Hill .. 230A
Biggleswade .. 240A
Bigrigg .. 230A
Bilbrooke .. 230A
Billericay .. 230A
Billinge .. 230A
Billingford .. 230A
Billington .. 230A
Bilston
(Lothian) .. 230A
Bilston (Staffs) 200A
Bilton .. .. 230A
Binfield .. 240A
Bingley .. 230A
Binstead .. 240A
Bintry .. .. 230A
Birch .. .. 230A
Birchanger .. 240A
Birchington .. 240A
Birchmoor .. 250A
Birchwood .. 230A
Birkdale .. 230A
230C
Birkenhead .. 230A
230C
Birling .. .. 230A
Birmingham .. 220C
230A
Birstall (Leic.) 240A
Birstall (York.) 230A
Birstwith .. 230A
Bishopbriggs 240A
Bishop Burton 230A
Bishop's Cleeve 230A
Bishopsteignton 230A
Bishop's
Stortford .. 240A
Bishop
Thornton .. 230A
Bishopton .. 240A
Bishton .. 230A
Bispham .. 230A
Bittaford .. 240A
Bitton .. .. 230A
Bixley .. .. 230A
Blackburn .. 220C
230A
Do. (Rural) .. 230A
Blackgang .. 240A
Blackheath
(Surrey) .. 280A
Blackmill .. 220A
Blackmore End 240A
Blackpool .. 200A
Blackrod .. 230A
Blackstone .. 230A
Blackwater
(I.O.W.) .. 240A
Blackwater
(Hants.) .. 250A
Blackwell
(Cumb.) .. 230A
Blackwell
(Durham) .. 230A
Blackwood
(Mon.)
Blacon .. .. 230A
Bladnoch .. 230A
Blaengarw .. 230A
Blair Atholl .. 220C
Blairlogie .. 250A
Blairmore .. 230A
Blakesley .. 230A
Blake Street .. 230A
Blandford .. 230A
Blantyre .. 240A
Blawith .. 230A
Blean (Part) .. 220C
230A
Bletchley .. 230A
Blicking .. 230A
Blisworth .. 230A
Blofield .. 230A
Blue Anchor .. 230A
Blundell .. 230A
Blunham .. 230A
Blymhill .. 240A
Blyth .. .. 230A
Blythe Bridge 230A
Boarhunt .. 230A
Bobbing .. 230A
Bobbington .. 200A
Boddington .. 230A
Bodmin .. 210C
Boggs .. .. 230A
Bognor Regis .. 230A
Bold .. .. 230A
230C
Boldre .. .. 240A
Bollington .. 230A
Bolney .. 230A
Bolsover .. 240A
Bolton .. .. 105A
210A
230A
Bolton-by-
Rowland .. 230A
Bolton-le-Sands 230A
Bolton-on-
Dearne .. 105A
Bonchurch .. 240A
Bonninghall .. 230A
Bonnybridge .. 250A
Bonnyrigg .. 230A
Boosbeck .. 230A
Bootle .. .. 230A
230C
Borden .. .. 230A
Boreham Street 230A
Boreham Wood 240A
Borough Green 230A
Borrowstounness 230C
Borth .. .. 280C
Boscobel .. 230A
100A
Boscombe .. 200A
Bosham .. 230A
Boston .. .. 240A
Bothenhampton 230A
Bothwell .. 240A
Botolph Claydon 280A
Bottisham .. 240A
Boughton (Kent) 230A
Boughton
(Northants) 210A
Boughton Aluph 230A
Boughton
Monchelsea .. 230A
Bouldnor .. 240C
Boulton .. 200A
Boundstone .. 230A
Bourn .. .. 240A
Bourne End
(Herts.) .. 200A
Bournemouth .. 200A
Bourton-on-the
Water .. 110C
Boveney .. 230A
Bovey Tracey 230A
Bovingdon .. 240A
Bow Brickhill 230A
Bowden .. 100A
Bower Hinton 230A
Bowlers Town 230A
Bowling .. 240A
Box .. .. 230A
Boxgrove .. 230A
Boxted .. 230A
Bozeat .. .. 230A
Brackley .. 230A
Bracknell .. 240A
220C
Braconash .. 230A
Bradfield
(Essex) .. 230A
Bradford .. 230A
230C
Bradford-on-
Avon .. 230A
Brading .. 240A
Bradley .. 230A
Bradninch .. 230A
Bradpole .. 230A
Bradsham .. 230A
Bradworthy .. 110C
Braerhead .. 230A
Brafield .. 230A
Brainwood .. 240A
Braintree .. 230A
Braithwaite .. 230C
Bramber .. 230A
Bramerton .. 230A
Bramfield .. 240A
Bramhall .. 230A
230A
Bramingham .. 240A
Bramley .. 230A
Brampton
(Cumb.) .. 230A
Brampton
(Derbys) .. 240A
Brampton
(Hunts.) .. 240A
Brampton Ash 230A
Branderburgh 230C
Brandesburton 230A
Brandiston .. 230A
Branston .. 230A
Brantham .. 230A
Brantingham .. 230A
Brasted .. 220A
Bratton .. 230A
Braughing .. 240A
Braunston .. 230A
Braunstone .. 240A
BraunstoneFrith 240A
Braunton .. 220C
Bray .. .. 230A
Braybrooke .. 240A
Breadsall .. 200A
Bream .. .. 230A
Brecon .. 230C
Bredbury .. 230A
Brede .. .. 230A
Brenchley .. 230A
Brentwood .. 240A
230A
Brereton .. 230A
Bretby .. .. 230A
Bretton .. 280A
Brewood .. 230A
Bricket Wood 240A
Bridestowe .. 230A
Bridge (Kent) 220A
Bridgend .. 200A
Bridge of Allan 250A
Bridge of Dee 230A
Bridge of Tilt .. 220C
Bridge of Weir 240A
Bridgtown .. 230A
Bridlington .. 230A
Bridport .. 230A
Briech .. .. 230A
Brierfield .. 230A
Brierfield Lower 230A
Brierley Hill .. 200A
Brighouse .. 230A
Brightlingsea .. 230A
Brighton .. 115C
230C
230A
Brightwell .. 280A
Brigsley .. 230A
Brigstock .. 230A
Brinsworth .. 230A
Brisley .. 230A
Brithdir .. 230A
Brixham .. 220C
Brixton (Devon) 230A
Broadbottom .. 230A
Broadhempston 240A
Broad Oak .. 230A
Broad Oak End 240A
Broadstairs .. 240C
Broadwater
(Herts.) .. 240A
Broadwath .. 230A
Broadwell .. 230A
Brock .. .. 230A
Brockmoor .. 200A
Brockworth .. 230A
Brocton .. 230A
Bromeswell .. 230A
Bromham .. 210A
Bromley .. 210A
230A
Bromley Cross 230A
Brompton .. 100A
Brompton(Kent) 230A
Brompton
(Yorks) .. 230A
Brook (I.O.W.) 240A
Brooke .. .. 230A
Brookfield .. 240A
Brookhouse .. 230A
Brookmans Park 240A
Brookshide .. 240A
Broomfield .. 230A
Brotton .. 250A
Brough .. 200C
Broughton
(Flints.) .. 230A
Broughton
(Lancs.) .. 230A
Broughton
(Northants.) 240A
Brown Edge .. 230A
Brownhills .. 250A
Broxbourne .. 240A
Broxburn .. 230C
Broxton .. 230A
BruenStapleford 230A
Brundall .. 230A
Bruton .. 230A
Brynamman .. 220A
Buckden .. 240A
Buckfastleigh .. 240A
Buckhaven .. 250A
Buckingham .. 230A
Buckland .. 240A
Buckland
Monachorum 280A
Bucklesham .. 230A
Bucklow Hill .. 220A
Bucks Horn
Oak .. .. 230A
Bude .. .. 200C
230A
Budleigh
Salterton .. 230A
Buerton .. 230A
Bugbrooke .. 210A
Buglawton .. 230A
Bugle .. .. 230A
Bulls Green .. 240A
Bullwood .. 230A
Bulmer .. 230A
Bungay .. 230A
Buntingford .. 240A
Bunwell .. 230A
Burchetts Green 240A
Burford .. 110C
230A
Burgess Hill .. 230A
240C
Burgh .. .. 230A
Burgh-by-Sands 230A
Burlescombe .. 230A
Burley .. .. 230A
Burley-in-
Wharfedale .. 230A
Burnham
(Bucks) .. 280A
Burnham
(Somerset) .. 230A
Burnham Green 240A
Burnham-on-
Crouch .. 230A
Burniston .. 230A
Burnley .. 220C
230A
Do. (Rural) 230A
Burnside .. 240A
Burntisland .. 250A
Burntwood .. 250A
Burnt Yates .. 230A
Burscough .. 230A
Bursiem .. 220C
240A
Burstwick .. 230A
Burton (Ches.) 230A
Burton
Bradstock .. 230A
Burton-in-
Lonsdale .. 230A
Burton Latimer 240A
Burton Lazars 240A
Burton Leonard 230A
Burton Pidsea .. 230A
Burton-upon-
Trent .. 200A
Burtonwood .. 230C
230A
250A
Burwardsley .. 230A
Burwash .. 230A
Burwell .. 240A
Bury .. .. 230A
Do. (Rural) 230A
Bury Green .. 240A
Bury St. Ed-
munds .. 200C
Busby .. .. 240A
Bushbury .. 230A
Bushey .. 200A
Bushley .. 240A
Butetown .. 280A
Butley .. .. 280A
Butterton .. 230A
Buxton (Derby) 280C
280A
Buxton
(Norfolk) .. 230A
Byfield .. 230A
Byfleet .. 200A
Bygrave .. 240A
Bylaugh .. 280A
Cabalfa .. .. 230A
Caddington .. 240A
Caerau .. .. 230A
230A
Caergwrle .. 230A
Caerleon .. 230A
Caernarvon .. 230A
Caerphilly .. 230A
Cairncross .. 230A
Calster
St. Edmunds 230A
Caldecote
(Bedford) .. 280A
Caldecote
(Chester) .. 230A
Calderbank .. 240A
Calderbridge .. 280A
Caldwell .. 230A
Caldy .. .. 230A
Calf Heath .. 230A
Callington .. 280A

# SUPPLY VOLTAGES

Caine .. .. 220c
Calstock .. 230A
Calthorpe .. 023A
Calverley .. 230A
Calvert .. 230A
Calverton .. 230A
Cam .. .. 230A
Camberley .. 250A
Camberwell .. 205A
205c
230A
Camborne .. 230A
Cambridge .. 200A
Cambusbarron .. 250A
Cambuskneth .. 250A
Cambuslang .. 240A
Cameron .. 250A
Campsea Ash .. 230A
Campton .. 240A
Canning Town 200A
Cannock .. 230A
Canterbury .. 220c
230A
Cantley .. 230A
Canvey Island .. 230A
Canwell .. 250A
Capel .. .. 250A
Capenhurst .. 230A
Carclaze .. 230A
Carden .. 230A
Cardenden .. 250A
Cardiff .. .. 200c
200A
230A
230A
240A
250A
Cardington .. 230A
Cardonald .. 240A
Cardross .. 240A
Carfin .. .. 240A
Cargo .. .. 230A
Carhampton .. 230A
Carisbrooke .. 240A
Cark .. .. 230A
Carleton .. 230A
Carleton Forehoe .. 230A
Carleton Rode .. 230A
Carlin How .. 250A
Carlisle .. 230c
230A
Carleton (Beds.) 230A
Carleton (Notts.) 230A
Carleton Colville .. 230A
Carluke .. 240A
Carmarthen .. 220c
230A
Carmunnock .. 240A
Carmyle .. 240A
Carnbee .. 250A
Carnwath .. 240A
Carpalla .. 230A
Carrog .. .. 230A
Carr Vale .. 240A
Carshalton .. 230A
Carstairs Junction .. 240A
Carstairs Village .. 240A
Cartmel .. 230A
Castle Bromwich 230A
Castle Douglas 230A
Castleford .. 230A
Castle Gresley 230A
Castlethorpe .. 230A
Casleton .. 230A
Castletown .. 230A
Castor .. .. 230A
Catfield .. 230A
Catforth .. 230A
Cathcart .. 240A
Catherington .. 230A
Catisfield .. 220A
Caton .. .. 230A
Catriue .. 240A
Catsfield .. 230A
Catton .. .. 230A
Catwick .. 230A
Caughall .. 230A
Caverswall .. 230A
Cawston .. 230A
Caxton .. 240A
Cayton .. 230A
Cefn Coed .. 230A
Cefn Cribbwr .. 230A
Cefn Fforest .. 230A
Cefn-y-Bedd .. 230A
Cellarhead .. 230A
Celynin .. .. 220c
Cemmaes .. 210c
Ceres .. .. 250A
Chadderton .. 230A
Chaddesdon .. 200A
Chadsmoor .. 230A
Chagford .. 230A
Chaigley .. 230A
Chailey .. 230A
Chale .. .. 240A
Chalfont St. Giles .. 200A
Chalfont St. Peter .. 200A
Chalk .. .. 230A
Chalton .. 240A
Chalvington .. 230A
Chapel Brampton .. 210A
Chapel Chorlton .. 230A
Chapelhall .. 240A
Chapeltown .. 230A
Chard .. .. 230A
Chardstock .. 230A
Charfield .. 230A
Charing .. 230A
Charing Heath 230A
Charlestown .. 230A
Charlesworth .. 230A
Charlton .. 230A
Charlton Kings 210A
220A
Charltons .. 250A
Charlwood .. 230A
Charlwelton .. 230A
Chase Terrace 250A
Chasetown .. 250A
Chatburn .. 230A
Chatham .. 230A
Chatteris .. 240A
Cheadle (Ches.) 230A
Cheadle (Staffs.) 230A
Cheadle Hulme 230A
Chebsey .. 230A
Cheddington .. 240A
Cheddleton .. 230A
Chelford .. 230A
Chellaston .. 200A
Chellington .. 230A
Chelmsford .. 230A
Chelsea .. 200c
230A
Cheltenham .. 210A
220A
Chelwood Gate 230A
Chenies .. .. 230A
Chepstow .. 210c
230A
Cherry Burton 230A
Cherry Hinton 240A
Chertsey .. 200A
Chesham .. 200A
240A
Chesham Bois 200A
Cheshunt .. 240A
Chesil .. .. 230A
Cheslyn Bay .. 230A
Chester .. 230A
Chesterfield .. 240c
240A
Chesterton Friary .. 240A
Cheswardine .. 230A
Cleveley Park .. 240A
Chevening .. 220A
Chichester .. 230A
Chickerell .. 230A
Chiddingstone .. 220A
Chigwell .. 230A
Chilcote .. 250A
Chilworth .. 230A
Chingford .. 240A
Chinley .. .. 230A
Chinnor .. 220A
Chippenham .. 230A
Chipping .. 230A
Chipping Ongar 230A
Chipping Sodbury .. 230A
Chirton .. .. 240A
Chislehurst .. 210c
230A
Chiswell Green 240A
Chiswick .. 220A
220c
Chisworth .. 230A
Chittering .. 240A
Chobham .. 200A
Chorley .. 230A
Chorley Wood 240A
Chorlton (Ches.) 230A
Chowley .. 230A
Christchurch .. 250c
Christleton .. 230A
Chryston .. 240A
Chudleigh .. 230A
Chudleigh Knighton .. 230A
Church .. .. 230A
Church Brampton .. 210A
Churchdown .. 230A
Church Gresley 230A
Churchtown .. 230A
Churston .. 220c
Churt .. .. 230A
Churton .. .. 230A
Churton-by-Farndon .. 230A
Churton Heath 230A
Cinderford .. 230A
Cirencester .. 240A
Clackmannan .. 250A
Clacton .. .. 230c
230A
Clanfield .. 230A
Clapham (Beds.) .. 210A
Clapham (Yorks.) .. 230A
Clapham (Sussex) .. 230A
Clarkston .. 240A
Claverley .. 200A
Claverton .. 230A
Clay Cross .. 250A
Clayton (Yorks.) 230A
Clayton-le-dale 230A
Clayton-le-Moors 230A
Cleator .. .. 230A
Cleator Moor .. 230A
Cleckheaton .. 230A
230A
Cleethorpes .. 230A
Cleland .. .. 240A
Cliddesden .. 230A
Cliffe .. .. 230A
Cliff Park .. 230A
Clifton (Lancs.) 230A
250A
Clifton (Staffs.) 230A
Clifton (Warwicks.) 240A
Clifton Reynes 230A
Clint .. .. 200A
Clipston .. 230A
Clitheroe .. 230A
Clitheroe (Rural) 230A
Clophill 230A
Clotton Hoofield 230A
Cloughton .. 230A
Clowne .. 250A
Clumbe Estate 220A
Clutton .. .. 230A
Clydach .. 230A
Clydebank .. 240A
Clymping .. 230A
Coaley .. .. 230A
Coaltown of Balgonie .. 250A
Coaltown of Wemyss .. 250A
Coatbridge .. 240c
220A
Coates .. .. 230A
Cobham (Kent) 230A
Cockenzie .. 230A
Coddington .. 230A
Codicote .. 240A
Codsall .. 230A
Coed Talon .. 230A
Cofton .. .. 200A
Cogenhoe .. 200A
Colty .. .. 230A
Colby (I.O.M.) 230A
Colby (Norfolk) 230A
Colchester .. 210c
230A
Cold Ashby .. 230A
Coldfair Green 230A
Cold Norton .. 230A
Coldrey .. 230A
Cole .. .. 230A
Coleford .. 230A
Cole Green .. 240A
Coleshill (Bucks.) 200A
Coleshill (Warwicks.) 230A
Collessie .. 250A
Collingtree .. 210A
Colne (Lancs.) .. 230A
240c
Coltishall .. 230A
Colton .. .. 230A
Colwick .. 230A
Colwyn Bay .. 220c
230A
Colyford .. 250c
Combe-in-Teignhead .. 230A
Comberbach .. 220A
Combe St. Nicholas .. 230A
Compton (Devon) .. 230A
Compton (Hants.) .. 230A
Compton (Surrey) .. 230A
Congleton .. 230A
Coniston (Lancs.) .. 230A
Coniston (Yorks.) 230A
Connah's Quay 250A
Conway .. 230A
Cookham .. 230A
230A
230c
Cooksbridge .. 230A
Cookshill .. 230A
Coombe .. 220A
Copford .. 230A
Copgrove .. 230A
Copie .. .. 230A
Copthorpe .. 230A
Corby .. .. 230A
Corpusty .. 230A
Corringham .. 230A
Corsham .. 230A
Corwen .. 230A
Coseley .. 200A
Cosgrove .. 230A
Costessey .. 230A
Cotebrook .. 220A
Coton-in-the-Clay .. .. 230A
Coton-in-the-Elms .. 230A
Cottenham .. 240A
Cottesbrooke .. 230A
Cottingham (Leics.) .. 230A
Cottingham (Yorks.) .. 230A
Cottingley .. 230A
Cotton Abbots 230A
Cotton Edmunds 230A
Cotton End .. 230A
Coulsdon .. 230A
Coventry .. 200A
Cowbit .. 230A
Cowdenbeath .. 250A
Cowes (I.O.W.) .. 240A
Cowfold .. 230A
Cowley (Devon) .. 230A
Cowley (Middx.) .. 200A
Cowpits .. 230A
Cowplain .. 230A
Coxheath .. 230A
Craddock .. 230A
Craigcefnparc .. 230A
Craighendoran 240A
Crail .. .. 250A
Cranborne .. 230A
Cranbrook (Kent.) .. 230A
Cranfield (Beds.) .. 230A
Cranford (Northants) 230A
Crawley .. 230A
240c
Crawley Down 230A
Crayford .. 240A
Creaton .. 210A
Crediton .. 230A
Creech .. .. 250A
Creeksea .. 230A
Creetown .. 230A
Creigiaw .. 250A
Crewe .. .. 230c
230A
Crewkerne .. 230A
Crick .. .. 230A
Crieff .. .. 240A
Cringleford .. 230A
Cripps Corner .. 230A
Croft .. .. 230A
Cromaron .. 100c
Cromer .. 240c
Cromhall .. 230A
Crompton (Lancs.) .. 230A
Cronton .. 230A
Crook .. .. 250A
Crookston .. 240A
Crossflatts .. 230A
Crossford .. 250A
Crossgates .. 250A
Crosshall .. 240A
Crosshouse .. 240A
Crosskeys .. 230A
Cross Roads (Yorks.) .. 230A
Croston .. 230A
Croughton (Ches.) .. 230A
Croughton (Northants.) 230A
Crowborough .. 230A
Crowhurst .. 230A
Crowland .. 230A
Crowthorne .. 250A
Croxley Green 240A
Croxton (Hunts.) 240A
Croxton (Staffs.) 230A
Croy .. .. 250A
Croydon .. 230A
Crumlin .. 250c

Cuckfield .. 230A
Cuddington (Ches.) .. 220A
Cudworth .. 230A
Cuerdale .. 230A
Cuffley .. .. 240A
Culcheth .. 230A
Cullercoats .. 240A
Cullingworth .. 230A
Cullompton .. 230A
Culmstock .. 230A
Culpho .. 230A
Culross .. 250A
Culton .. .. 230A
Cults .. .. 250A
Culworth .. 230A
Cumbernauld .. 250A
Cummersdale .. 230A
Cunwhinton .. 230A
Cupar .. .. 250A
Curdworth .. 230A
Currie .. .. 230A
Custom House 200A
Cwm .. .. 240C
Cwmbram .. 230A
Cwmfelinfach .. 230A
Cwmllynfell .. 230A
Cynwyd .. 230A

Dacre .. .. 230A
Dagenham .. 230C
230A
230A
230A
Dairsie .. 250A
Dalbeattie .. 200C
230A
Dalkeith .. 230A
Dalmellington 240A
Dalmuir .. 240A
Dalry (Ayr.) .. 240A
Dalry (Kirkcud) 230A
Dalrymple .. 240A
Dalston (Cumberland) 230A
Dalston(Lancs.) 230A
Dalton-in-Furness .. 220A
Danbury .. 230A
Dane End .. 240A
Danehill .. 230A
Danesbury .. 240A
Danzey Green 230A
Daresbury .. 250A
Darlaston .. 200A
Darley .. .. 230A
Darley Abbey 200A
Darlington .. 230C
230A
Dartford .. 230C
230A
Dartmouth .. 240A
Darton .. 230A
Darvel .. .. 240A
Darwen .. 230C
230A
Datchworth .. 240A
Davenham .. 220A
Daventry .. 210A
Davington .. 230A
Dawlish .. 230A
Dawlish Warren 230A
Deal .. .. 230A
Deane .. .. 230A
Deanhouse .. 230A
Deanshanger .. 230A
Dearne .. 230A
Dedham .. 230A
Deganwy .. 230A
Delabole .. 200C
330C
Delamere .. 220A
Delph .. .. 230A
Denbury .. 240A
Denford .. 210A
Denham .. 200A
Denmead .. 230A
Denny .. .. 230A
Denton (Kent) 230A
Denton (Northants) 230A
Denton .. 200C
(Manchester) 230A
Denton (Yorks.) 230A
Deopham .. 230A
Derby .. .. 230C
200A
230A
Derl .. .. 230A
Detling .. 230A
Devizes .. 230A
Dewarton .. 230A
Dewsbury .. 220C
230A
Diggle .. .. 230A
Digswell .. 240A
Dilham .. 230A
Dillhorne .. 230A
Dilton Marsh .. 230A
Dinas Powis .. 230A
Dingoey .. 230A
Dippenhall .. 230A
Dirleton .. 230A
Disborough .. 230A
Disley .. .. 230A
Diss .. .. 230A
Ditchling .. 230A
Ditton .. .. 230A
Dobcross .. 230A
Dockenfield .. 230A
Doddington .. 240A
Dodington .. 230A
Dodleston .. 230A
Dodworth .. 230A
Dolywern .. 230A
Doncaster .. 230C
230A
Donington .. 230A
230A
Donyatt .. 230A
Dorchester .. 220C
Dordon.. .. 250A
Dorking .. 230A
240C
Dorney .. 230A
Dorridge .. 230A
Dosthill .. 250A
Douglas .. 230A
230C
Dousland .. 230A
Dove Holes .. 230A
Dover .. .. 100A
200A
230A
Dovercourt Bay 240A
Dowlais .. 200C
Downham .. 230A
Downham Market .. 230A
Drakelow .. 230A
Draycott .. 230A
Drayton (Norfolk) .. 230A
Drayton Parslow 230A
Dreghorn .. 240A
Drem .. .. 230A
Drewsteignton 230A
Driffield .. 230A
Drigg .. .. 230A
Dronfield 200A
Droylsden .. 200C
230A
Drumchapel .. 240A
Drybrook .. 230A
Duddon .. 230A
Duffield .. 200A
Dukinfield .. 230A
Dullatur .. 250A
Dulverton .. 230C
230A
Dumfries .. 230C
230A
Dunbar .. 230A
Dumbog .. 250A
Duncote .. 230A
Dundee .. 200C
200A
Dundonald .. 240A
Dunham-on-the-Hill .. .. 250A
Dunfermline .. 220A
250A
Dunford Bridge 230A
Dunino .. 250A
Dunipace .. 250A
Dunlop .. .. 240A
Dunmow .. 230A
Dunnington .. 230A
Dunnockshaw 230A
Dunoon .. 230A
Dunsden .. 230A
Dunstable .. 240A
Dunster .. 230A
Dunswell .. 230A
Dunton Green 220A
Dursley .. 230A
Dutton .. 250A
Duxford .. 240A
Dyffryn .. 230A
Dymchurch .. 230A

Eaglesham .. 240A
Ealing .. .. 230A
Earby .. .. 230A
Earlstown .. 230A
Earley .. .. 230A
Earls Barton .. 210A
Earlswood .. 230A
Easington .. 250A
East Ashling .. 230A
East Ayton .. 230A
East Barnet .. 240A
East Bergholt .. 230A
East Bilney .. 230A
Eastbourne .. 200A
Eastburn .. 230A
East Calder .. 230A
East Carleton .. 230A
East Chiltington 230A
East Chinnock.. 230A
East Claydon .. 230A
Eastcote (Middx.) .. 240A
Eastcote (Northants) .. 230A
East Dean (Susex) .. 230A
East Dereham.. 230A
Eastergate .. 230A
Easter Howgate 230A
Easterton .. 230A
East Farleigh .. 230A
East Farndon .. 240A
East Grinstead 230C
230A
East Haddon .. 210A
East Ham .. 230C
230A
East Hanningfield .. .. 230A
East Hoatley .. 230A
Easthorpe .. 230A
East Hyde .. 240A
Eastington .. 230A
East Kerrier .. 240A
East Kilbride .. 240A
East Linton .. 230A
East Malling .. 230A
Eastnor .. 230A
East Ogwell .. 200A
Easton .. .. 230A
Easton Mandit 230A
East Philipstoun 250A
Eastrea .. 230A
East Retford .. 230A
Eastry .. .. 230A
East Sheen .. 210C
East Tilbury .. 230A
Eastwell .. 230A
East Wemyss .. 250A
East Wickham 200A
Eastwood .. 230A
Eaton (Ches.) .. 230A
Eaton (Notts.) 230A
Eaton Bray .. 240A
Eaton Socon .. 240A
Ebbw Vale .. 240C
Eccleshall .. 230A
Eccleston (Ches.) 230A
Eccleston (Chorley, Lancs.) .. 115A
230A
Eccleston (St. Helens, Lancs.) .. 230C
230A
Ecton .. .. 210A
Eddleston .. 230A
Edenbridge .. 230A
Edgehead .. 230A
Edgerley (Ches.) 230A
Edgware .. 240A
Edgworth .. 230A
Edinburgh .. 230C
230A
Edingale .. 250A
Edington .. 230A
Edlesborough .. 240A
Edmonton .. 240A
Edwalton .. 230A
Egerton (Kent.) 230A
Egerton (Lancs.) 230A
Eggbrickland .. 230A
Eggington .. 240A
Egglescliffe .. 250A
Egham .. .. 100A
230A
Egremont .. 230A
Eight Ash Green 230A
Elderslie .. 240A
Eldwick .. 230A
Elford .. .. 230A
Elgin .. .. 240C
Elie .. .. 250A
Elland .. .. 230A
240C
Ellerby .. 230A
Ellerker .. 230A
Ellesmere Port 230A
250A
Ellisfield .. 230A
Elloughton-with-Brough 230A
Elmdon .. 230A
Elmhurst .. 230A
Elmstead .. 230A
Elphinstone .. 230A
Elsenham .. 240A
Elsing .. 230A
Elstow .. .. 210A
Elstree .. 240A
Elswick .. 230A
Eltisley .. 240A
Elton .. .. 240A
Elton (Ches.) .. 250A
Ely (Cambs.) .. 240A
Ely (Cardiff) .. 230A
Emberton .. 210A
Emsworth .. 230A
Endon .. .. 230A
Enfield .. .. 240C
240A
Epping .. 240A
230A
Epping Upland 230A
Epsom .. .. 230C
230A
Erith .. .. 200A
Erpingham .. 230A
Essendon .. 240A
Essington .. 230A
Eston .. .. 230A
Etchingham .. 230A
Etching Hill .. 230A
Eton .. .. .. 230A
Eton Wick .. 230A
Etton .. .. 230A
Evans Farm Estate .. 240A
Evenley .. 230A
Eversholt .. 240A
Evington .. 200A
240A
Ewenny .. 230A
Ewhurst (Kent) 230A
Ewood Bridge 230A
Exbourne .. 230A
Exeter .. .. 210A
Exminster .. 230A
Exmouth .. 230A
Exton .. .. 230A
Exning .. 240A
Eydon .. .. 230A
Eye .. .. 230A
Eye (Northants) 230A
Eynesford .. 230A
Eythorne .. 230A

Facit .. .. 230A
Failsworth .. 200C
230A
Fairlie .. .. 240A
Fairlight Cove.. 230A
Fakenham .. 230A
(Norfolk) .. 230A
Falkirk .. 250A
Falkland .. 250A
Falmouth .. 240C
Farcet .. .. 230A
Fareham .. 220A
Farington .. 230A
Farleigh Wallop 230A
Farley Green .. 230A
Farmington .. 220C
Farnborough .. 240A
Farndon .. 230A
Farnham (Surrey) .. 230A
Farnham (Yorks.) .. 230A
Farnham Royal .. 230A
Farningham .. 230A
Farnworth .. 220C
230A
Farsley .. 230A
Farthingboe .. 230A
Fauldhouse .. 250A
Faversham .. 230C
Fazeley .. 250A
Featherstone .. 230A
Felbridge (Surrey) .. 230A
Felixstow .. 200C
240A
Felmersham .. 230A
Felmingham .. 230A
Felpham .. 230A
Feltham .. 200A
230A
Felthorpe .. 230A
Fence .. .. 230A
Fenny Stratford 230A
Fenstanton .. 240A
Fenton .. 240A
Fernlie .. 230A
Ferrensby .. 230A
Ferrers .. 220C
Ferring .. 230A
Festiniog .. 230C
Field Burcote .. 230A
Filey .. .. 230A
Finchampstead 250A
Finchley .. 250C
Findon .. 230A
Finedon .. 230A
Fingringhoe .. 230A
Finsbury .. 104A
Firlie .. .. 230A
Fishbourne (I.O.W.) .. 240A
Fishbourne (Sussex) .. 230A
Fishtoft .. 240C
Five Ashes .. 230A
Five Oak Green 220A
Flackwell Heath 230A
Flamstead .. 240A
Flaunden .. 230A

# SUPPLY VOLTAGES

Flaxby .. 230A
Flaxton .. 230A
Fleet Hargate 230A
Fleetwood .. 200C 230A
Fletching .. 230A
Fletton .. 230A
Fleur-de-lis .. 230A
Flexbury .. 230A
Flimwell .. 230A
Flitton .. 240A
Flitwick .. 240A
Flookburgh .. 230A
Flordon .. 230A
Flore .. .. 210A
Fobbing .. 230A
Fochriw .. 230A
Folkestone .. 210C 210A
Folkington .. 230A
Follifoot .. 200A
Fontley .. 220A
Foots Cray .. 200A
Ford (Midlothian) 230A
Ford (Lancs.) .. 230A
Fordcombe .. 220A
Fordham .. 240A
Forest Gate .. 200A
Forest Row .. 230A
Formby .. 230A
Forncett .. 230A
Forsdyke .. 230A
Forshaw Heath 230A
Fort Augustus 130C
Fortimeswell .. 230A
Forton .. .. 230A
Foston .. .. 230A
Foulk Stapleford 230A
Foulridge .. 230A
Foulsham .. 230A
Fowey .. .. 230A
Foxdale .. 230A
Foxham .. 230A
Foxhole .. 230A
Foxley .. .. 230A
Foxton .. .. 240A
Framfield .. 230A
Framingham Earl .. .. 230A
Framingham Pigot .. 230A
Framlingham .. 220C
Frampton .. 240A
Frampton Cotterel .. 230A
Frankby .. 230A
Frant .. .. 230A
Featherne-with-Saul .. .. 230A
Freckleton .. 240A
Freethorpe .. 230A
Fremington .. 230A
Frensham .. 230A
Freshfield .. 230A
Freshford .. 230A
Freshwater (I.O.W.) .. 240A
Frettenham .. 230A
Frenchie .. 250A
Friern Barnet 240A
Friers Bay .. 230A
Friers Wash .. 240A
Frinton-on-Sea 230C
Friston (Suffolk) 230A
Fritton .. 230A
Frodingham .. 250A
Frodsham .. 250A
Frodsham Lordship .. 250A
Frome .. 230A 240C
Frompton-on-Severn .. 230A
Froyle .. .. 230A
Fulbourn .. 240A
Fulham .. .. 200A
Fulmer .. .. 200A
Fulneck .. .. 230A
Fulwood .. .. 230A
Fundenhall .. 230A
Funtington .. 230A
Furness Vale .. 230A
Furneux Pelham 230A

Gaddesden Row 230A
Gailey .. .. 230A
Gainsborough .. 230A
Galston .. .. 240A
Gamlingay .. 240A
Gamston .. .. 230A 230A
Ganstead .. 230A
Gardner Street 230A
Garforth .. 230A
Garnant .. .. 230A
Garstang .. .. 230A
Garth .. .. 230A
Garvald .. .. 230A
Garw .. .. .. 230A
Gate Helmsley 230A
Gatehouse .. 230A
Gatley .. .. 230A
Gawcott .. .. 230A
Gawsworth .. 230A
Gayle .. .. .. 230A
Gayton .. .. 230A
Gaywood .. .. 230A
Gedgrave .. 230A
Gedling .. .. 230A
Gedney .. .. 230A
Gellygaer .. 230A
Gerrards Cross 200A
Giddington .. 240A
Gifford .. .. 230A
Giggleswick .. 230A
Gildersome .. 230A
Gilfach .. .. 230A
Gillingham (Kent) .. 230A
Gilroes .. .. .. 240A
Gilsland .. .. 230A
Gilstead .. .. 230A
Girvan .. .. .. 240A
Gisburn .. .. 230A
Gladsmuir .. 230A
Glais .. .. .. 230A
Glanamman .. 230A
Glan Conway .. 230A
Glascote .. .. 250C 250A
Glazebrook .. 230A
Glazebury .. 230A
Glencraig .. 250A
Glenfield .. .. 240A
Glenfield Frith 240A
Glengarnock .. 240A
Glenluce .. .. 230A
Glossop .. .. 240C
Gloucester .. 220C 230A
Glynde .. .. 230A
Gonsall .. .. 230A
Godmanchester 240A
Godrergraig .. 230A
Godstone .. .. 220A
Goffs Oak .. 240A
Golbourne .. 230A
Golborne Bellow 230A
Golborne David 230A
Golders Green 240A
Goldington .. 210A
Goldsborough .. 230A
Gomersal .. .. 230A
Gomshall .. .. 230A
Goole .. .. .. 230A
Gosnargh .. 230A
Gorebridge .. 230A
Gorran Haven .. 230A
Gorselnon .. 200C 230A
Gosberton .. 230A
Gosforth .. .. 230A
Gosmore .. .. 240A
Goudhurst .. 230A
Gourock .. .. 200C 250A
Grafton .. .. 230A
Grafton Underwood .. .. 230A
Grampound .. 230A
Grandborough .. 230A
Grange (Ches.) 230A
Grange (Lancs.) 230A
Grange (Yorks.) 230A
Grangetown .. 250A
Grantham .. 240C
Grappenhall .. 250A
Grasmere .. .. 100A 200A
Grassington .. 250C
Graveley .. .. 240A
Gravenhurst .. 240A
Gravesend .. .. 230C 230A
Grays .. .. .. 200C 230A
Greasborough .. 230A
Greasby .. .. 230A
Great Amwell .. 240A
Great Baddow 230A
Great Barford 230A
Great Barr .. .. 230A
Great Bealings 230A
Great Bentley 230A
Great Berkhampstead .. 200A
Great Billing .. 210A
Great Boughton 230A
Great Brickhill 230A
Great Bridgeford 230A
Great Brington 230A
Great Bndworth 220A
Great Burden .. 230A
Great Chart .. 230A
Great Chevenell 240A
Great Coates .. 230A
Great Cransby 240A
Great Crosby .. 230C 230A
Great Dunmow 230A
Great Eccleston 230A
Great Gaddesdon 230A
Great Harwood 230A
Great Haywood 230A
Great Holland .. 230A
Great Horkesley 230A
Great Houghton 230A
Great Malvern .. 100A 200A
Great Molewood 240A
Great Oakley (Essex) .. 230A
Great Oakley (Northants) 230A
Great Offley .. 240A
Great Ouseburn 230A
Great Oxendon 230A
Great Plumstead 230A
Great Sankey .. 250A
Great Saughall 230A
Great Torrington 230A
Great Totham 230A
Great Urswick .. 230A
Great Warford 230A
GreatWilbraham 240A
Great Witchingham 230A
Greatworth .. 230A
Great Wymondley .. 240A
Great Wyrley .. 230A
Greenfield (Beds.) .. 240A
Greenfield (Cheshire) .. 230A
Greenford .. 200A
Green Hammerton .. 230A
Greenock .. .. 250C 250A
Greenodd .. .. 230A
Greens Norton 230A
Green Street .. 240A
Green Street Green .. 230A
Greetland .. 230A
Grendon (Northants) 230A
Grendon (Staffs.) .. 250A
Gressenhall .. 230A
Grimsby .. .. 230C 230A
Grindleton .. 230A
Grisleham .. 230A
Gristhorpe .. 230A
Groombridge .. 220A
Grove .. .. .. 220C 230A
Guestling .. 230A
Gneatwick .. 230A
Guilden Sutton 230A
Guildford .. .. 220C 230A
Gullaborough .. 210A
Guisborough .. 250A
Guiseley .. .. 230A
Guist .. .. .. 230A
Gullane .. .. 230A
Gunton .. .. 230A
Gurnard .. .. 240A
Gustard Wood 240A
Gwann-cae-Gurwen .. 220A
Habeigham .. 220C 230A
Habrough .. 230A
Hackleton .. 230A
Hackney .. .. 230A 240C
Haddenham .. 220A
Haddington .. 230A
Hadleigh .. .. 230A
Hadlow .. .. 220A
Hadlow Down .. 230A
Hafodyrynys .. 250C
Hailsham .. .. 220C 230A
Hainford .. .. 230A
Halbeath .. .. 250A
Halberton .. .. 230A
Hale (Farnham) 230A
Hale (Liverpool) 230A
Hales Place .. 230A
Halewood .. .. 230A
Halesworth .. 230A
Halifax .. .. .. 230C 230A
Hallbankgate .. 230A
Halls Green .. 240A
Halsall .. .. 230A 220A
Halstead (Essex) 230A
Halstead (Kent) 220A
Haltenprice .. 230A
Halton (Ches.) 250A
Halton (Lancs.) 230A
Ham .. .. .. 230A
Hambledon .. 230A
Hambleton .. 230A
Hamfallow .. 230A
Hammersmith .. 110A 230A
Hammerwick .. 250A
Hammonds End Farm .. 240A
Hampnett .. 220C
Hampstead .. 105A 210A
Hampsthwaite 200A
Hampton-in-Arden .. 230A
Hampton Lucy 250A
Hanbury .. .. 230A
Handcross .. 230A
Handforth (Ches.) .. 230A
Handley (Ches.) 230A
Handsacre .. 230A
Hanley .. .. 240A
Hanslope .. 230A
Hanston .. .. 240A
Hanworth .. 200A 230A
Happisburgh .. 230A
Hapsford .. 250A
Hapton .. .. 230A
Harbledon .. 230A
Harden .. .. 230A
Hardingham .. 230A
Hardingstone .. 210A
Hardwick .. 230A
Harefield .. 200A
Hare Street .. 240A
Harlaston .. 250A
Harleston .. 230A
Harlington 240A
(Beds) .. 200A
Harlington (Mddx) .. 200A 230A 240A
Harlow .. .. 240A 230A
Harner Green .. 240A
Harmondsworth 200A 230A
Harpenden .. 240A
Harpford .. 230A
Harpole .. .. 210A
Harpsden .. 230A 100A
Harrogate .. 200A 230A
Harrold .. .. 230A
Harrow .. .. 230C
Harrowden Great .. 230A
Harrowden Little .. 230A
Harrow Weald .. 240A
Harston .. .. 240A
Hartfield .. 230A
Hartford (Ches) .. 220A
Hartford (Hunts) .. 240A
Harthill (Chester) .. 230A
Harthill (Lanark) .. 240A
Hartley (Cranbrook, Kent) 230A
Hartley (Longfield, Kent) .. 230A
Hartshead .. 240A
Hartshill .. 200A
Hartshorne .. 230A
Hartwood .. 240A
Harwich .. .. 240A
Haselbury-Plucknett .. 230A
Hasland .. .. 240A
Haslingden .. 230A
Hassocks .. 230A 200A
Hastings .. 230A
Hatch End .. 240A
Hatching Green 240A
Hatfield .. .. 240A
Hatherleigh .. 230A
Hathern .. .. 230A
Hatherton .. 230A
Hatton .. .. 250A
Hatton Heath 230A

Haunton .. 230A
Havant .. 230A
Havehill .. 230A
Haverigg .. 230A
Haveringland .. 230A
Haverthwaite .. 230A
Hawarden .. 230A
Hawes .. .. 230A
Hawick .. 240C
Hawkhurst .. 230A
Hawkwell .. 230A
Haxby .. .. 230A
Haydock .. 230A
Hayes .. .. 240A
Hayfield .. 230A
Hayle .. .. 240A
Hayling Island 230A
Haynes .. .. 230A
Hayton .. 230A
Haywards Heath 230A
Hazel Grove .. 230A
Hazelmere .. 210C
Heads Nook .. 230A
Heald Green .. 230A
Healey .. 230A
Healing .. 230A
Heath .. .. 240A
Heath End .. 230A
Heathfield .. 230A
Heath Hayes .. 230A
Heaton-with Oxcliffe .. 230A
Hebden Bridge 230A
Heckmondwike 230C
Hedneaford .. 230A
Hedon .. .. 230A
Hele .. .. 230A
Helensburgh .. 240A
Hellesdon .. 230A
Hellidon .. 230A
Hellfield .. 230A
Hellingly .. 230A
Helmdon .. 230A
Helmshore .. 230A
Helsby .. 250A
Helston .. 240A
Hemblington .. 230A
Hemel Hemstead .. 240A
Hemingford Abbots .. 240A
Hemingford Grey .. 240A
Hemley .. 230A
Hempnall .. 230A
Hempstead (Kent) .. 230A
Hempsted .. 230A
Hemyock .. 230A
Hendon .. 240A
Henfield .. 230A
Hengoed .. 230A
Henley-on-Thames .. 230A
Henlow .. 240A
Hensingham .. 230A
Hensington .. 230A
Hempworth .. 230A
Hermiston .. 230A
Herne .. .. 230A
Herne Bay .. 230A
Herstmonceux 230A
240C
Hertford .. 240A
Hertford Heath 240A
Hertingfordbury 240A
Hesketh .. 230A
Hessle .. .. 230A
Hest Bank .. 230A
Hethersett .. 230A
Hevingham .. 230A
Hexham .. 250A
Hextable .. 230A
Hexton .. .. 240A
Heybridge .. 230A
Heydon .. 230A
Heysham .. 230A
Heywood .. 200C
230A
Heywood Park 240A
Hickling .. 230A
Higham .. 230A
Higham Ferrers 210A
Higham Park .. 230A
Highams Park 230A
High Beech .. 240A
Higher Walton 250A
High Halden .. 230A
High Legh .. 250A
220A
High Ongar .. 230A
High Street .. (Cornwall) .. 230A
Hildenborough 220A
Hill Chorlton .. 230A
Hill End .. 240A
Hillhead .. 230A
Hillingdon .. 200A
Hillstown .. 240A
Hilperton .. 230A
Himley .. 200A
230A
Hilton .. .. 240A
Hindley .. 230A
Hindley Green 230A
Hindolveston .. 230A
Hingham .. 230A
Hinton .. 230A
Hinton St. George .. 230A
Hints .. .. 250A
Hinxhill .. 230A
Hinxton .. 240A
Hipperholme .. 230A
Hitcham .. 230A
Hobson .. 240A
Hockenhall .. 230A
Hockley .. 230A
Hockley Heath 230A
Hoddesdon (Herts) .. 240A
Hoddesden .. 230A
Hoe .. .. 230A
Hoggeston .. 230A
Holbeach .. 230A
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Holborn .. 104A
Holcombe .. 230A
Holcutt .. 230A
Holker .. .. 230A
Hollingbourne 230A
Hollingworth .. 230A
Hollybush .. 230A
Holme .. .. 230A
Holme Pierrepoint .. 230A
Holmfirth .. 230A
Holmbrook .. 230A
Holme .. .. 240A
Holt (Norfolk) 230A
Holt (Wilts) .. 230A
Holton-le-Clay 230A
Holyhead .. 200C
230A
Holyton .. 240A
Honing .. 230A
Honiton .. 230A
Hoo .. .. 230A
Hooe .. .. 230A
Hookwood .. 230A
Hoole .. .. 230A
Hoole Village .. 230A
Hope .. .. 230A
Hopwas .. 250A
Horbury .. 230A
Horeham Road 230A
Horley .. .. 230A
Hormead .. 240A
Hornchurch .. 230A
Horndean .. 230A
Horning .. 230A
Hornsea .. 230A
Hornsey .. 240A
Horrabridge .. 230A
Horsebridge .. 230A
Horsell .. 200A
Horsford .. 230A
Horsforth .. 230A
Horsham St. Fatihs .. 230A
Horsmonden .. 230A
Horstead-with-Stanninghall 230A
Horton (Bucks.) .. 240A
Horton (Ches.) 230A
Horton-cum-Peel .. .. 230A
Horwich End .. 230A
Hothfield .. 230A
Houghton (Hunts) .. 240A
Houghton (Lancs) .. 250A
Houghton Conquest .. 230A
Houghton Regis 240A
Houley .. 230A
Houston .. 240A
220C
220A
Hove .. .. 230C
230A
Hoveton St. John .. 230A
Hoveton St Peter .. 230A
Howick .. 230A
Howwood .. 240A
Hoylake .. 230A
Hoyland Nether 230A
Huby .. .. 230A
Hucclecote .. 230A
Hucknall .. 230A
100A
Huddersfield .. 200A
230A
Hughenden .. 230A
Hulcote .. 230A
Hull .. .. 220C
230A
Humberston .. 230A
Humberstone .. 200A
240A
Huncoat .. 230A
Humanby .. 230A
Hunsdon .. 240A
Hunstanton .. (Norfolk) .. 230A
Hunters Quay 230A
Huntingdom .. 240A
Huntington (Ches) .. 230A
Huntington (York) .. 230A
Hurlet .. .. 240A
Hurley (Berks.) 240A
Hurlford .. 240A
Hurst Green .. (Lancs.) .. 230A
Hurst Green (Sussex) .. 230A
Hurstmoncenx *See* Herstmonceux .. ..
Hurstpierpoint 230A
Hurworth .. 230A
Husborne Crawley .. 230A
Hutton (Essex) 240A
Hutton (Lancs) 230A
Hutton Bushel 230A
Hutton Cranswick .. .. 230A
Huxley (Ches) 230A
Huyton-with-Roby .. 230A
Hyde .. .. 230C
230A
Hyde Heath .. 230A
Hyde Lea .. 230A
Hythe (Kent) .. 210C
210A
Ickenham .. 200A
Ickleford .. 240A
Icklesham .. 230A
Ickleton .. 240A
Ickwell .. 230A
Iddenshall .. 230A
Ide .. .. 230A
Iden .. .. 230A
Ifield .. .. 230A
Ightenhill .. 230A
220C
Ightam .. 230A
Ilford .. .. 230A
230C
Ilfracombe .. 240A
Ilkley .. .. 230A
Illogan .. 240A
Ilminster .. 230A
Ilsington .. 240A
Immingham .. 230A
Ince (Liverpool) 230A
Inchinnan .. 240A
Ingatestone .. 230A
Ingham .. 230A
Ingleton .. 230A
Ingrave .. 240A
Ingworth .. 230A
Inmellan .. 230A
Instow .. .. 230A
Inveresk .. 230C
Inverkeithing .. 250A
Inverkip .. 230A
Inverlochy .. 240A
Inverness .. 240C
Ipplepen 200A
Ipswich .. 230A
230C
Irchester (Part) 230A
Irleston .. 230A
Irmingland .. 230A
Irstead .. 230A
Irlington .. 230A
Irthlingborough 210A
Irvine .. .. 240A
Irwell Vale .. 230A
Isleham .. 240A
Islington .. 100A
200A
Islip .. .. 210A
Itteringham .. 230A
Iver .. .. 200A
Iver Heath .. 200A
Ivinghoe .. 240A
Ivinghow Aston 240A
Ivybridge .. 230C
250C
Jaywick .. 230A
Jersey .. .. 230A
Jesson .. .. 230A
Jevington .. 230A
Johnstone .. 240A
Johnstown .. 230A
Jordanhill .. 240A
Kearsley .. 230A
Keckwick .. 250A
Kelleston .. 200A
Keelby .. 230A
Keighley .. 230A
230C
Kelsall .. .. 230A
Kelty .. .. 250A
Kemback .. 250A
Kempston .. 210A
Kempston Box-End .. .. 210A
Kempston Hardwick .. 210A
Kensing .. 220A
Kendal .. 230A
220C
Kenfig .. .. 230A
Kenfig Hill .. 230A
Kennford .. 230A
Kennington .. 230A
Kennishead .. 240A
100A
Kensington .. 230A
200C
Kensworth .. 240A
Kentisbeare .. 230A
Kenton (Devon) .. 200A
Kent Street .. 230A
Kenyon .. 230A
Kesgrave .. 230A
Kessingland .. 230A
Keston .. 240A
Keswick(Cumb) 100A
200A
Keswick (Norfolk) .. 230A
Kettering .. 230A
280C
Kettlebrook .. 250A
Kettleaing .. 230A
Kew .. .. 220A
220C
Keyingham .. 230A
Keymer .. 230A
Keyser's Estate 240A
Key Street .. 230A
Kidmore End .. 230A
Kidsgrove .. 230A
Kilbarchan .. 240A
Kilbirnie .. 240A
Kilconquhar .. 250A
Killinghall .. 200A
Kilmacolm .. 240A
Kilmany .. 250A
Kilmarnock .. 240A
240C
Kilmaurs .. 240A
Kilmun .. .. 230A
Kilrenny .. 250A
Kilsby .. .. 230A
Kilsyth .. .. 250A
Kilwinning .. 240A
Kimberley .. 230A
Kimpton .. 240A
Kincardine .. 250A
Kineton .. 250A
Kinghorn .. 250A
Kingavarns .. 250A
Kingsbridge .. 230A
Kings Bromley 230A
Kingsbury (Middx) .. 240A
Kingsbury (Staffs) .. 200A
Kingsford .. 230A
Kingskerswell 200A
Kingskettle .. 250A
King's Langley 240A
Kingsley 250A
Kings Lynn .. 230A
200C
Kingsmarsh .. 230A
Kingsnorth .. 230A
Kingspark .. 240A
King's Sutton 230A
Kingstanley .. 230A
Kingsteignton 230A
Kingston (Lothians) .. 230A
Kingston (Sussex) .. 230A
Kingston-upon-Thames .. 240A
Kingstown (Cumb) .. 230A
Kingswear .. 240A
Kingswinford .. 200A
Kingswood .. 250A
Kingswood (Glouc) .. 230A
Kinnerton .. 230A
Kinsbourne Green .. 240A
Kinvaston .. 230A
Kirby Cross .. 230A
Kirby-le-Soken 230A
Kirkandrews .. 230A
Kirkby .. 230A

## SUPPLY VOLTAGES

Kirkby (Whiston) .. 230A
Kirkcaldy .. 230A
230C
Kirkcudbright .. 230A
Kirk Ella .. 230A
Kirkfieldbank 240A
Kirkham .. 230A
Kirk Hammerton .. 230A
Kirk Heaton .. 230A
Kirkintilloch .. 240A
Kirk Langley .. 200A
Kirkliston .. 230A
250A
Kirk Michael .. 230A
Kirknewton .. 230A
Kirkoswald .. 240A
Kirn .. .. 230A
Kirton (Lincs) 240A
Kirton (Suffolk) 230A
Kislingbury .. 210A
Knapton .. 230A
Knaresborough 200A
Knebworth .. 240A
Knighton .. 230A
Knightsbirdge 230A
200C
Knightswood .. 240A
Knodishall .. 250A
Knowle .. 230A
Knowle Hill .. 240A
Knowsley .. 115A
230A
Knutsford .. 220A
Kyng .. .. 230A

Laceby .. 230A
Lacock .. 230A
Ladybank .. 250A
Lakeside .. 230A
Laleham .. 200A
Lamberhurst .. 230A
Lambeth .. 220A
Landhill .. 240A
Lambourne .. 230A
Lamerton .. 230A
Lammas .. 230A
Lanark .. 240A
Lancaster .. 230A
Lancing .. 230A
Landbeach .. 240A
Lane End .. 230A
Langbank .. 240A
Langcliffe .. 230A
Langdon Hills 230A
Langford (Beds.) 240A
Langford (Essex) .. 230A
Langham .. 230A
Langholm .. 230A
Langley (Ches.) 230A
Langley (Norfolk) .. 230A
Langley Marish 230A
Langstone .. 230A
Langton .. 220A
Lapley .. .. 230A
Lapworth .. 230A
Larbert .. 250A
Largos .. .. 250A
Largs .. .. 240A
Larkfield .. 230A
Larkhall .. 240A
Lasswade .. 230A
Latchford .. 240A
Latchford Without .. 250A
Latchingdon .. 230A
Lathom .. 230A
Latimer .. 230A
Launceston .. 200C
Lavant .. 230A
Lavendon .. 230A
Lavernock .. 230A

Law .. .. 240A
Lawford .. 230A
Laxey .. .. 230A
Layer Breton .. 230A
Layer-de-la-Haye .. 230A
Layer Marney 230A
Lea (Ches) .. 230A
Lea (Lancs) .. 230A
Leagram .. 230A
Lea Marston .. 230A
Leamington .. 250A
Lea Newbold .. 230A
Leatherhead .. 230C
230A
Lebberston .. 230A
Leckhampstead 230A
Leckhampton .. 210A
220A
Ledburn .. 240A
Ledbury .. 230A
Leeds .. .. 200A
230A
Leek .. .. 230C
Leekbrook .. 230A
Lee-on-Solent .. 230A
Lees (Lancs) .. 230A
Lees (Yorks) .. 230A
Leeswood .. 230A
Leftwich .. 220C
220A
100A
Leicester .. 200A
240A
Leicester Frith 240A
Leigh (Kent) .. 220A
Leigh (Lancs) .. 220C
230A
Leigh (Lancs) (Rural) .. 230A
Leighton Buzzard .. 240A
Leiston .. 230A
Lensford .. 240A
Lennoxtown .. 240A
Lemonfield .. 230A
Lenzie .. .. 240A
Leominster .. 230A
Lerwick .. 230C
Lesmahagow .. 240A
Lessingham .. 230A
Letchworth .. 240A
250C
Leuchars .. 250A
Leven (Fife) .. 250A
Leven (Yorks) 230A
Levington .. 230A
Lewes .. .. 230C
Lewisham .. 200A
Leybourne .. 230A
Leyburn .. 130C
Ley Hill .. 230A
Leyland .. 230A
Lichfield (Hunts.) .. 230A
Lichfield (Staffs) 240A
Lidlington .. 230A
Lifton .. .. 230A
Light Oaks .. 230A
Lightwater .. 240A
Lilford-cum-Wigthorpe .. 230A
Lilley .. .. 240A
Lilling .. .. 230A
Limpley .. 230A
Limpsfield .. 230A
Lincoln .. .. 230C
230A
Lindal .. .. 230A
Lindale .. .. 230A
Lindfield .. 230A
Lingdale .. 250A
Lingerfield .. 230A
Lingfield .. 230A
Lingwood .. 230A

Linlithgow .. 250A
Linton (Kent) 230A
Linton (Staffs) 230A
Linton (York) 230A
Linton (Yorks) 250C
Lintz .. .. 230A
Linwood .. 240A
Liskeard .. 240A
Lisvan .. .. 230A
Litherland .. 230C
230A
Litlington .. 230A
Little .. .. 230A
Little Anwell .. 240A
Little Aston .. 230A
Little Baddow 230A
Little Barningham 230A
Little Bealing 230A
Little Berkhampstead 240A
Littleborough .. 230A
Little Braxted 230A
Little Brickhill 230A
Little Brington 230A
Little Budworth 220A
Little Chart .. 230A
Little Clacton 230A
Littledean .. 230A
Little Eaton .. 200A
230A
Little Fambridge .. 230A
Little Gaddesden 230A
Little Haywood 230A
Littlehampton 230A
240C
Little Heath .. 240A
Little Hoole .. 230A
Little Horkesley 230A
Little Houghton 230A
Little Hulton .. 230A
Little Kingshill 230A
Little Leigh .. 220A
Little Lever .. 230A
Little Missenden .. 230A
Littlemoss .. 240A
Little Oakley .. 230A
Little Ouseburn 230A
Littleover .. 200A
Little Parndon 240A
Little Plumstead 230A
Littleport .. 240A
Little Saughall 230A
Little Stanney 250A
Little Sutton .. 230A
Little Thurrock 230A
Littleton (Nr. Chester) 230A
Littleton (Nr. Woking) 200A
Little Urswick 230A
Littlewick Green 240A
Little Witchingham 230A
Little Wymondley .. 240A
Liverpool .. 230C
230A
Liversedge .. 230A
Livesey .. 230A
Llandaff .. 230A
Llandaff North 230A
Llandavenny .. 230A
Llandilo .. 220C
230C
Llandrindod Wells .. 230C
Llandudno .. 230A
Llandudno Junction .. 230A
Llanedyrne .. 230A
Llangeinor .. 230A
Llangollen .. 220C
Llangwystenin 230A
Llanhilleth .. 250C
Llandiloes .. 230C

Llanisden .. 230A
Llanrhos .. 230A
Llanrwst .. 230C
230A
Llansantffraid .. 220C
Llantarnum .. 230A
Llanwern .. 230A
Llysfaen .. 230A
Loanhead .. 230A
Loans .. .. 240A
Lochaber .. 240A
Lochgelly .. 250A
Lochmabin .. 230A
Lochwinnoch .. 240A
Lockerbie .. 230A
Locks Bottom 240A
Locksheath .. 230A
Loddington .. 240A
Loddiswell .. 240A
Loddon .. 230A
Lofthouse .. 230A
100C
200C
London (City) 230A
208C
208A
London Colney 240A
Long Buckley 230A
Longdown .. 230A
Long Easton .. 220C
220A
Longfield .. 230A
Longford .. 230A
Longniddry .. 230A
Long Preston .. 230A
Longridge .. 230A
Longscales .. 230A
Longsdon .. 230A
Long Sutton .. 230A
Longton (Lancs) .. 230A
Longton (Staffs) .. 240A
Longtown .. 230A
Looe .. .. 200C
Loose .. .. 230A
Lossiemouth .. 230C
Lostock Graham 220A
Lostwithiel .. 230A
Lothianburn .. 230A
Loughborough 220C
230A
Loughor .. 230A
Loughton .. 230A
Lound (Notts.) 230A
Louth .. .. 230A
Lower Boddington 230A
Lower Bourne 230A
Lower Froyle .. 230A
Lower Harlestone .. 230A
Lower Heyford 230A
LowerKinnerton 230A
Lower Penn .. 200A
Lower Walton .. 250A
Lowestoft .. 230C
230A
Lowfield Heath 230A
Lowick (Lancs) 230A
Lowick (Northants) 230A
Low Lalthe .. 230A
Lowton .. 230A
Lubbersthorpe 240A
Lubenham .. 230A
Ludgvan .. 240A
Lugton .. 240A
Lullington .. 230A
Lundin Links .. 250A
Lustleigh .. 240A
Luton .. .. 240A
Lydbrook .. 230A
Lydd .. .. 230A
Lydden .. 230A
Lydford .. 230A
Lydiate .. 230A

Lydney .. 230A
Lye .. .. 200A
Lyme Regis .. 220C
Lyminge .. 230A
Lymington .. 240A
Lympstone .. 230A
Lymm .. .. 250A
Lynmouth .. 100A
Lynton .. 100A
200A
Lytham St. Annes .. 240A

Macclesfield .. 230A
Machen .. 230A
Machynlleth .. 230A
Mackeye End .. 240A
Macnerry .. 230A
Mackworth .. 200A
Madeley .. 230A
Madresfield .. 100A
200A
Madron .. 240A
Maer .. .. 230A
Maesteg .. 230A
Maesycoed .. 230A
Maesycwmmer 230A
Maghull .. 230A
Magor .. .. 230A
Maidenhead .. 230C
230A
Maidford .. 230A
Maids Norton .. 230A
Maidstone .. 230C
230A
Malsemore .. 230A
Malden .. 220A
Maldon .. 205C
205A
230A
Malmesbury .. 230A
Malpas .. 230A
Malvern Link .. 100A
200A
Malvern Wells .. 100A
200A
Manchester .. 200C
230A
Mancot .. 220C
230A
Manley .. 250A
Mannington .. 230A
Manningtree .. 230A
Manor Park .. 230C
230A
Mansfield .. 250A
Mansfield Woodhouse .. 250A
Manton .. 220C
Mapledurham .. 200A
March .. .. 240A
Marchington .. 230A
Maresfield .. 230A
Margaretting .. 230A
Margate .. 240C
Margrove Park 250A
Marhamchurch 230A
Mark Cross .. 230A
Markeaton .. 200A
MarketBosworth 240A
Market Drayton 240C
Market Harborough .. 240A
Market Lavington .. 230A
Market Weighton .. 230A
Markham .. 230A
Markham Moor 230A
Markinch .. 250A
Marks Tey .. 230A
Markyate .. 240A
Marlborough .. 220C
Marldon .. 200A
Marlpit Hill .. 230A

Marlston-cum-Lache .. 230A
Marple .. .. 230A
Marple Bridge 230A
Marsham .. 230A
Marston Green 230A
Marston Moretain .. 230A
Marston St. Lawrence 230A
Marsworth .. 240A
Marthill .. 230A
Martlesham .. 230A
Martock .. 230A
Marton .. 230A
Marytavy .. 230A
Matfield .. 230A
Mathern .. 230A
Matson .. 230A
Mattersey .. 230A
Mauchline .. 240A
Maulden .. 230A
Maxweltown .. 230C 230A
Maybole .. 240A
Mayfield .. 230A
Meaux .. .. 230A
Melbourn .. 240A
Melcombe Regis 230A
Meldreth .. 240A
Meldreth North 240A
Melksham .. 230A
Mellor (Ches) .. 230A
Mellor (Lancs) 230A
Melton (Suffolk) 230A
Melton (Yorks) 230A
Melton Mowbray 240C
Menai Bridge .. 230C 230A
Mentmore .. 240A
Meopham .. 230A
Mere .. .. 220A
Merriott .. 230A
Mersham .. 230A
Merthyr Mawr 200A
Merthyr Tydfil 230C
Merthyr Vale .. 250A
Merton .. 220A
Messing .. 230A
Methil .. .. 250A
Methley .. 230A
Mevagissey .. 230A
Mexborough .. 220C
Mickleover .. 200A
Mickle Trafford 230A
Mid Calder .. 230A
Middle Bourne 230A
Middle Clayton 230A
Middlesbrough 230A
Middlesmoor .. 230A 230A
Middleton (Lancs) .. 220C 230A 250A
Middleton (Leics) .. 230A
Middleton (Sussex) .. 230A
Middleton Cheney .. 230A
Middleton-in-Wharfdale 230A
Middlewich .. 220A
Midway .. 230A
Miklerston .. 240A
Mildenhall .. 220C
Mile Oak .. 250A
Milford .. 230A
Milford Haven 220C
Milford-on-Sea 230C
Millbridge .. 230A
Millbrook .. 230A
Mill Hill .. 240A
Milliken Park .. 240A
Millom .. .. 230A
Mill Street .. 230A
Milngavie .. 240A
Milnrow .. 230A
Milton (Dumfries) .. 240A
Milton (Hants) 230A
Milton (Northants) 210A
Milton (Staffs) 230A
Milton Abbot .. 230A
Milton Bridge 230A
Milton Brynan 240A
Milton Ernest 210A
Milton Regis .. 230A
Milverton .. 230A
Mimbridge .. 200A
Minchinhampton 230A
Minehead .. 230A
Minnigaff .. 230A
Minster .. .. 230A
Mimworth .. 230A
Mirfield .. 200C 230A
Misterton .. 230A
Mistley .. 230A
Mitcham .. 230A
Mitcheldean .. 230A
Mobberley .. 220A
Mochdre .. 230A
Modbury .. 240A
Moffat .. .. 230A
Moggerhanger 230A
Mold .. .. 230A
Mold Junction 230A
Molescroft .. 230A
Mollington .. 230A
Monkton .. 240A
Monmouth .. 230A
Moonzie .. 250A
Moore .. .. 250A
Moor Park .. 240A
Moor Row .. 230A
Moorsholm .. 250A
Morden .. .. 230A
Morecambe .. 230A
Moreton Pinkney .. 230A
Morley .. .. 100A 200A
Morley St. Peter 230A
Morningthorpe 230A
Mortlake .. 210C
Moreton .. 230A
Mossend .. 240A
Mossley .. 230A
Mosspit .. 230A
Moston (Ches.) 230A
Motherwell .. 230C
Mottingham .. 200A
Mottistone .. 240A
Mottram .. 230A
Mottram St. Andrews 230A
Mouldsworth .. 230A
Moulton (Ches.) 220A
Moulton(Lincs.) 230A
Moulton Chapel 230A
Mountain Ash 230A
Mountfield .. 230A
Mouton-hampstead .. 240A
Much Hadham 240A
Much Hoole .. 230A
Mucklestone .. 230A
Muirhead .. 240A
Mulbarton .. 230A
Mundham .. 230A
Mursley .. 230A
Murton .. 230A
Musselburgh .. 230C 230A
Muston .. 230A
Mytholmroyd .. 230A
Mytton .. 230A
Nacton .. 230A
Nafferton .. 230A
Nailsworth .. 230A
Naupantan .. 230A
Nanpean .. 230A
Nantyffyllon .. 230A
Nantymoel .. 220A
Naphill .. 230A
Naseby .. 230A
Nazeing .. 240A
Neath .. .. 220A
Neatishead .. 230A
Needwood .. 230A
Nellston .. 240A
Nelson .. .. 230A
Neston (Ches.) 230A
Neston (Wilts.) 230A
Nethebury .. 230A
Netherfield .. 230A
Nether Poppleton .. 230A
Netherseal .. 230A
Netherton .. 230A
Netteswell Cross 240A
Nettledon .. 230A
Nettlestone .. 240A
Newark .. .. 110C 220C 230A
Newarthill .. 240A
New Barn .. 230A
Newboldpacey 250A
Newbourne .. 230A
New Bradwell 210A
Newburgh .. 250A
Newby Bridge .. 230A
Newcastle-on-Tyne .. 240C 250A 240A 230C
Newcastle-under-Lyne 230A
New Cumnock 240A
New Duston .. 210A
New Earswick .. 230A
Newenden .. 230A
New Fenlake .. 210A
New Galloway 230A
Newgatestreet .. 240A
New Harrowden 210A
Newhythe .. 230A
Newick .. .. 280A
Newington .. 230A
Newlands .. 240A
Newmarket .. 240A
New Mill .. 230A
Newmilns .. 240A
Newnham (Glos.) 230A
Newnham(Kent) 230A
New Parks .. 240A
Newport (Fife) 250A
Newport (I.O.W.) .. 240A 200A
Newport (Mon.) 230C 230A
Newport Pagnell .. 210A
Newquay .. 230A
New Radnor .. 110C
New Romney .. 230A
New Stevenston 240A
Newton (Cambs.) 240A
Newton (Ches.) 230A
Newton (York.) 230A
Newton Abbot 240A
Newton Blossomville 230A
Newton-by-Daresbury 250A
Newton-by Frodsham 250A
Newton-by-Tattenhall 230A
Newton Ferrers 230A
Newton Flotman 230A
Newtongrange .. 230A
Newton-le-Makerfield .. 230A
Newton-in-Willows .. 230A
Newton Longville .. 230A
Newton Mearns 240A
Newton Regis 250A
Newton Solney 230A
Newton Stewart 230A
Newtown .. 230A
New Tredegar 230A
New Windsor .. 110C 220C
Ninfield .. 230A
Niton .. .. 240A
Nitshill .. 240A
No Man's Heath 250A
Norley .. .. 220A
Normanby .. 250A
Norman Cross 230A
Normanton .. 230A
Northall .. 240A
Northam .. 230A
Northampton .. 210A
Northaw .. 240A
North Bersted .. 230A
Northbourne .. 230A
North Bradley 230A
Northchurch .. 200A
North Cray .. 240A
North Elmham 230A
North Ferriby 230A
Northfleet .. 230A
North Harrow .. 240A
Northiam .. 230A
Northill .. 230A
Northleach .. 220C
North Marston 230A
Northolt .. 200A
North Ormesby 230A
North Preston .. 230A
North Queensferry 250A
North Shields .. 240A
North Skirlaugh .. 230A
North Tawton .. 230A
North Thoresby .. 230A
Northumberland Heath .. 200A
North Walsham 230A
North Weald .. 230A
Northwich .. 220C 220A
Northwood .. 240A
Norton .. .. 250A
Norton (Herts) 240A
Norton Bridge .. 230A
Norton Canes .. 250A
Norton Green .. 240A
Norton-juxta Twycross .. 250A
Norton-sub-Mandon .. 230A
Norwich .. 220C 230A
Norwood Hill .. 230A
Nottingham .. 200C 230A
Notting Hill .. 200C 230A
Nuncaton .. 220C 230A
Nunney .. 230A
Nunthorpe .. 230A
Nutbourne .. 230A
Nutfield .. 230A
Nutley .. .. 230A
Nyetimber .. 230A
Oadley .. 240A
Oakdale .. 230A
Oaken .. .. 230A
Oakenshaw .. 230A
Oakley (Beds.) 210A
Oakley (Hants.) 230A
Oakworth .. 230A
Ochiltree .. 240A
Ockham .. 200A
Odell .. .. 230A
Offham .. 230A
Offord .. .. 240A
Ogmore .. 230A
Ogmore Vale .. 220A
Okehampton 230A
Old Bradwell .. 230A
Old Cleeve .. 230A
Old Colwyn .. 220C 230A
Old Craighall .. 230A
Old Cummock 240A
Old Fletton .. 230A
Oldhall .. 240A
Old Hall Green 240A
Oldham .. 210C 230A
Old Kilpatrick 240A
Old Sodbury .. 230A
Old Warden .. 230A
Old Windsor .. 230A
Old Ynysbwl .. 230A
Ollerton .. 220A
Olney .. .. 230A
Olton .. .. 230A
Oncham .. 230A
Ongar .. .. 230A
Orford .. .. 230A
Orlingbury .. 230A
Ormesby .. 230A
Orniston .. 230A
Ormskirk .. 230A
Orpington .. 240A
Orrell .. .. 230A
Orsett .. .. 230A
Orton Longueville 230A
Orton-on-the-hill .. 250A
Orton Waterville 240A
Osbaldeston .. 230A
Osbaldswick .. 230A
Oswaldtwistle 230A
Osmington .. 230A
Osmington Mills 230A
Ospringe .. 230A
Ossett .. .. 230A
Otford .. .. 220A
Otley .. .. 230A
Ottringham .. 230A
Oulton .. .. 230A
Oundle .. 230A
Outwood .. 230A
Overseal .. 230A
Overstone .. 210A
Overthorpe .. 230A
Overton (Hants.) 230A
Overton (Lancs.) 230A
Overtown .. 240A
Oxenhope .. 230A
Oxford .. 200A 100A 100C 230A
Oxted .. .. 230A
Packwood .. 230A
Padbury .. 230A
Paddock Wood 230A
Padiham .. 230A
Padstow .. 240A
Paignton .. 230A
Paisley .. 200A 250A
Pall Mall .. 220C 230A
Pannel .. .. 200A
Pantygog .. 230A
Papworth .. 240A
Par .. .. 230A
Parfold .. 230A
Parkeston .. 240A
Parkgate .. 230A
Parks .. .. 230A
Parkstone .. 200A
Park Street .. 240A
Partridge Green 230A
Patching .. 230A
Pateley Bridge 230A
Pathhead .. 230A
Patna .. .. 240A

## SUPPLY VOLTAGES

Patrington .. 230A
Patrington (Rural) .. 230A
Patshul .. 230A
Pattingham .. 230A
Pattishall .. 230A
PaulChurchtown 240A
Paulerspury .. 230A
Paull .. .. 230A
Pavenham .. 230A
Paxton Little .. 240A
Peacehaven .. 230A
Peaslake .. 230A
Peasmarsh (Sussex) .. 230A
Peel .. .. 230A
Pelsall .. .. 230A
Pembury .. 220A
Penarth .. 230C
Pencaitland .. 230A
Pendlebury .. 230A
250C
Pendleton .. 230A
Pengam .. 230A
230A
Penge .. .. 200A
Penicuik .. 230A
Penistone .. 230A
Penithick .. 230A
Penketh .. 250A
Penkridge .. 230A
Penmaenmawr 230A
Penn .. .. 200A
Pennington .. 230A
Pennybridge .. 230A
Penrhiwceiber 230A
Penryn .. 240A
Penrhyn Bay .. 230A
Penshurst .. 220A
Pensanett .. 200A
Pentewan .. 230A
Pentrebach .. 250A
Pentyrch .. 250A
Penwortham .. 230A
Penybank .. 230A
Penybont .. 230A
Penydarren .. 230C
Penyffordd .. 230A
Penzance .. 240A
Peover .. .. 220A
Peover Heath 220A
Percy Main .. 240A
Perth .. .. 230C
Peterborough .. 200C
230A
Peterhead .. 230A
Petersham .. 220A
Petersham-super-Ely .. 230A
Perertavy .. 230A
Pett .. .. 230A
Pett Level .. 230A
Pettisfree .. 230A
Petts Wood .. 240A
Pevensey .. 230A
Pevensey Bay 230A
Philliack .. 240A
Picton .. .. 230A
Pilcombe .. 230A
Piltdown .. 230A
Pilton .. .. 230A
Pinchbeck .. 230A
Pinchbeck West 230A
Pinhoe .. .. 230A
Pinner .. .. 240A
Pipe Gate .. 230A
Pirbright .. 200A
Pitstone .. 240A
Pittenween .. 250A
Plaistow .. 200A
Platt .. .. 230A
Platt Bridge .. 230A
Playden .. 230A
Playford .. 230A
Pleasington .. 230A
Pleasley .. 250A
Pluckley .. 230A
Plumley .. 220A
Plumpton .. 230A
Plymouth .. 230C
200A
230A
Plymstock .. 230A
Plympton St. Mary .. 230A
Plympton St. Maurice .. 230A
Pocklington .. 230A
Polebrook .. 230A
Polegate .. 230A
Polmont .. 250A
Ponlottyn .. 230A
Pontardawe .. 230A
Pontardulais .. 230A
Pontblyddyn .. 230A
Pontlanfraith .. 230A
Pontnewynydd 230A
Pontycymmer 230A
Pontymister .. 230A
Pontypool .. 230A
Pontypridd .. 230C
Pontyrhyl .. 230A
Pontywain .. 230A
Poole .. .. 200A
Poplar .. .. 230C
Porchester .. 230A
Poringland .. 230A
Porlock .. 230A
Porlock Weir .. 230A
Port Erin .. 230A
Port Glasgow .. 250C
250A
Porth .. .. 230A
Porthcawl .. 230A
Porthcean .. 230A
Portland .. 230A
Portpatrick .. 230A
Port St. Mary 230A
Port Seton .. 230A
Portslade .. 230C
230A
Portsmouth .. 200A
230A
Port Talbot .. 240A
Portway .. 230A
Postwick .. 230A
Potter End .. 230A
Potterne .. 230A
Potter Row .. 230A
Potters Bar .. 240A
Potterspury .. 230A
Potton .. .. 210A
Poughill .. 230A
Poulton .. 200A
Poulton-le-Fylde 230A
Poulton-with-Fearnhead .. 250A
Poynings .. 230A
Poynton .. 230A
Presall .. .. 240A
Prescot .. 115A
230A
Prestatyn .. 230A
Prestbury(Ches.) 230A
Prestbury (Glos.) 210A
220A
Preston (Dumfries) .. 230A
Preston (Durham) .. 250A
Preston (Herts) 240A
Preston (Lancs.) 230A
Preston (Yorks.) 230A
Preston Bissett 230A
Preston-on-the-Hill .. .. 250A
Prestonpans .. 230A
Prestwich .. 200A
230A
Prestwick .. 240A
Preatwood .. 230A
Princes Risborough .. 220A
Princetown .. 200C
Prinknash .. 230A
Privis Hayes .. 230A
Puckeridge .. 240A
Pudsey .. 230A
Pulborough .. 230A
Pulford .. .. 230A
Pulloxhill .. 240A
Pulrose .. 230A
Purbrook .. 230A
Purdis Farm .. 230A
Purleigh .. 230A
Purley .. 230A
Putnoe .. 210A
Pyle .. .. 230A
Pyrford .. 200A
Pytchley .. 240A

Quadring .. 230A
Quakers Yard 250A
Quarndon .. 200A
Quarry Bank .. 200A
Queensbury .. 230A
Queensferry .. 230A
Quinton .. 210A

Rabley Gardens 240A
Rabley Heath 240A
Rabley Park .. 240A
Rackheath .. 230A
Radbourne .. 200A
Radcliffe(Lancs.) 230A
Radcliffe-on-Trent .. 230A
Radwell .. 240A
Radyr .. .. 240A
Rainford .. 230A
230C
Rainham (Kent) 230A
Rainhill .. 230A
115A
Rainow .. 230A
Ramsbottom .. 230A
Ramsden Bellhouse .. 230A
Ramsey (Essex) 230A
Ramsey (Hunts.) 240A
Ramsey (I O.M.) 230A
Ramsgate .. 240A
Ramsgill .. 230A
Ramsgreave .. 230A
Rangemore .. 230A
Rankinston .. 240A
Ranskill .. 230A
Ranworth-with-Panxworth .. 230A
Ratho .. .. 230A
Raunds .. 210A
Ravenscar .. 230A
Ravensden .. 230A
Ravensthorpe 230A
Ravenstone .. 230A
Ravenstown .. 230A
Rawdon .. 230A
Rawmarsh .. 230A
Rawtenstall .. 230A
Rayleigh .. 230A
Rayners Lane 240A
Reach .. .. 240A
Read .. .. 230A
Reading .. 200A
200C
Reculver .. 230A
Redbourn .. 240A
Redcar .. 250A
Redlynch .. 230A
Redruth .. 240A
Reed .. .. 240A
Reedley .. 230A
220C
Reedley Hallows 230A
220C
Reepham .. 230A
Reeth .. .. 230A
Remenham .. 230A
Rendlesham .. 230A
Renfrew .. 240A
Renhold .. 230A
Renton .. 240A
Repton .. 230A
Rhiwbina .. 230A
Rhiwfawr .. 230A
Rhodesia .. 220A
Rhonehouse .. 230A
Rhoose .. 230A
Rhos-on-Sea .. 230A
Rhos .. .. 230A
Rhu .. .. 240A
Rhydyfelin .. 230A
Rhydyfro .. 230A
Ribchester .. 230A
Richmond (Surrey) .. 220A
Richmond (Yorks) .. 220C
Rickmansworth 240A
Riddlesden (Yorks.) .. 230A
Riddrie .. .. 240A
Ridgmont .. 230A
Rimington .. 230A
Ringland .. 230A
Ringmer .. 230A
Ringstead .. 210A
Ringway .. 220A
Ringwood .. 230A
Ripe .. .. 230A
Ripley (Surrey) 200A
Risca .. .. 230A
Rise .. .. 230A
Rishton .. 230A
Rising Bridge .. 230A
Riverhead .. 220A
Rixton-with-Glazebrook .. 230A
Roade .. .. 210A
Roadwater .. 230A
Robertsbridge 230A
Robin Hood's Bay .. .. 230A
Rocester .. 230A
Rochdale .. 230A
Roche .. .. 230A
Rochester .. 230A
Rochford .. 230A
Rockland .. 230A
Rockley .. 230A
Rodborough .. 230A
Roe End .. 240A
Rolleston .. 230A
Rolvenden .. 230A
Romford .. 230A
Romiley .. 230A
Roos .. .. 230A
Roslin .. .. 230A
Rosliston .. 230A
Rosyth .. 250A
Rotherfield .. 230A
Rotherfield Peppard .. 230A
Rothernam .. 230A
Rothesay .. 230C
Rothwell (Northants) .. 240A
Rothwell (Yorks.) .. 230A
Rough Close .. 230A
Rough Common 230A
Routh .. .. 230A
Rowde .. .. 230A
Rowhedge .. 230A
Rowlands Castle 230A
Rowledge .. 230A
Rowley .. .. 230A
Rowley Regis .. 200A
Rowton (Ches.) 230A
Rowton (Yorks.) 230A
Roxton .. .. 230A
Roydon .. .. 240A
Royston (Herts.) 240A
Royton .. .. 230A
Ruardean .. 230A
Ruddington .. 230A
Rudge .. .. 230A
Rudheath .. 220A
Rudyard .. 230A
Rufford .. 230A
Rugby .. .. 230A
Rugeley .. 230A
Ruislip .. 240A
Runcorn .. 250A
Rumford .. 230A
Runwell(Yorks.) 230A
Ruscombe .. 230A
Rushall .. 230A
Rushden .. 210C
210A
Rushmere St. Andrew .. 230A
Rushton .. 230A
Rustington .. 230A
Ruston .. 230A
Rutherglen .. 240A
Ruthin .. 230C
Ryarsh .. 230A
Ryburn .. 230A
Ryde (I.O.W.) 240A
Rye .. .. 230A
Rye Foreign .. 230A
Rye Harbour .. 230A
Ryehill .. 230A
Rye Park .. 240A

Sabden .. 230A
Sadberge .. 230A
Saffron Walden 230A
220C
Saighton .. 230A
Saint Albans .. 240A
Saint Andrews (Fife) .. 250A
Saint Andrews (Glam.) .. 230A
Saint Annes .. 240A
240C
Saint Arvans .. 230A
Saint Austell .. 230A
Saint Bees .. 230A
Saint Blazey .. 230A
Saint Blazey Gate .. 230A
Saint Brides .. 230A
Saint Budeaux 230A
Saint Columb Major 240A
Saint Dennis .. 230A
Saint Germans 230A
Saint Gorran .. 230A
Saint Helens .. (I.O.W.) .. 240A
Saint Helens (Lancs.) .. 230C
Saint Ippollitts 240A
Saint Ives (Cornwall) . 240A
Saint Ives (Hunts.) .. 240A
Saint James .. 230A
220C
Saint Johns (I.O.M.) .. 230A
Saint Just .. 240A
Saint Lawrence (I.O.W.) .. 240A
Saint Leonards (Fife) .. 250A
Saint Margarets at Cliffe .. 200A
St. Martha .. 230A
St. Mary Cray 240A
St. Marylebone 240A
240C
St. Michaels .. 230A
St. Monans .. 250A
St. Neots .. 240A
St. Nicholas Hurst .. 230A
St. Osyth .. 230A
St. Peters .. 240C
St. Stephens .. 230A

St. Stephens Coombe .. 230A
St. Woolos .. 230A
Salcombe .. 230A
Sale .. .. 240A
Salehurst .. 230A
Salesbury .. 230A
Salford (Beds.) 230A
Salford (Lancs.) 200A
230A
230C
Salfords .. 230A
Salhouse .. 230A
Salisbury .. 230A
Sall .. .. 230A
Salsburgh .. 240A
Saltash .. 240A
Saltcoats .. 240A
Saltney .. .. 230A
Saltwood .. 210A
210C
Samford (Rural) 230A
Samlesbury .. 230A
Sampford Brett 230A
Sampford Courtenay .. 230A
Sampford Peverell 230A
Sandbank .. 230A
Sandford .. 230A
Sandgate .. 210A
210C
Sandhoe .. 250A
Sandhurst (Glouc.) .. 230A
Sandhurst(Kent) 230A
Sandhurst (Surrey) .. 250A
Sand Hutton .. 230A
Sandiway .. 220A
Sandling .. 230A
Sandown (I.O.W.) .. 240A
Sandridge .. 240A
Sandsend .. 230A
Sandwich .. 230A
Sandy .. .. 210A
Sandycroft .. 230A
Santon .. .. 230A
Sanquhar .. 230A
Saredon .. 230A
Sarisbury .. 230A
Sawbridgeworth 240A
Sawley .. 230A
Sawston .. 240A
Saxlingham .. 230A
Saxmundham .. 230A
220C
Saxthorpe .. 230A
Scalby .. .. 230A
Scaleby .. 230A
Scales .. .. 230A
Scarborough .. 230A
Scarisbrick .. 230A
220A
Scarthoe .. 230A
Scaynes .. 230A
Scholes .. 230A
Scotby .. .. 230A
Scotstoun .. 240A
Scotton .. 230A
Scraptoft .. 240A
Scriven .. 200A
Scunthorpe .. 250A
Seaforth .. 230A
230C
Seaham Harbour 250A
Seal .. .. 220A
Sealand .. 230A
Seamer .. 230A
Seasalter .. 230A
Seascale .. 230A
Seaton (Devon) 220C
Seaton (Yorks.) 230A
Seaview (I.O.W.) 240A
Seckington .. 250A
Sedlescombe .. 230A
Seend .. .. 230A
Seer Green .. 220A
220C
Seething .. 230A
Sefton .. .. 230A
Seighford .. 230A
Seighley .. 200A
Seisdon .. .. 200A
Selby .. .. 230A
Selmeston .. 230A
Send .. .. 200A
Settle .. .. 230A
Sevenoaks .. 220A
Sevenoaks Weald .. 220A
Sevington .. 230A
Sewardstonebury 240A
Sewardstone Road (Waltham Abbey) 240A
Sewerby .. 230A
Shadoxhurst .. 230A
Shaldon .. 230A
Shalfleet .. 240A
Shalford .. 230A
Shanklin (I.O.W.) .. 240A
Shareshill .. 230A
Sharnbrook .. 210A
Sharpenhoe .. 240A
Shawforth .. 230A
Shaw Mills .. 230A
Sheepy .. 250A
Sheffield .. 200A
Shefford .. 240A
Shelfield .. 250A
Shelley .. 230A
Shenfield .. 240A
Shenley .. 240A
Shenley (Church End) (Bucks.) .. 230A
Shenstone .. 230A
Shephall .. 240A
Shepherd's Bush 110A
230A
Shepherdswell 230A
Shepperton .. 200A
Shepreth .. 240A
Shepton Beauchamp 230A
Sherbourne .. 250A
Sherbourne St. John .. 220A
Shere (Surrey).. 230A
Sheriff Hutton 230A
Sheringham .. 240A
Sherington .. 230A
Shermanbury .. 230A
Shevington .. 230A
Shide .. .. 240A
Shillington .. 240A
Shinfield .. 230A
Shipdham .. 230A
Shiplake .. 230A
Shipley Bridge 230A
Shipton .. 230A
Shireoaks .. 220A
Shirley .. 230A
Shocklach Church .. 230A
Shocklach Oviatt .. 230A
Shoeburyness .. 230A
Shoreditch .. 240A
Shoreham .. 220A
Shoreham-by-Sea .. .. 230A
Shorne .. .. 230A
Shortfield Common .. 230A
Short Heath .. 200A
Shortstown .. 210A
Shotesham All Saints .. 230A
Shotton .. 230A
Shotts .. .. 240A
Shotwick .. 230A
Shotwick Park 230A
Shrewsbury .. 210C
Shurdington .. 230A
Shustoke .. 230A
Shuttington .. 250A
Shuttle Wood 240A
Sibbertoft .. 230A
Sidbury .. 220C
Sidcup .. .. 200A
200A
Siddington .. 230A
Sidlesham .. 230A
Sidmouth .. 230A
Sigglesthorne .. 230A
Silsoe .. .. 240A
Silverstone 230A
Silverton .. 230A
Silvertown .. 200A
Simonstone .. 230A
Sinfin Moor .. 200A
230A
Singleton .. 230A
Singlewell .. 230A
Sissinghurst .. 230A
Siston .. .. 230A
Sittingbourne .. 230A
Six Mile Bottom 230A
Skelmersdale .. 230A
Skelmorlie .. 230A
Skelton (Yorks.) 250A
Skelton-in-Cleveland .. 230A
Skidby .. 230A
Skipton .. 230A
Skirlaugh (Rural) .. 230A
Slaithwaite .. 230A
Slamannan .. 250A
Slapton .. 240A
Sleaford .. 220C
230A
Sleights .. 230A
Slindon .. .. 230A
Slip End .. 240A
Slitting Mill .. 230A
Slough .. .. 230A
Slyne .. .. 230A
Smallburgh .. 230A
Smallfield .. 230A
Smallford .. 240A
Smarden .. 230A
Smelthouses .. 230A
Snainton .. 230A
Snitterfield .. 250A
Snodland .. 230A
Solham .. 240A
Solihull .. .. 230A
Sompting .. 230A
Sonning .. 230A
Soulbury .. 240A
Souldrop .. 230A
Southam .. 230A
South Ascot .. 220C
South Bank .. 250A
South Bersted 230A
Southborough 220A
Southbourne .. 230A
(Bournemouth) 250C
Southbourne (Portsmouth) 230A
Southend .. 230C
230A
South Cave .. 230A
South Dalton .. 230A
South Fambridge 230A
Southfleet .. 230A
Southgate .. 240A
South Heath .. 230A
Southill .. 230A
South Killingholme 230A
South Mimms .. 240A
South Molton .. 230A
South Nutfield 230A
South Petherton 230A
Southport .. 220A
South Queensferry .. 250A
South Skirlaugh 230A
South Stainley .. 200A
South Walsham 230A
205A
Southwark .. 205C
230A
220C
South Weald .. 240A
Southwell .. 230A
Southwick .. 230A
230C
Southwold .. 230A
South Wootton 230A
Southworth-with-Croft .. 250A
South Zeal .. 230A
Sowerby Bridge 230A
Spalding .. 230A
Sparham .. 230A
Sparkbridge .. 230A
Speldhurst .. 220A
Spellbrook .. 240A
Spenborough .. 230A
Spondon .. 200A
Spratton .. 210A
Springboig .. 240A
Springfield .. 230A
Springhead .. 230A
Springside .. 240A
Sproughton .. 230A
Sprowston .. 230A
Stableford .. 230A
Stackhouse .. 230A
Stafford .. 210C
230A
Stagsden .. 230A
Staines .. 200A
230A
Stalham .. 230A
Stallingborough 230A
Stalmine .. 230A
Stalybridge .. 230A
230C
Stamford (Lincs.) .. 240C
Stamford Bridge (York.) .. 230A
Stamborough .. 240A
Stanbridge .. 240A
Standish .. 230A
Standon (Herts.) 240A
Standon (Staffs.) 230A
Standrop .. 230A
Stanford-le-Hope .. 230A
Stanground .. 230A
Stanlees .. 230A
Stanley (Yorks.) 230A
Stanmore .. 240A
Stanningley .. 230A
Standstead Abbots .. 240A
Stanstead Mountfitchet 240A
Stanton .. 230A
Stanway .. 230A
Stanwell .. 200A
230A
Stapleford .. 230A
240A
Stapleford Tawney .. 230A
Staplehurst .. 230A
Starcross .. 200A
Staveley(Derby) 230A
Staveley(Yorks.) 240A
Staverton (Glouc.) .. 230A
Staverton (Northants) 230A
Steelworks .. 240C
Steeple Claydon 230A
Steeton .. .. 230A
Stenton .. 230A
Stepney .. 240C
Steppingley .. 240A
Stepps .. .. 240A
Stevenage .. 240A
Stevenston .. 240A
Steventon (Herts.) .. 230A
Stevington .. 230A
Stewartby .. 210A
Stewarton .. 240A
Stewkley .. 230A
Steyning .. 230A
Sticklepath .. 230A
Stillington .. 230A
Stirling .. 230C
Stockham .. 250A
Stockport .. 230A
230C
Stockton Brook 230A
Stockton Heath 250A
Stockton-on-Forest .. 230A
Stockton-on-Tees .. .. 230C
Stoke (Chester) 250A
Stoke Abbot .. 230A
Stoke Albany .. 230A
Stoke Doyle .. 230A
Stoke Fleming 240A
Stoke Goldington .. 230A
Stoke Hammond 240A
Stokeinteign-head .. .. 230A
Stoke Newington 230A
240C
230C
Stoke-on-Trent 240C
240A
Stoke Poges .. 230A
Stoke-under-Ham .. 230A
Stone (Bucks.) 220A
Stone (Glouc.).. 230A
Stone (Staffs.) .. 230A
Stone Cross .. 230A
Stonehouse (Glouc.) .. 230A
Stonehouse (Lanark) .. 240A
Stonyhurst .. 230A
Stony Stratford 210A
Stopsley .. 240A
Storkhill .. 230A
Stornbridge .. 200A
Stornoway .. 230C
Storrington .. 230A
Stotfold .. 240A
Stoughton .. 240A
Stourbridge .. 200A
Stowmarket .. 230A
Stow St. Mary's 230A
Stranraer .. 230A
Stratford .. 200A
Stratford St. Mary .. 230A
Strathaven .. 240A
Strathmiglo .. 250A
Stratton .. 230A
Stratton Hall .. 230A
Stratton St. Margaret 220C
Stratton St. Mary .. 230A
Stratton St. Michael .. 230A
Streat .. .. 230A
Streatley .. 240A
Streetly .. 230A
230C
Strensall .. 230A
Strete .. .. 240A
Stretton (Burton-on Trent, Staffs.) 230A
Stretton (Ches.) 230A
Stretton (Staffs.) 250A
Stretton Chapelry .. 230A

## SUPPLY VOLTAGES

Strone .. .. 230A
Strood (Rural) .. 230A
Stroud .. .. 230A
Strumpshaw .. 230A
Stubbington .. 230A
Stubbins Village 240A
Studham .. 240A
Stuntney .. 240A
Sturminster .. 230A
Styal .. .. 230A
Sudborough .. 230A
Sudbourne .. 230A
Sudbury .. (Suffolk) .. 230A
Sulgrave .. 230A
Sullington .. 230A
Sully .. .. 230A
Summerbridge 230A
Sunbury .. 200A 230A
Sunderland (Boro.) .. 220A
Sundridge .. 220A
Sunningdale .. 2200
Sunninghill .. 2200
Surbiton .. 230A 2400
Surfleet .. 230A
Surlingham .. 230A
Sutterton .. 230A
Sutton (Beds.) 230A
Sutton (Ches.) .. 250A
Sutton (Lincs.) 230A
Sutton (Norfolk) 230A
Sutton (Notts.) 230A
Sutton (Surrey) 200A
Sutton (Yorks.) 230A
Sutton Bridge .. 230A
Sutton Coldfield 230A 2300
Sutton-on-Forest .. 230A
Sutton-on-Hull 230A
Swadlincote .. 230A
Swaffham .. 230A
Swaffham Bulbeck .. 240A
Swaffham Prior .. 240A
Swainsthorpe .. 230A
Swalecliffe .. 230A
Swanbourne .. 230A
Swanland .. 230A
Swanley Junction .. 230A
Swannington .. 230A
Swanscombe .. 230A
Swansea .. 2200 220A
Swanton Morley 230A
Swanwick .. 230A
Swarcliffe Top .. 230A
Swardeston .. 230A
Swarthmoor .. 230A
Sway .. .. 240A
Swindon (Glouc.) 230A
Swindon (Wilts.) 220A 2200
Swindon (Worc.) 200A
Swine .. .. 230A
Swinley .. 240A
Swinton .. 2500 (Manchester) 230A
Swinton (Yorks.) 230A
Symington (Ayr) 240A
Symington (Lanark) .. 240A
Symondsbury .. 230A
Syresham .. 230A

Tacolneston .. 230A
Tadcaster .. 230A
Tamerton .. 230A
Tamworth .. 250A
Tandridge .. 220A
Tanfield .. 250A
Tanfield Lea .. 230A
Tang .. .. 230A
Tangmere .. 230A
Tantobie .. 240A
Tanworth-in-Arden .. 230A
Taplow .. 230A
Tarbock .. 230A
Tarbolton .. 240A
Tarleton .. 230A
Tarporley .. 230A
Tarvin .. .. 230A
Tasburgh .. 230A
Tatsfield .. 230A
Tatenhill .. 230A
Tattenhall .. 230A
Tatworth .. 230A
Taunton .. 210A
Taverham .. 230A
Tayport .. 250A
Tean .. .. 230A
Teesville .. 250A
Teignmouth .. 230A
Telscombe .. 230A
Temple Ewell .. 200A
Tempsford .. 230A
Tendring .. 230A
Tenterden .. 230A
Terrance .. 240A
Terrington .. 230A
Teston .. 230A
Tetbury .. 230A
Tetney .. 230A
Tettenhall .. 230A
Tewin .. .. 240A
Thame .. .. 220A
Thankerton .. 240A
Theale .. .. 200A
Thearne .. 230A
The Lee .. 230A
Thelwall .. 250A
Themelthorpe .. 230A
Thetford .. 1200
Theydon .. 230A
Theydon Bois .. 230A
Thirtleby .. 230A
Thornbury .. 230A
Thornby .. 230A
Thorney .. 240A
Thorngumbald 230A
Thornhill .. 230A
Thornliebank .. 240A
Thornthwaite .. 2300
Thornton (Fife) 250A
Thornton Cleveleys .. 230A
Thorntonhall .. 240A
Thornton-le-Clay .. .. 230A
Thornton-le-Moors .. 250A
Thorpe (Staffs.) 250A
Thorpe (Surrey) 200A 230A
Thorpe Achurch 230A
Thorpe Acre-cum-Dishley 230A
Thorpe-le-Soken 230A
Thorpe Lubenham .. 230A
Thorpe Malsor 240A
Thorpeness .. 230A
Thorpe St. Andrew .. 230A
Thorpe Waterville .. 230A
Thorrington .. 230A
Thorverton .. 230A
Thrapston .. 210A
Three Bridges .. 2400 230A
Three Oaks .. 230A
Threshfield .. 2500
Thrupp .. 230A
Thurgarton .. 230A
Thurlestone (Devon) .. 240A
Thurlestone (Yorks.) .. 230A
Thurmaston .. 240A
Thurning .. 230A
Thurnley .. 240A
Thurnscoe .. 230A
Thurstonland .. 230A
Ticehurst .. 230A
Tickton .. 230A
Tidal Basin .. 200A
Tidenham .. 230A
Tiffield .. .. 230A
Tilbury .. 230A
Tilehurst .. 200A
Tilford .. .. 230A
Tillicoultry .. 250A
Tilston (Ches.) .. 230A
Tilstone Fearnall 230A
Tilsworth .. 240A
Timperley .. 100A
Tingewick .. 230A
Tingrith .. 240A
Tinhead .. 230A
Tinkers Hill .. 240A
Tintinhull .. 230A
Tipton .. .. 200A
Tipton St. John 230A
Tiptree .. 230A
Tirphill .. 230A
Tiryberth .. 230A
Tisbury .. 2100
Titchfield .. 230A
Titchmarsh .. 230A
Titmore Green .. 240A
Titsey .. .. 230A
Titensor .. 230A
Tiverton (Ches.) 230A
Tiverton (Devon) .. 230A
Tixall .. .. 230A
Tobermory .. 2200
Tockholes .. 230A
Toddington .. 240A
Todds Green .. 240A
Todmorden .. 230A
Toftwood .. 230A
Tollerton .. 230A
Tollesbury .. 230A
Tolleshunt Knights .. 230A
Tonbridge 2200 220A
Tonbridge (Rural) .. 220A
Tong .. .. 230A
Topsham .. 220A
Torpoint .. 230A
Torquay .. 200A
Torryburn .. 250A
Tortworth .. 230A
Torworth .. 230A
Totland Bay .. 240A
Toton .. .. 220A
Tottenham .. 240A
Totteridge .. 240A
Totternhoe .. 240A
Tottington .. 230A
Towchester .. 230A
Townhill .. 220A
Tranent .. 230A
Trawden .. 230A
Trebanos .. 230A
Treforest .. 2300 230A
Trefriw .. 230A
Trehafod .. 230A
Treharris .. 250A
Trelewis .. 230A
Trentham .. 230A
Trethomas .. 230A
Trewoon .. 230A
Trimley St. Martin .. 240A
Trimley St. Mary .. 240A
Tring .. .. 220A
Troedrhiwfuwch 230A
Troedyrhiw .. 250A
Troon .. .. 240A
Troutbeck .. 100A 200A
Trowbridge .. 230A
Trowse-with-Newton .. 230A
Truddox Hill .. 230A
Truro .. .. 240A
Tryddyn .. 230A
Trysull .. 200A
Tuddenham .. 230A
Tunbridge Wells 220A
Tunstall .. 2200 240A
Tunstead .. 230A
Turleigh .. 230A
Turnberry .. 240A
Turton .. 230A
Turvey .. 230A
Turweston .. 230A
Tutbury .. 230A
Tuttington .. 230A
Tuxford .. 220A
Twickenham .. 2400 240A
Two Gates .. 250A
Twycross .. 250A
Twyford (Berks.) 230A
Twyford(Hants.) 230A
Twyford (Norfolk) .. 230A
Twyford (Northants) 230A
Twynholm .. 230A
Tyldesley .. 230A
Tyler Hill .. 230A
Tylers Green .. 2100
Tynemouth .. 240A
Tytherington .. 230A
Tywardreath .. 230A
Uckfield .. 230A
Uckington .. 230A
Uddingston .. 240A
Udimore .. 230A
Ufculme .. 230A
Ufford .. .. 230A
Ugborough .. 240A
Ulverston .. 230A
Unsworth .. 230A
Uphall .. .. 2300
Uphill .. .. 2300 230A
Upholland .. 230A
Uplawmoor .. 240A
Upper Boat .. 230A
Upper Boddington 230A
Upper Bourne 230A
Upper Hale .. 230A
Upper Harlestone .. 230A
Uppermill .. 230A
Upper Noble .. 230A
Upper Poppleton .. 230A
Upshire .. 240A
Upton (Ches.) 230A
Upton (Cornwall) .. 230A
Upton (North'pton) 210A
Upton Park .. 200A
Upton St. Leonards 230A
Upton-with-Fishley .. 230A
Urchfont .. 230A
Uttoxeter .. 230A
Uxbridge .. 200A
Ventnor(I.O.W.) 240A
Victoria (Mon.) 2400
Vinehall .. 230A
Wacton .. 230A
Waddesdon .. 220A
Waddington .. 230A
Wadebridge .. 240A
Wadenhoe .. 230A
Wadhurst .. 230A
Wakefield .. 200A 230A
Wakes Colne .. 230A
Walberton .. 230A
Walcott .. 230A
Waldingfield .. 230A
Waldron .. 230A
Walker Fold .. 230A
Walkern .. 240A
Walkhampton 230A
Walkington .. 230A
Wallasey .. 200A 230A
Wallington .. 240A
Walmer .. 230A
Walmer Bridge 230A
Walsall .. 230A
Walsall Wood 250A
Waltham .. 230A
Waltham Abbey 240A
Waltham St. Lawrence 240A
Walthamstow 230A 230C
Walton (Cumb.) 230A
Walton (Derbyshire) 240A
Walton (Essex) 230A
Walton (Staffs.) 230A
Walton-le-Dale 230A
Walton-upon-Trent .. 230A
Wanstrow .. 230A
Wantage .. 230A
Warboys .. 240A
Warburton (Ches.) .. 250A
Warden .. 250A
Wardle .. 230A
Ware .. .. 240A
Wareham .. 230A
Warfield .. 240A
Wargrave .. 230A
Warkton .. 230A
Warminster .. 230A
Warmley .. 230A
Warrington .. 2300 250A
Warrington (Rural) .. 230A
Warsash .. 230A
Warton .. 240A
Warton (Staffs.) 250A
Warwick .. 250A 2300
Washford .. 230A
Washington .. 230A
Watchet .. 230A
Waterbeach .. 240A
Water Eaton .. 230A
Waterford .. 240A
Wateringby .. 230A
Waterloo (Lanark.) .. 240A
Waterloo (Lancs.) .. 240A
Waterloo (Liverpool) .. 230C
Waterlooville .. 230A
Water Orton .. 230A
Watford .. 200A
Wath (Yorks.) 230A
Wath-on-Dearne 230A
Watling Street 250A
Watton .. 240A
Wattsville .. 230A
Wauldby .. 230A
Waunllwyd .. 2400
Wavendon .. 230A
Waverley .. 230A
Waverton(Ches.) 230A
Wawne .. 230A

Wealdstone .. 240A
2300
Weare Gifford .. 230A
Weaverham .. 220A
Wednesbury .. 200A
Wednesfield .. 200A
Weedon
(Northants) 210A
Weekley .. 240A
Weel .. .. 230A
Weeley .. 230A
Weeley Heath 230A
Welburn .. 230A
Weldon .. 230A
Welford .. 230A
Welham
(Notts.) .. 230A
Welham Green 240A
Well End .. 240A
Wellesbourne .. 250A
Welling (Kent) 200A
Wellingborough 230A
2300
Wells (Norfolk) 230A
Welton .. 230A
Welwyn (Rural) 240A
Welwyn Garden
City .. .. 240A
Wembley .. 240A
Wembury .. 230A
Wemyss Bay .. 230A
Wendover .. 220A
Wentworth 200A
(Surrey) .. 230A
Werrington .. 230A
Wervin .. 230A
Wesham .. 230A
West Ashling .. 230A
West Ayton .. 230A
West Barns .. 230A
West Bergholt 230A
Westbourne .. 230A
West Bradford 230A
West Bridgford 230A
West Bromwich 230A
2300
Westbury
(Northants) 230A
Westbury
(Wilts.) .. 230A
Westbury
Leigh .. 230A
Westbury-on-
Severn .. 230A
West Calder .. 230A
West Chobham 240A
West Clandon 230A
West Coker .. 230A
West Dean .. 230A
West Drayton 200A
West Ella .. 230A
Westerfield .. 230A
Westerham .. 220A
Westerleigh .. 230A
Westerton .. 230A
Westfield .. 230A
Westgate .. 240A
West Grinstead 230A
West Haddon 230A
West Ham .. 200A
Westham .. 230A
Westhampnett 230A
West Hartlepool 230A
2300
West Hoathley 230A
West Hill .. 230A
West Hougham 230A
Westhoughton 230A
West Kilbride 240A
West Kirby .. 230A
Westland Green 240A
West Lavington 230A
Westleigh .. 230A
West Linton .. 230A
Westlinton .. 230A
West Lynn .. 230A
West Malling .. 230A
West Malvern 100A
200A
West Markham 230A
West Mersea .. 230A
Westmeston .. 230A
230A
Westminster .. 2000
2000
230A
Weston (Herts.) 240A
Weston (Ches.) 250A
Weston(Dorset) 230A
Weston Coyney 230A
Westoning .. 240A
Weston Longville 230A
Weston Peverell 230A
Weston-super-
Mare .. 2300
Weston Turville 220A
Weston-under-
Lizard .. 230A
Weston
Underwood .. 230A
West Penwith 240A
Westward Ho! 230A
Westwell .. 230A
Westwick .. 230A
West Wickham 240A
Wetheral .. 230A
Wetherby .. 230A
Wetley Rocks 230A
Wetwood .. 230A
Wexham .. 230A
Weybourne .. 230A
Weybridge .. 240A
Weymouth .. 2300
230A
Whaley .. 240A
Whalley .. 230A
Whaplode .. 230A
Wharfedale .. 230A
Whatlington .. 230A
Wheathamp-
stead .. .. 240A
Wheaton Aston 230A
Wheldrake .. 230A
Wherstead .. 230A
Whimple .. 230A
Whipsnade .. 240A
Whiston (Lancs.) 115A
230A
Whiston
(Northants.) 230A
Whitacre .. 230A
Whitburn .. 250A
Whitby .. 2300
230A
Whitchurch ..
(Devon) .. 230A
Whitchurch 230A
(Glam.) .. 230A
Whitechapel . 2400
Whitecraigs . 240A
Whitefield .. 230A
Whitegate .. 220A
Whitehaven .. 2100
230A
White Lund .. 230A
Whiteshill .. 230A
White Waltham 240A
Whitewell .. 230A
Whitfield
(Kent) .. 230A
Whitfield
(Northants) 230A
Whitlebury .. 230A
Whitley Inferior 250A
Whitley Superior 250A
Whitlingham
(Norfolk) .. 230A
Whitmore .. 230A
Whitstable .. 230A
Whittingham
(Lancs.) .. 230A
Whittlesey .. 230A
Whittlesford .. 240A
Whitwell(Herts.) 240A
Whitwell
(I.O.W.) .. 240A
Whitwell
(Norfolk) .. 230A
Whitwood .. 230A
Whitworth .. 230A
Whixley .. 230A
Wick (Sussex) 230A
2400
Wick
(Caithness) .. 230A
Wicken .. .. 230A
Wickford .. 230A
Wickham .. 230A
Wickham
Bishops .. 230A
Wicklewood .. 230A
Wickmere .. 230A
Wickwar .. 230A
Widemouth .. 230A
Widford (Essex) 230A
Widford (Herts.) 240A
Widnes .. 250A
Wigan .. .. 230A
Wigan (Rural) 230A
Wigginton ..
(York.) .. 230A
Wigginton
(Staffs.) .. 250A
Wigmore(Kent) 230A
Wigtaft .. 230A
Wigtown .. 230A
Wilbarston .. 230A
Wilby .. .. 230A
Wilden .. 230A
Wilford .. 230A
Wilkins Green 240A
Willand .. 230A
Willenhall .. 200A
Willensborough 230A
Willerby .. 230A
Willesden .. 2400
240A
Willington
(Beds.) 210A
Willington
(Ches.) .. 230A
Williton .. 230A
Willian .. 240A
Wilmington .. 230A
Wilpshire .. 230A
Wilsden .. 230A
Wilstead .. 230A
Wilton .. .. 230A
Wimbledon .. 220A
Wimblington .. 240A
Wimbourne .. 230A
Wincham .. 220A
Winchburgh .. 250A
Winchelsea .. 230A
Winchelsea
Beach .. 230A
Winchester .. 2100
230A
Windermere .. 100A
200A
Windle .. 2300
230A
Windygates .. 250A
Wing .. .. 240A
Winkfield .. 240A
Winkfield Row 240A
Winnersh .. 230A
Winnington .. 2200
Winsford .. 220A
Winsley .. 230A
Winslow .. 230A
Winstanley .. 230A
Winwick-with-
Hulme .. 250A
Wirrall .. 230A
Wisbech .. 2400
Wiseton .. 230A
Wishanger .. 230A
Wishaw .. 2400
Wiswell .. 230A
Witham .. 230A
Witheridge .. 2300
Withernsea .. 230A
Withnell .. 230A
Withyham .. 230A
Witney .. 2200
230A
Wittersham .. 230A
Wittlestone .. 230A
Witton
(Blackburn) 230A
Witton
(Norfolk) .. 230A
Wivelscombe .. 230A
Wivelsfield .. 230A
Wivenhoe .. 230A
Wix .. .. 230A
Woburn .. 240A
Woburn Sands 230A
Woking .. 200A
Wokingham .. 250A
Wollaston .. 230A
Wollescote .. 200A
Wolstanton .. 240A
Wolterton .. 230A
Wolverton .. 210A
Womburn .. 200A
Wombwell .. 230A
Wonersh .. 230A
Woodbank
(Ches.) .. 230A
Woodbastwick 230A
Woodbridge .. 230A
Woodbury .. 230A
Woodchester .. 230A
Wood Dalling 230A
Wood End .. 250A
Woodford
(Ches.) .. 230A
Woodford
(Northants.) 210A
Woodford Halse 230A
Woodford Side 230A
Wood Green .. 2400
240A
Woodham
Ferrers .. 230A
Woodham
Mortimer .. 230A
Woodham
Walter .. 230A
Woodhouses .. 240A
Woodley
(Berks.) .. 230A
Woodley (Ches.) 230A
Woodmancote
(Glos.) .. 230A
Woodmancote
(Sussex) .. 230A
Woodmansey .. 230A
Wood Norton .. 230A
Woodplumpton 230A
Wood Rising .. 230A
Woodseaves .. 230A
Woodside .. 240A
Woodston .. 230A
Woodthorpe
(Derby) .. 240A
Woodthorpe
(Leics.) .. 230A
Woodville .. 230A
Woolmer Green 240A
Woolston-with-
Martinscroft 250A
Woore .. .. 230A
Wootton (Beds.) 230A
Wootton.(IO.W.) 240A
Wootton
Courtney .. 230A
Wootton St.
Mary Without 230A
Wootton-under-
Edge .. 230A
Wootton Vill .. 230A
Wordsley .. 200A
Workington .. 240A
2200
Worksop .. 220A
230A
Worlington .. 2200
Wormingford .. 230A
Wormit .. 250A
Wormley .. 240A
Worplesdon .. 230A
Worsborough .. 230A
Worsley .. 230A
Worsted .. 230A
Worston .. 230A
Worth .. .. 230A
Worthing
(Norfolk) .. 230A
Worthing
(Sussex) .. 230A
Worting .. 230A
Wortley .. 230A
Worton .. 230A
Wouldham .. 230A
Wrabness .. 230A
Wrafton .. 2200
Wraysbury .. 200A
230A
Wrea Green .. 230A
Wrecclesham .. 230A
Wrenningham .. 230A
Wrexham .. 2300
230A
Wrightlington .. 230A
230A
Writtle .. 230A
Wrotham .. 230A
Wroxall .. 240A
Wroxham .. 230A
Wyberton .. 240A
Wychnor .. 230A
Wycombe .. 2100
230A
Wye .. .. 230A
Wykeham .. 230A
Wyllie .. .. 230A
Wymondham .. 230A
Wyton (Yorks.) 230A
Yalding .. 230A
Yale .. .. 2300
Yapton .. 230A
Yardley Gobion 230A
Yardley
Hastings .. 230A
Yarmouth
(I.O.W.) .. 240A
Yate .. .. 230A
Yaxham .. 230A
Yaxley .. .. 230A
Yeadon .. 230A
Yelmpton .. 230A
Yelvertoft .. 230A
Yelverton .. 230A
Yeovil .. .. 2400
Yeovil Without 230A
Yiewsley .. 200A
Ynismeudw .. 230A
Ynysawdre .. 230A
Ynysybwl .. 230A
York .. .. 2300
230A
Yorker .. 240A
Yorktown .. 250A
Yoxall .. .. 230A
Ystradgynlais .. 2200
Ystrad Mynach 230A

# RADIO VALVE

This chart is arranged in eleven sections, as follows: Screen grids and H.F. pentodes; general purpose triodes; power output triodes; output pentodes; frequency changers; diode combinations; double valves; rectifiers; barretters; metal rectifiers; and Westectors.

In each section the types are grouped by manufacturers, and then by filament ratings, thus: 2 volt, A.C., D.C., Universal.

The following abbreviations are used: * Indicates indirectly heated A.C. valve; ** Indicates directly-heated A.C. valve; † indicates indirectly-heated D.C. valve; ° indicates universal A.C.-D.C. valve; A (in base pins column) indicates American type; C, Continental; M, magnification; S.C., side contacts; T.C., top diode connection; V variable-mu; V.D., voltage doubler.

## SCREEN GRID AND H.F. PENTODE VALVES

| Maker. | Type. | Fil. volts. | Fil. amps. | Anode volts. | Screen volts. | Grid bias. | Anode current. | Screen current. | Bias res. ohms. | Slope mA/v. | Base pins. | Price |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Clarion | SG2 | 2.0 | 0.15 | 150 | 80 | 0—1½ | 2.5 | — | — | 1.0 | 4 | 8/6 |
| | VS2 | 2.0 | 0.15 | 150 | 80 | 0—9 | 4.5 | — | — | 1.2 | 4 | 8/6 |
| | VHP2 | 2.0 | 0.15 | 150 | 60 | 0—10 | 3.6 | 0.8 | — | 1.0 | 7 | 8/6 |
| | *ACSG | 4.0 | 1.0 | 200 | 85 | —2 | 3.0 | — | 500 | 1.4 | 5 | 10/6 |
| | *ACHP | 4.0 | 1.0 | 200 | 100 | —2 | 4.5 | 1.3 | 350 | 2.5 | 7 | 10/6 |
| | *ADHP | 20.0 | 0.18 | 200 | 100 | —2 | 5.0 | 2.0 | 300 | 2.8 | 7 | 10/6 |
| | *ACVS | 4.0 | 1.0 | 200 | 90 | 0—30 | 7.0 | — | V | 2.0 | 5 | 10/6 |
| | *ACVHP | 4.0 | 1.0 | 200 | 100 | —1—18 | 4.8 | 1.5 | V | 2.2 | 7 | 10/ |
| | *ADVHP | 20.0 | 0.18 | 200 | 100 | —1—18 | 5.5 | 2.3 | V | 2.8 | 7 | 10/6 |
| Cossor | 215 SG | 2.0 | 0.15 | 150 | 80 | 0—1½ | 0.7 | — | — | 1.1 | 4 | 12/6 |
| | 220 SG | 2.0 | 0.2 | 150 | 80 | 0—1½ | 0.7 | — | — | 1.5 | 4 | 12/6 |
| | 220VSG | 2.0 | 0.2 | 150 | 80 | 0—15 | 2.6 | — | — | 1.6 | 4 | 12/6 |
| | 220 VS | 2.0 | 0.2 | 150 | 80 | 0—9 | 1.6 | — | — | 1.6 | 4 | 12/6 |
| | 210 SPT | 2.0 | 0.1 | 150 | 80 | 0—1½ | 3.0 | — | — | 1.3 | 7 | 13/6 |
| | 210 VPT | 2.0 | 0.1 | 150 | 80 | 0—9 | 2.9 | — | — | 1.1 | 7 | 13/6 |
| | *MSG-HA | 4.0 | 1.0 | 200 | 80 | —1½ | 2.1 | — | 600 | 2.0 | 5 | 17/6 |
| | *41MSG | 4.0 | 1.0 | 200 | 80 | —1½ | 0.8 | — | 1500 | 2.5 | 5 | 17/6 |
| | *MSG-LA | 4.0 | 1.0 | 200 | 80 | —1½ | 6.2 | — | 250 | 3.7 | 5 | 17/6 |
| | *MVSG | 4.0 | 1.0 | 200 | 80 | —1—35 | 7.8 | — | V | 2.5 | 5 | 17/6 |
| | *MS/Pen | 4.0 | 1.0 | 200 | 100 | —1½ | 4.5 | 1.3 | 250 | 3.5 | 5 & 7 | 17/6 |
| | *MS/PenA | 4.0 | 1.0 | 200 | 150 | —2½ | 9.0 | 5.0 | 200 | 4.0 | 5 | 17/6 |
| | *MVS/Pen | 4.0 | 1.0 | 200 | 100 | —1—20 | 2.2 | — | V | 2.2 | 5 & 7 | 17/6 |
| | †DV8G | 16.0 | 0.25 | 200 | 80 | —1—35 | 7.5 | — | V | 2.8 | 5 | 17/6 |
| | †DS/Pen | 16.0 | 0.25 | 200 | 100 | —1½ | 5.0 | 1.7 | 250 | 3.0 | 7 | 17/6 |
| | †DVS/Pen | 16.0 | 0.25 | 200 | 100 | —1—20 | 6.0 | — | V | 3.0 | 7 | 17/6 |
| | *13VPA | 13.0 | 0.2 | 200 | 100 | —1—30 | 10.0 | — | V | 1.8 | 7 | 17/6 |
| Dario | TE442 | 2.0 | 0.18 | 150 | 90 | 0—1 | 2.5 | 0.5 | — | 1.5 | 4 | 10/6 |
| | *TE424 | 4.0 | 1.0 | 200 | 100 | —3 | 1.5 | 0.6 | 1500 | 0.9 | 5 | 12/6 |
| | *TE524 | 4.0 | 1.0 | 200 | 100 | —3 | 3.0 | 1.0 | 750 | 2.0 | 5 | 12/6 |
| | *TE464 | 4.0 | 1.1 | 200 | 100 | —2 | 3.0 | 1.5 | 800 | 2.5 | 5 | 12/6 |
| | *TD4613 | 13.0 | 0.2 | 200 | 100 | —3 | 3.0 | 1.2 | 700 | 2.2 | — | 12/6 |
| | TB452 | 2.0 | 0.15 | 150 | 70 | 0—9 | 2.0 | 0.4 | — | 1.5 | 4 | 10/6 |
| | *TE554 | 4.0 | 1.0 | 200 | 100 | —2—40 | 3.0 | 1.0 | V | 3.0 | 5 | 12/6 |
| | *TE474 | 4.0 | 1.1 | 200 | 100 | —1—40 | 4.5 | 2.0 | V | 2.0 | 5 | 12/6 |
| | *TE564 | 4.0 | 1.2 | 200 | 100 | —1—20 | 4.5 | 2.0 | V | 3.2 | 5 | 12/6 |
| | *TB5613 | 13.0 | 0.2 | 200 | 100 | —1—20 | 3.0 | 1.2 | V | 2.2 | — | 12/6 |
| Ferranti | VS2 | 2.0 | 0.1 | 150 | 70 | 0—9 | 2.2 | — | — | 1.0 | 4 | 12/6 |
| | *VPT4 | 4.0 | 1.0 | 200 | 100 | —2—25 | 5.5 | 2.0 | V | 2.6 | 4 | 17/6 |
| | *VPT8 | 13.0 | 0.3 | 200 | 100 | —1—30 | 5.5 | 2.0 | V | 2.6 | 7 | 17/6 |
| Fotos | BC150 | 2.0 | 0.11 | 150 | 60 | 0—1 | — | — | — | 1.0 | 4 | 12/6 |
| | SG/V12 | 2.0 | 0.11 | 150 | 60 | 0—9 | — | — | — | 1.0 | 4 | 12/6 |
| Hivac | SG215 | 2.0 | 0.15 | 150 | 60 | —1½ | 4.0 | 0.4 | — | 1.0 | 4 | 10/6 |
| | SG220 | 2.0 | 0.2 | 150 | 60 | —1½ | 5.0 | 0.4 | — | 1.5 | 4 | 10/6 |
| | VS215 | 2.0 | 0.15 | 150 | 60 | 0—14 | 5.0 | 0.4 | — | 1.0 | 4 | 10/6 |
| | HP215 | 2.0 | 0.15 | 150 | 60 | —1½ | 3.0 | 0.8 | — | 1.2 | 4 | 10/6 |
| | VP215 | 2.0 | 0.15 | 150 | 60 | 0—9 | 4.0 | 1.1 | — | 1.3 | 4 | 10/6 |
| | ACSL | 4.0 | 1.0 | 200 | 80 | —1½ | 7.0 | 0.8 | V | 3.2 | 5 | 13/6 |
| | ACSH | 4.0 | 1.0 | 200 | 80 | —1½ | 12.0 | 0.8 | V | 3.5 | 5 | 13/6 |
| | ACVS | 4.0 | 1.0 | 200 | 80 | 0—40 | 9.0 | 0.8 | V | 3.0 | 5 | 13/6 |
| | ACVH | 4.0 | 1.0 | 200 | 80 | 0—40 | 14.0 | 0.9 | V | 3.3 | 5 | 13/6 |
| | ACHP | 4.0 | 1.0 | 200 | 100 | —1½ | 8.0 | 3.0 | V | 3.2 | 7 | 13/6 |
| | ACVP | 4.0 | 1.0 | 200 | 100 | 0—30 | 10.0 | 3.0 | V | 3.0 | 7 | 13/6 |
| Lissen | SG215 | 2.0 | 0.15 | 150 | 60 | 0—1 | 1.6 | 0.3 | — | 1.1 | 4 | 12/6 |
| | SP2 | 2.0 | 0.1 | 150 | 80 | 0—1 | 2.5 | 0.6 | — | 1.0 | 7 | 13/6 |
| | SG2 | 2.0 | 0.15 | 150 | 80 | 0—10 | 4.0 | 0.3 | — | 1.2 | 4 | 12/6 |
| | SP2V | 2.0 | 0.1 | 150 | 80 | 0—10 | 3.0 | 0.8 | — | 1.1 | 7 | 13/6 |
| | *AC/SG | 4.0 | 1.0 | 200 | 80 | —1½ | 7.0 | 0.5 | 200 | 4.0 | 5 | 17/6 |
| | *AC/SP | 4.0 | 1.0 | 250 | 100 | —1 | 3.0 | 1.0 | 300 | 3.0 | 7 | 17/6 |
| | *AC/SGV | 4.0 | 1.0 | 200 | 80 | —1—20 | 6.0 | 0.5 | V | 4.0 | 5 | 17/6 |
| | *AC/SPV | 4.0 | 1.0 | 250 | 100 | —1—20 | 4.0 | 1.3 | V | 3.0 | 7 | 17/6 |
| | †SGV16 | 16.0 | 0.25 | 250 | 80 | —1—20 | 6.0 | 0.5 | V | 4.0 | 5 | 17/6 |
| Marconi | S23 | 2.0 | 0.1 | 150 | 70 | 0—1½ | 2.8 | 0.8 | — | 1.1 | 4 | 12/6 |
| | S24 | 2.0 | 0.15 | 150 | 70 | 0—1½ | 3.2 | 1.0 | — | 1.4 | 4 | 12/6 |
| | VS24 | 2.0 | 0.15 | 150 | 75 | 0—9 | 4.6 | 0.5 | — | 1.5 | 4 | 12/6 |
| | VS24/k | 2.0 | 0.15 | 150 | 75 | 0—9 | 4.6 | 0.5 | — | 1.5 | 4 | 12/6 |
| | VP21 | 2.0 | 0.1 | 150 | 60 | 0—9 | 2.8 | 0.7 | — | 1.1 | 7 | 13/6 |
| | *MS4 | 4.0 | 1.0 | 200 | 70 | —1½ | 2.4 | 0.3 | 550 | 1.1 | 5 | 17/6 |
| | *MS4B | 4.0 | 1.0 | 200 | 80 | — 1 | 3.4 | 1.2 | 250 | 3.2 | 5 | 17/6 |
| | *MS4B/k | 4.0 | 1.0 | 200 | 80 | —1 | 3.4 | 1.2 | 250 | 3.2 | 5 | 17/6 |
| | *VMS4 | 4.0 | 1.0 | 200 | 80 | —1—30 | 10.0 | 2.1 | V | 2.6 | 5 | 17/6 |
| | *VMS4/k | 4.0 | 1.0 | 200 | 80 | —1—30 | 10.0 | 2.1 | V | 2.6 | 5 | 17/6 |
| | *VMS4B | 4.0 | 1.0 | 200 | 80 | —1—15 | 6.7 | 1.3 | V | 2.9 | 5 | 17/6 |
| | *MSP4 | 4.0 | 1.0 | 200 | 100 | —1½ | 3.0 | 1.0 | 400 | 4.0 | 5 & 7 | 17/6 |
| | *VMP4 | 4.0 | 1.0 | 200 | 100 | —1—30 | 5.5 | 1.6 | V | 3.5 | 5 & 7 | 17/6 |
| | *VMP4/k | 4.0 | 1.0 | 250 | 100 | —1—30 | 8.0 | 4.0 | V | 2.9 | 7 | 17/6 |
| | †DS | 16.0 | 0.25 | 200 | 70 | —1½ | 2.4 | 0.3 | 600 | 1.1 | 5 | 17/6 |

# DATA CHART

| Maker. | Type. | Fil volts. | Fil amps. | Anode volts | Screen volts. | Grid bias. | Anode current. | Screen current. | Bias res. ohms. | Slope mA/v. | Base pins. | Price. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | †DS8 .. | 10.0 | 0.25 | 200 | 80 | — 1 | 3.4 | 1.2 | 220 | 3.2 | 5 | 17/6 |
| | †VDS .. | 16.0 | 0.25 | 200 | 80 | —1—30 | 11.0 | 1.2 | V | 2.4 | 5 | 17/6 |
| | †VDS8 .. | 16.0 | 0.25 | 200 | 80 | —1—25 | 5.5 | 0.0 | V | 3.0 | 5 | 17/6 |
| | *W30 .. | 13.0 | 0.3 | 250 | 250 | —1—20 | 12.3 | 6.0 | V | 4.0 | 7 | 17/7 |
| Mazda .. .. | SG215 .. | 2.0 | 0.15 | 150 | 80 | —1½ | 1.5 | 0.25 | — | 1.1 | 4 | 12/6 |
| | S215a .. | 2.0 | 0.15 | 150 | 80 | —1½ | 1.9 | 0.3 | — | 1.1 | 4 | 12/6 |
| | S215b .. | 2.0 | 0.15 | 150 | 80 | —1½ | 1.5 | 0.8 | — | 1.7 | 4 | 12/6 |
| | S215vm .. | 2.0 | 0.15 | 150 | 80 | 0—9 | 1.0 | 0.15 | — | 1.4 | 4 | 12/0 |
| | SP215 .. | 2.0 | 0.15 | 150 | 80 | —1½ | .8 | .3 | — | 1.9 | 7 | 13/0 |
| | VP215 .. | 2.0 | 0.15 | 150 | 80 | 0—9 | 1.1 | .4 | — | 1.4 | 7 | 13/6 |
| | *AC.SG .. | 4.0 | 1.0 | 200 | 100 | —2 | 4.5 | 0.8 | 400 | 3.0 | 5 | 17/6 |
| | *AC.S2 .. | 4.0 | 1.0 | 200 | 100 | —1½ | 7.0 | 1.2 | 170 | 5.0 | 5 | 17/6 |
| | *AC.S1.vm .. | 4.0 | 1.0 | 200 | 100 | —1—40 | 4.5 | 1.0 | V | 1.1 | 5 | 17/6 |
| | *AC.SG.vm .. | 4.0 | 1.0 | 200 | 100 | —1—30 | 5.0 | 1.0 | V | 2.0 | 5 | 17/6 |
| | *AC.S2 pen .. | 4.0 | 1.0 | 250 | 100 | —4½ | 6.5 | 2.2 | 500 | 5.5 | 7 | 17/6 |
| | *AC.VP1 .. | 4.0 | 1.0 | 250 | 250 | —30 | 7 | .4 | V | 2.6 | 7 | 17/6 |
| | †DC2.SG .. | 20.0 | 0.1 | 200 | 100 | —1½ | 7.8 | 1.5 | 170 | 1.5 | 5 | 17/6 |
| | †DC2.SGvm .. | 20.0 | 0.1 | 200 | 100 | —1—30 | 5.0 | 1.0 | V | 1.5 | 5 | 17/6 |
| | *SP1320 .. | 13.0 | 0.2 | 250 | 250 | —1.5 | 4.25 | 1.0 | — | 2.5 | 7 | 17/6 |
| | *VP1320 .. | 13.0 | 0.2 | 250 | 250 | —30 | 5 | 1.25 | V | 2.7 | 7 | 17/6 |
| | *VP1321 .. | 13.0 | 0.2 | 250 | 250 | —2.8 | 3.3 | 85 | V | 3.0 | 7 | 17/6 |
| Micromesh . | *8A1 .. .. | 4.0 | 1.0 | 200 | 80 | —1½ | 2.5 | — | 500 | 4.0 | 7 | 17/6 |
| | *8A1 .. .. | 4.0 | 1.0 | 200 | 80 | —1½—35 | 1.0 | 2.0 | V | 4.3 | 7 | 17/6 |
| (Britmor) | *9D2 .. .. | 13.0 | 0.2 | 250 | 125 | —3—40 | 10.0 | 3.5 | V | 1.7 | 7 | 17/6 |
| Mullard .. .. | PM12a .. | 2.0 | 0.18 | 150 | 90 | 0 | 2.9 | — | — | 15 | 4 | 12/6 |
| | PM12m .. | 2.0 | 0.18 | 150 | 90 | 0—7 | 2.5 | — | — | 14 | 4 | 12/6 |
| | 8P2 .. .. | 2.0 | 0.18 | 150 | 150 | 0 | 3.8 | 1 | — | 2.2 | 7 | 13/6 |
| | VP2 .. | 2.0 | 0.18 | 150 | 150 | 0—7 | 3.8 | 0.5 | — | 1.75 | 7 | 13/0 |
| | *8P4 .. .. | 4.0 | 1.0 | 200 | 100 | —1½ | .5 | 1.2 | 300 | 3.0 | 5 & 7 | 17/6 |
| | *VP4 .. .. | 4.0 | 1.0 | 200 | 100 | 0—22 | 6.0 | 1.9 | V | 2.5 | 5 & 7 | 17/0 |
| | *VP4a .. .. | 4.0 | 1.0 | 200 | 100 | 0—10 | 5.0 | 1.5 | V | 3.3 | 5 & 7 | 17/6 |
| | *S4v .. .. | 4.0 | 1.0 | 200 | 75 | —1 | 1.5 | 0.6 | 600 | 1.1 | 5 | 17/6 |
| | *S4va .. .. | 4.0 | 1.0 | 200 | 110 | —1½ | 2.8 | 0.6 | 450 | 2.0 | 5 | 17/6 |
| | *S4vb .. .. | 4.0 | 1.0 | 200 | 110 | —1½ | 5.0 | 0.7 | 250 | 2.5 | 5 | 17/6 |
| | *MM4v .. .. | 4.0 | 1.0 | 200 | 110 | —1—40 | 6.0 | 0.8 | V | 2.5 | 5 | 17/6 |
| | *VM4v .. .. | 4.0 | 1.0 | 200 | 100 | 0—40 | 8.5 | 1 | V | 1.2 | 5 | 17/6 |
| | †SG20 .. | 20.0 | 0.18 | 200 | 100 | —1½ | 3.5 | 0.2 | 300 | 2.0 | 5 | 17/6 |
| | †SP20 .. | 20.0 | 0.18 | 200 | 100 | —1½ | 4.5 | 1.2 | 250 | 2.7 | 5 | 17/6 |
| | †VP20 .. | 20.0 | 0.18 | 200 | 100 | —1—22 | 4.5 | 1.8 | V | 2.5 | 5 | 17/0 |
| | *SP13 .. .. | 13.0 | 0.2 | 200 | 100 | —2 | 3.5 | 1 | 400 | 2.2 | Se.c. | 17/0 |
| | *VP13a .. | 13.0 | 0.2 | 200 | 100 | —2—20 | 4.0 | 1.5 | V | 2.2 | Se.c. | 17/6 |
| Osram .. .. | S23 .. .. | 2.0 | 0.1 | 150 | 70 | 0—1½ | 2.8 | 0.8 | — | 1.1 | 4 | 12/0 |
| | S24 .. .. | 2.0 | 0.15 | 150 | 75 | 0—1½ | 3.2 | 1.0 | — | 1.4 | 4 | 12/6 |
| | VS24 .. .. | 2.0 | 0.15 | 150 | 75 | 0—9 | 4.5 | 0.5 | — | 1.5 | 4 | 12/6 |
| | VS24/k .. | 2.0 | 0.15 | 150 | 75 | 0—9 | 4.5 | 0.5 | — | 1.5 | 4 | 12/0 |
| | VP21 .. .. | 2.0 | 0.1 | 150 | 60 | 0—3 | 2.8 | 0.7 | — | 1.1 | 7 | 13/6 |
| | *MS4 .. .. | 4.0 | 1.0 | 200 | 70 | —1½ | 2.4 | 0.3 | 550 | 1.1 | 5 | 17/6 |
| | *MS4B .. .. | 4.0 | 1.0 | 200 | 80 | —1 | 3.4 | 1.2 | 250 | 3.2 | 5 | 17/6 |
| | *MS41/k .. | 4.0 | 1.0 | 200 | 80 | —1 | 3.4 | 1.2 | 250 | 3.2 | 5 | 17/6 |
| | *VMS4 .. .. | 4.0 | 1.0 | 200 | 80 | —1—30 | 10.0 | 2.1 | V | 2.6 | 5 | 17/6 |
| | *VMS4/k .. | 4.0 | 1.0 | 200 | 80 | —1—30 | 10.0 | 2.1 | V | 2.6 | 5 | 17/6 |
| | *VMS4B .. | 4.0 | 1.0 | 200 | 80 | —1—15 | 6.7 | 1.3 | V | 2.9 | 5 | 17/6 |
| | *MSP4 .. .. | 4.0 | 1.0 | 200 | 100 | —1½ | 3.0 | 1.0 | 400 | 4.0 | 5 & 7 | 17/6 |
| | *VMP4 .. .. | 4.0 | 1.0 | 200 | 100 | —1—30 | 5.5 | 1.0 | V | 3.5 | 5& 7 | 17/6 |
| | *VMP4/k .. | 4.0 | 1.0 | 250 | 100 | —1—30 | 8.0 | 4.0 | V | 2.9 | 7 | 17/6 |
| | †DS .. .. | 16.0 | 0.25 | 200 | 70 | —1½ | 2.4 | 0.3 | 600 | 1.1 | 5 | 17/6 |
| | †DS8 .. .. | 16.0 | 0.25 | 200 | 80 | —1 | 3.4 | 1.2 | 220 | 3.2 | 5 | 17/0 |
| | †VDS .. .. | 16.0 | 0.25 | 200 | 80 | —1—30 | 11.0 | 1.2 | V | 2.4 | 5 | 17/6 |
| | †VDS8 .. | 16.0 | 0.25 | 200 | 80 | —1—25 | 5.5 | 0.6 | V | 3.0 | 5 | 17/6 |
| | *W30 .. .. | 13.0 | 0.3 | 250 | 250 | —1—20 | 12.3 | 6.0 | V | 4.0 | 7 | 17/6 |
| Osfar-Ham? . | *SE25 .. .. | 250 | 0.02 | 250 | 100 | —2 | 7.0 | — | 200 | 3.8 | 7 | 18/9 |
| | *S100 .. .. | 250 | 0.02 | 250 | 100 | —1 | 1.6 | — | 600 | 4.0 | 7 | 18/9 |
| | *MS18 .. .. | 250 | 0.02 | 250 | 100 | —1—40 | 5.0 | — | V | 3.0 | 7 | 18/9 |
| | *MS70 .. .. | 250 | 0.02 | 250 | 100 | —1—40 | 4.0 | — | V | 3.0 | 7 | 18/9 |
| | *HS .. .. | 250 | 0.02 | 250 | 200 | —1½ | 3.5 | — | 700 | 3.5 | 7 | 18/0 |
| | *VS .. .. | 250 | 0.02 | 250 | 200 | —1—40 | 4.6 | — | V | 3.0 | 7 | 19/6 |
| Philco .. .. | *36E .. .. | 6.3 | 0.3 | 275 | 90 | —1½ | 1.8 | 0.6 | 600 | 0.8 | A5b | 13/- |
| | *39E .. .. | 6.3 | 0.3 | 275 | 90 | —3 | 4.4 | 1.3 | 3,500 | 1.0 | A5c | 12/- |
| | *44E .. .. | 6.3 | 0.3 | 275 | 90 | —3(v) | 6.5 | — | V | 1.1 | A5c | 17/- |
| | *77E .. .. | 6.3 | 0.3 | 250 | 100 | —3 | 2.3 | 0.6 | 1,000 | 1.3 | A6a | 13/- |
| | *78E .. .. | 6.3 | 0.3 | 250 | 100 | —3(v) | 4.6 | — | V | 1.6 | A6a | 13/- |
| | *24E .. .. | 2.5 | 1.75 | 275 | 90 | —3 | 4.0 | 1.3 | 580 | 1.0 | A5b | 12/- |
| | *35E .. .. | 2.5 | 1.75 | 275 | 90 | —3(v) | 6.5 | 2.1 | V | 1.1 | A5b | 11/- |
| | 32E .. .. | 2.0 | 0.06 | 180 | 68 | —3 | 1.7 | 6.0 | 1,300 | 0.6 | A4b | 12/6 |
| | 15E .. .. | 2.0 | 0.22 | 135 | 68 | —1½ | 1.85 | 0.0 | 600 | 0.7 | A5b | 15/6 |
| | †14E .. .. | 14.0 | 0.3 | 250 | 90 | —3 | 4.0 | — | 608 | 1.1 | A5b | 16/3 |
| Pix .. .. .. | 25 .. .. | 2.0 | 0.15 | 150 | 70 | —1½ | 2.5 | 0.5 | — | 1.1 | 4 | 11/6 |
| | *460AC .. | 4.0 | 1.0 | 200 | 100 | —3 | 3.5 | 0.8 | 700 | 3.0 | 5 | 15/6 |
| Six-Sixty .. | 215SG .. | 2.0 | 0.15 | 150 | 75 | —1½ | 2.5 | — | — | 1.0 | 4 | 12/6 |
| | 218SG .. | 2.0 | 0.18 | 150 | 90 | 0 | 2.8 | — | — | 1.4 | 4 | 12/6 |
| | 215VSG .. | 2.0 | 0.15 | 150 | 90 | 0—15 | 3.0 | — | — | 0.8 | 4 | 12/6 |
| | 218HF .. | 2.0 | 0.18 | 150 | 150 | 0 | 3 | 1 | — | 1.5 | 7 | 13/6 |
| | 218VP .. | 2.0 | 0.18 | 150 | 150 | 0—7 | 2 | .5 | — | 1.8 | 7 | 13/6 |
| | 218VSG .. | 2.0 | 0.18 | 150 | 90 | 0—7 | 2.0 | .5 | — | 1.4 | 4 | 12/6 |
| | *4SG AC .. | 4.0 | 1.0 | 200 | 100 | —1½ | 1.0 | .3 | 600 | 1.0 | 5 | 17/0 |
| | *4X8G.AC .. | 4.0 | 1.0 | 200 | 100 | —1½ | 2.5 | 6 | 450 | 3.0 | 5 | 17/6 |
| | *4VSG.AC .. | 4.0 | 1.0 | 200 | 100 | —3 | 4.5 | .7 | 250 | 3.5 | 5 | 17/6 |
| | *4MM.AC .. | 4.0 | 1.0 | 200 | 100 | 0 20 | 5.0 | .7 | V. | 3.0 | 5 | 17/6 |
| | *4V.MAC .. | 4.0 | 1.0 | 200 | 100 | 0—30 | 5.0 | 1 | V | 1.1 | 5 | 17/6 |
| | *HP.1.AC .. | 4.0 | 1.0 | 200 | 100 | —1½ | 4.5 | 1 | 500 | 3.5 | 5&7 | 17/6 |
| | *HP.2 AC .. | 4.0 | 1.0 | 200 | 100 | 0—20 | 6.0 | 1.5 | V | 3.2 | 5&7 | 17/6 |

# VALVE DATA CHART

| Maker. | Type | Fil. volts. | Fil. amps. | Anode volts. | Screen volts. | Grid bias. | Anode current. | Screen current. | Bias res. | Slope mA/v. | Base Pins | Price |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Triotron | S207 | 2.0 | 0.15 | 200 | 100 | 0—1 | 3.5 | 0.5 | — | 1.0 | 4 | 9/6 |
| | S215 | 2.0 | 0.18 | 150 | 90 | 0—1 | 2.8 | 0.5 | — | 1.5 | 4 | 10/- |
| | S208 | 2.0 | 0.15 | 200 | 100 | 0—20 | 5.0 | 0.5 | — | 0.8 | 4 | 10/- |
| | *S41ON | 4.0 | 1.0 | 200 | 60 | —2 | 4.0 | 1.0 | 400 | 1.0 | 5 | 12/6 |
| | *S43ON | 4.0 | 1.0 | 200 | 100 | —2 | 3.0 | 1.0 | 500 | 3.0 | 5 | 12/6 |
| | *S43SN | 4.0 | 1.1 | 200 | 100 | —2 | 3.0 | 0.5 | 600 | 3.5 | 5 | 12/6 |
| | *S41SN | 4.0 | 1.0 | 200 | 100 | —2—40 | 6.0 | 1.0 | V | 1.2 | 5 | 12/6 |
| | *S43 4N | 4.0 | 1.1 | 200 | 100 | —2—35 | 5.5 | 1.0 | V | 3.5 | 5 | 12/6 |
| | *S201ON | 20.0 | 0.18 | 200 | 60 | —2 | 4.0 | 1.0 | 400 | 1.0 | 5 | 12/6 |
| | *S203SN | 20.0 | 0.18 | 200 | 100 | —2 | 3.0 | 0.5 | 600 | 3.5 | 5 | 12/6 |
| | *S2034N | 20.0 | 0.18 | 200 | 100 | —2—35 | 5.5 | 1.0 | V | 3.5 | 5 | 12/6 |
| Tungsram | HP210 | 2.0 | 0.12 | 150 | 150 | 0—1 | 1.9 | 0.7 | — | 1.9 | 4 | 11/- |
| | S210 | 2.0 | 0.12 | 150 | 100 | 0—1 | 1.5 | 0.4 | — | 1.2 | 4 | 10/- |
| | HP211 | 2.0 | 0.12 | 150 | 150 | 0—7 | 2.5 | 0.6 | — | 1.7 | 4 | 11/- |
| | SE220 | 2.0 | 0.18 | 200 | 100 | 0—15 | 3.0 | 0.5 | — | 1.2 | 4 | 10/- |
| | *AS4120 | 4.0 | 1.0 | 200 | 100 | —½ | 3.0 | 0.8 | 150 | 3.0 | 5 | 14/- |
| | *HP4100 | 4.0 | 1.0 | 200 | 100 | —1 | 3.0 | 1.2 | 200 | 3.5 | 5 | 14/- |
| | *HP4105 | 4.0 | 1.0 | 200 | 100 | —2—35 | 5.0 | 1.1 | V | 3.5 | 5 | 14/- |
| | *AS4125 | 4.0 | 1.2 | 200 | 100 | —1—24 | 3.0 | 0.8 | V | 3.0 | 5 | 14/- |
| | *HP2018 | 20.0 | 0.18 | 200 | 100 | —1 | 4.0 | 1.2 | 200 | 3.5 | 5 | 14/- |
| | *S2018 | 20.0 | 0.18 | 200 | 100 | —1 | 3.0 | 1.0 | 200 | 3.0 | 5 | 14/- |
| | *S2018 | 20.0 | 0.18 | 200 | 60 | —1½ | 4.0 | 1.2 | 300 | 1.2 | 5 | 14/- |
| | *HP1018 | 10.0 | 0.18 | 250 | 150 | —½ | 2.3 | 0.6 | 300 | 1.3 | 7 | 14/- |
| | *HP1118 | 10.0 | 0.18 | 250 | 150 | —3—52 | 10.5 | 3.0 | V | 1.7 | 7 | 14/- |
| | *HP2118 | 20.0 | 0.18 | 200 | 100 | —2—35 | 5.0 | 1.1 | V | 3.5 | 5 | 14/- |
| | *S2118 | 20.0 | 0.18 | 200 | 100 | —1½—24 | 3.0 | 0.8 | V | 3.0 | 5 | 14/- |
| | *S2018 | 20.0 | 0.18 | 200 | 60 | —2—40 | 4.0 | 1.1 | V | 1.2 | 5 | 14/- |
| | 57 | 2.5 | 1.0 | 250 | 100 | —1 | 2.3 | 0.6 | 300 | 1.3 | A6 | 12/- |
| | 77 | 6.3 | 0.3 | 250 | 100 | —1 | 2.3 | 0.6 | 300 | 1.3 | A6 | 12/- |
| | 24A | 2.5 | 1.75 | 275 | 90 | —1½ | 4.0 | 1.7 | 300 | 1.0 | A5 | 11/- |
| | 58 | 2.5 | 1.0 | 250 | 150 | —2—52 | 10.5 | 3.0 | V | 1.7 | A6 | 12/- |
| | 78 | 6.3 | 0.3 | 250 | 150 | —2—52 | 10.5 | 3.0 | V | 1.7 | A6 | 12/- |
| | 35 | 2.5 | 1.75 | 275 | 90 | —2—45 | 6.5 | 2.5 | V | 1.1 | A5 | 10/- |
| 362 | SG2 | 2.0 | 0.2 | 150 | 75 | —1½ | 4.0 | 1.0 | — | 1.5 | 4 | 7/6 |
| | VS2 | 2.0 | 0.2 | 150 | 60 | 0—25 | 3.0 | 1.0 | — | 1.2 | 4 | 7/6 |
| | VP2 | 2.0 | 0.2 | 150 | 60 | 0—12 | — | — | — | 1.2 | 4 | — |
| | *AC8G4 | 4.0 | 1.0 | 250 | 60 | —1 | 4.0 | 2.0 | 150 | 2.5 | 7 | 12/6 |
| | *ACHM4 | 4.0 | 1.0 | 250 | 100 | —8 | 5.0 | — | — | 2.5 | 5&7 | 13/- |
| | *ACVS4 | 4.0 | 1.0 | 250 | 50 | 0—40 | 6.0 | 2.0 | V | 2.0 | 7 | 12/6 |
| | *MSG20 | 20.0 | 0.18 | 250 | 60 | —1 | 4.0 | — | — | 2.5 | 7 | 12/6 |
| | *MHM20 | 4.0 | 0.18 | 250 | 100 | —8 | 6.0 | — | — | 2.5 | 7 | 3/- |
| | *MVS20 | 20.0 | 0.18 | 250 | 50 | 0—40 | 8.0 | — | V | 2.0 | 5 | 12/6 |

## GENERAL PURPOSE TRIODES

| Maker. | Type. | Fil. volts. | Fil. amp. | Anode volts. | Amp. factor. | Impedance. | Slope mA/v. | Grid bias | Anode current. | Bias resistance. | Price. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Clarion | HF2 | 2.0 | 0.1 | 150 | 20 | 20,000 | 1.0 | —1½ | 2.5 | — | 2/6 |
| | HI2 | 2.0 | 0.1 | 150 | 20 | 20,000 | 1.0 | —1½ | 2.5 | — | 2/6 |
| | LF2 | 2.0 | 0.1 | 150 | 10 | 10,000 | 1.0 | —4½ | 4.0 | — | 2/6 |
| | HL2 | 2.0 | 0.1 | 150 | 10 | 10,000 | 1.0 | —4½ | 4.0 | — | 2/6 |
| | *ACHF | 4.0 | 1.0 | 200 | 35 | 14,000 | 2.5 | — 3 | 3.0 | 1,000 | 4/6 |
| | *ACG | 4.0 | 1.0 | 200 | 16 | 6,000 | 2.7 | —7½ | 8.0 | 1,000 | 4/6 |
| | *ADHF | 20.0 | 0.18 | 200 | 35 | 10,000 | 3.5 | — 3 | 5.0 | 600 | 4/6 |
| | *ADG | 20.0 | 0.18 | 200 | 20 | 5,700 | 3.5 | —7½ | 10.0 | 750 | 4/6 |
| 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 |
| | 210 Det. | 2.0 | 0.1 | 150 | 15 | 13,000 | 1.2 | —4½ | 3.0 | — | 5/6 |
| | 210LF | 2.0 | 0.1 | 150 | 14 | 10,000 | 1.4 | —4½ | 4.8 | — | 5/6 |
| | *41MH | 4.0 | 1.0 | 200 | 72 | 18,000 | 4.0 | —1½ | 3.2 | 500 | 13/6 |
| | *41MRC | 4.0 | 1.0 | 200 | 50 | 19,500 | 2.6 | — 2 | 2.7 | 750 | 14/- |
| | *41MHF | 4.0 | 1.0 | 200 | 41 | 14,500 | 2.8 | — 3 | 3.0 | 1,000 | 18/6 |
| | *41MLF | 4.0 | 1.0 | 200 | 15 | 7,900 | 1.9 | —5½ | 9.0 | 620 | 14/- |
| | *41MHL | 4.0 | 1.0 | 200 | 52 | 11,500 | 4.5 | — 3 | 4.0 | 750 | 13/6 |
| | †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 | 1.2 | —1½ | 2.5 | — | 3/9 |
| | TB172 | 2.0 | 0.1 | 150 | 17 | 13,000 | 1.4 | —4½ | 4.0 | — | 3/9 |
| | TB102 | 2.0 | 0.1 | 150 | 10 | 8,000 | 1.3 | — 6 | 6.0 | — | 3/9 |
| | *TE894 | 4.0 | 1.0 | 200 | 99 | 25,000 | 4.0 | —1½ | 4.0 | 380 | 8/6 |
| | *TE384 | 4.0 | 1.0 | 200 | 38 | 25,000 | 1.5 | — 2 | 3.0 | 660 | 8/6 |
| | *TE244 | 4.0 | 1.0 | 200 | 24 | 10,000 | 2.4 | — 4 | 6.0 | 660 | 18/6 |
| Ferranti | *D4 | 4.0 | 1.0 | 200 | 40 | 12,500 | 3.3 | — 3 | 4.0 | 750 | 18/6 |
| Fotos | BC18 | 2.0 | 0.11 | 150 | 21 | 21,000 | 1.0 | — 3 | — | — | 5/- |
| | BC18D | 2.0 | 0.11 | 150 | 21 | 21,000 | 1.0 | — 3 | — | — | 5/- |
| | BC9 | 2.0 | 0.11 | 150 | 11 | 9,000 | 1.2 | — 6 | — | — | 5/- |
| | BC9D | 2.0 | 0.11 | 150 | 11 | 9,000 | 1.2 | — 6 | — | — | 5/- |
| Hivac | H210 | 2.0 | 0.1 | 150 | 25 | 22,000 | 1.2 | — 3 | 1.0 | — | 3/9 |
| | D210 | 2.0 | 0.1 | 150 | 16 | 12,000 | 1.4 | —4½ | 3.5 | — | 3/9 |
| | L210 | 2.0 | 0.1 | 150 | 12 | 7,500 | 1.6 | — 6 | 4.0 | — | 3/9 |
| | *AC/HL | 4.0 | 1.0 | 200 | 35 | 10,000 | 3.5 | — 3 | 7.0 | 600 | 9/6 |
| Lissen | H2 | 2.0 | 0.1 | 150 | 50 | 45,000 | 1.1 | —1½ | 1.0 | — | 5/- |
| | 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 |
| | *AC HL | 4.0 | 1.0 | 200 | 40 | 10,000 | 3.0 | —4½ | 3.0 | 1,500 | 13/6 |
| | †HL16 | 16.0 | 0.25 | 200 | 40 | 10,000 | 3.0 | —4½ | 3.0 | 1,500 | 13/6 |

| Maker. | Type. | Fil. volts. | Fil. amp. | Anode volts. | Amp. factor. | Impedance. | Slope mA/v. | Grid bias. | Anode current. | Bias resistance. | Price. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Marconi | H2 | 2.0 | 0.1 | 150 | 35 | 35,000 | 1.0 | —1½ | 1.5 | — | 5/6 |
| | 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 |
| | HL210 | 2.0 | 0.1 | 150 | 24 | 20,000 | 1.2 | — 3 | 1.5 | — | 5/6 |
| | L21 | 2.0 | 0.1 | 150 | 16 | 8,900 | 1.8 | — 6 | 2.2 | — | 5/6 |
| | *MH4 | 4.0 | 1.0 | 200 | 40 | 11,000 | 3.6 | — 3 | 4.5 | 600 | 13/6 |
| | *MH4/k | 4.0 | 1.0 | 200 | 40 | 11,000 | 3.6 | — 3 | 4.5 | 600 | 13/6 |
| | *MH41 | 4.0 | 1.0 | 200 | 80 | 13,300 | 6.0 | — 2 | 6.0 | 400 | 13/6 |
| | *MHL4 | 4.0 | 1.0 | 200 | 20 | 8,000 | 2.5 | — 6 | 8.0 | 850 | 13/6 |
| | †DH | 16.0 | 0.25 | 200 | 40 | 10,800 | 3.7 | — 3 | 6.0 | 500 | 13/6 |
| | *H30 | 13.0 | 0.3 | 200 | 80 | 13,300 | 6.0 | — 2 | 5.5 | 350 | 13/6 |
| Mazda | H2 | 2.0 | 0.1 | 150 | 50 | 45,000 | 1.1 | —1½ | 0.8 | — | 5/6 |
| | HL2 | 2.0 | 0.1 | 150 | 32 | 21,000 | 1.5 | —1½ | 2.7 | — | 5/6 |
| | L2 | 2.0 | 0.1 | 150 | 18 | 10,000 | 1.9 | — 3 | 5.0 | — | 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 |
| | †DC3/HL | 25.0 | 0.1 | 200 | 35 | 11,700 | 3.0 | —3½ | 5.0 | 700 | 13/6 |
| | *HL1320 | 13.0 | 0.2 | 250 | 30 | 10,000 | 3.0 | — 4 | 6.0 | 650 | 13/6 |
| Micromesh | *HLA2 | 4.0 | 1.0 | 200 | 50 | 25,000 | 5.5 | —2½ | 6.0 | 420 | 13/6 |
| Mullard | PM1A | 2.0 | 0.1 | 150 | 50 | 41,800 | 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 |
| | *994V | 4.0 | 1.0 | 200 | 125 | 35,000 | 3.6 | —1½ | 1.4 | 1,000 | 13/6 |
| | *964V | 4.0 | 1.0 | 200 | 75 | 34,000 | 2.2 | — 2 | 1.8 | 1,100 | 13/6 |
| | *484V | 4.0 | 1.0 | 200 | 48 | 21,800 | 2.2 | — 3 | 2.8 | 1,000 | 13/6 |
| | *354V | 4.0 | 1.0 | 200 | 36 | 12,000 | 3.0 | — 4 | 4.0 | 1,000 | 13/6 |
| | *244V | 4.0 | 1.0 | 200 | 26 | 9,000 | 2.8 | —5½ | 5.5 | 1,000 | 13/6 |
| | *154V | 4.0 | 1.0 | 200 | 15 | 7,500 | 2.0 | —7½ | 9.0 | 850 | 13/6 |
| | †H20 | 20.0 | 0.18 | 200 | — | — | 2.6 | —1½ | 1.0 | 1,500 | 13/6 |
| | †HL20 | 20.0 | 0.18 | 200 | 36 | 14,000 | 2.6 | —3½ | 3.6 | 1,000 | 13/6 |
| Osram | H2 | 2.0 | 0.1 | 150 | 35 | 35,000 | 1.0 | —1½ | 1.5 | — | 5/6 |
| | 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 |
| | HL210 | 2.0 | 0.1 | 150 | 24 | 20,000 | 1.2 | — 3 | 1.5 | — | 5/6 |
| | L21 | 2.0 | 0.1 | 150 | 16 | 8,000 | 1.8 | — 6 | 2.2 | — | 5/6 |
| | *MH4 | 4.0 | 1.0 | 200 | 40 | 11,000 | 3.6 | — 3 | 4.5 | 600 | 13/6 |
| | *MH4/k | 4.0 | 1.0 | 200 | 40 | 11,000 | 3.6 | — 3 | 4.5 | 600 | 13/6 |
| | *MH41 | 4.0 | 1.0 | 200 | 80 | 13,300 | 6.0 | — 2 | 6.0 | 400 | 13/6 |
| | *MHL4 | 4.0 | 1.0 | 200 | 20 | 8,000 | 2.5 | — 6 | 8.0 | 850 | 13/6 |
| | †DH | 16.0 | 0.25 | 200 | 40 | 10,800 | 3.7 | — 3 | 6.0 | 500 | 13/6 |
| | *H30 | 13.0 | 0.3 | 200 | 80 | 13,300 | 6.0 | — 2 | 5.5 | 350 | 13/6 |
| Ostar-Ganz | *D130 | 25 | 0.02 | 300 | 100 | 40,000 | 3.5 | — 1 | 2.0 | 500 | 17/6 |
| | *A520 | 200 | 0.02 | 300 | 22 | 8,800 | 2.5 | — 7 | 4.0 | 1,800 | 16/0 |
| Philco | *37 | 6.3 | 0.3 | 275 | 9.2 | 10,000 | 0.9 | — 6 | 2.5 | 2,400 | 8/6 |
| | *75 | 6.3 | 0.3 | 250 | 100.0 | 91,000 | 1.1 | — 2 | 0.8 | 2,500 | 14/— |
| | *85 | 6.3 | 0.3 | 250 | 8.3 | 7,500 | 1.1 | —20 | 8.0 | 2,500 | 12/— |
| | *27 | 2.5 | 1.75 | 250 | 9.0 | 9,250 | 1.0 | — 6 | 2.7 | 220 | 8/— |
| | 30 | 2.0 | 0.06 | 180 | 9.0 | 10,300 | 0.9 | —4½ | 2.5 | 1,800 | 7/— |
| | 101A | 5.0 | 0.25 | 150 | 8.0 | 10,000 | 0.8 | —4½ | 2.5 | 1,800 | 7/— |
| | 117 | 14.0 | 0.3 | 250 | 9.0 | 9,000 | 1.0 | —13½ | 50 | 2,700 | 12/— |
| | *26 | 1.5 | 1.05 | 180 | 8.2 | 7,000 | 1.2 | —13½ | 7.4 | 1,800 | 16/— |
| | V99 | 3.3 | 0.06 | 90 | 6.6 | 15,500 | 0.4 | —4½ | 2.5 | 1,800 | 16/3 |
| | X99 | 3.3 | 0.06 | 90 | 6.6 | 15,500 | 0.4 | —4½ | 2.5 | 1,800 | 11/— |
| Pix | 2 | 2.0 | 0.1 | 150 | 20 | 20,000 | 1.0 | — 4 | 1.5 | — | 4/6 |
| | 3 | 2.0 | 0.1 | 150 | 11 | 12,000 | 0.9 | —7½ | 3.4 | — | 4/6 |
| | 4 | 2.0 | 0.1 | 150 | 33 | 37,000 | 0.9 | —1½ | 1.0 | — | 4/6 |
| | 210 | 2.0 | 0.1 | 150 | 20 | 22,000 | 0.9 | — 4 | 1.2 | — | 4/6 |
| | *90AC | 4.0 | 1.0 | 200 | 40 | 23,000 | 1.7 | —1½ | 3.0 | 500 | 11/6 |
| | *100AC | 4.0 | 1.0 | 200 | 15 | 7,000 | 2.0 | — 6 | 5.0 | 1,200 | 11/6 |
| Six-Sixty | 210RC | 2.0 | 0.1 | 150 | 26 | 20,000 | 1.4 | — 1½ | 1.0 | — | 5/6 |
| | 210HL | 2.0 | 0.1 | 150 | 19 | 25,000 | 0.8 | — 3 | 2.0 | — | 5/6 |
| | 210HF | 2.0 | 0.1 | 150 | 18 | 10,000 | 1.8 | — 3 | 1.0 | — | 5/6 |
| | 210D | 2.0 | 0.1 | 150 | 11 | 12,500 | 0.9 | — 3 | 2.0 | — | 5/6 |
| | 210LF | 2.0 | 0.1 | 150 | 16.5 | 12,000 | 1.4 | —4½ | 3.0 | — | 5/6 |
| | *4DXAC | 4.0 | 1.0 | 200 | 75 | 36,000 | 2.1 | —1½ | 1.5 | 1,000 | 13/6 |
| | *42PAC | 4.0 | 1.0 | 200 | 36 | 12,000 | 3.0 | — 4 | 4.0 | 1,000 | 13/6 |
| | *4HLAC | 4.0 | 1.0 | 200 | 25 | 9,500 | 2.6 | — 4 | 4.0 | 1,000 | 13/6 |
| Tridtron | WD2 | 2.0 | 0.08 | 200 | 37 | 37,000 | 1.0 | —2½ | 1.0 | — | 3/6 |
| | HD2 | 2.0 | 0.08 | 200 | 15 | 15,000 | 1.0 | — 5 | 5.0 | — | 3/6 |
| | 8D2 | 2.0 | 0.1 | 200 | 18 | 12,000 | 1.5 | — 5 | 6.0 | — | 3/6 |
| | A214 | 2.0 | 0.1 | 150 | 20 | 10,000 | 2.0 | — 3 | 5.5 | — | 3/6 |
| | TD2 | 2.0 | 0.08 | 150 | 19 | 10,000 | 0.9 | — 7 | 7.0 | — | 3/6 |
| | *W415N | 4.0 | 1.0 | 200 | 35 | 23,000 | 1.5 | — 3 | 2.5 | 1,000 | 8/6 |
| | *A440N | 4.0 | 1.0 | 200 | 120 | 30,000 | 4.0 | —1½ | 0.5 | 2,000 | 8/6 |
| | *A430N | 4.0 | 1.0 | 200 | 30 | 10,000 | 3.0 | —3½ | 6.0 | 600 | 8/6 |
| | *A2040N | 20.0 | 0.18 | 200 | 120 | 30,000 | 4.0 | —1½ | 0.5 | 2,000 | 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 |
| | AC2495 | 4.0 | 1.0 | 200 | 25 | 7,000 | 3.5 | — 6 | 6.0 | 1,000 | 10/6 |
| | AR4101 | 4.0 | 1.0 | 200 | 40 | 13,000 | 3.0 | —2½ | 3.0 | 1,000 | 10/6 |
| | AR 295 | 4.0 | 1.0 | 200 | 85 | 17,000 | 5.0 | —1½ | 2.5 | 300 | 10/6 |
| | R2018 | 20.0 | 0.18 | 200 | 40 | 13,000 | 3.0 | —2½ | 2.5 | 1,000 | 10/6 |
| | G2018 | 20.0 | 0.18 | 200 | 25 | 7,000 | 3.5 | — 6 | 6.0 | 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 | 9.0 | 9,000 | 1.0 | —21 | 6.0 | 3,500 | 7/6 |
| 362 | H2 | 2.0 | 0.1 | 150 | 32 | 32,000 | 1.0 | —1½ | 2.0 | — | 3/6 |
| | HL2 | 2.0 | 0.1 | 150 | 24 | 16,000 | 1.5 | — 3 | 3.5 | — | 3/6 |
| | L2 | 2.0 | 0.1 | 150 | 15 | 12,000 | 1.5 | — 6 | 5.0 | — | 3/6 |
| | ACHL4 | 4.0 | 1.0 | 250 | 33 | 8,000 | 4.0 | — 4 | 3.0 | 1,300 | 7/6 |
| | MHL20 | 20.0 | 0.18 | 250 | 33 | 8,000 | 4.0 | — 4 | 3.0 | 1,300 | 7/6 |

# VALVE DATA CHART

## POWER OUTPUT TRIODES

| Maker. | Type. | Fil. volts. | Fil. amps. | Anode volts. | Impedance. | Slope Ma/V. | Grid bias. | Anode current. | Bias res. | Output mW. | Price |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Clarion | LP2 | 2.0 | 0.1 | 150 | 6,500 | 1.1 | —9 | 8.0 | — | 75 | 2/0 |
| | P2 | 2.0 | 0.2 | 150 | 2,850 | 1.4 | —18 | 12.0 | — | 200 | 3/6 |
| | PX2 | 2.0 | 0.2 | 150 | 1,850 | 1.6 | —24 | 22.0 | — | 400 | 3/6 |
| | *ACL | 4.0 | 1.0 | 200 | 3,000 | 3.0 | —12 | 18.0 | 700 | 500 | 4/6 |
| | *ADL | 20.0 | 0.18 | 200 | 2,700 | 3.0 | —13 | 20.0 | 650 | 550 | 4/6 |
| | **ACP | 4.0 | 1.0 | 200 | 2,000 | 3.0 | —21 | 19.0 | 700 | 700 | o/— |
| Cossor | 215P | 2.0 | 0.15 | 150 | 4,000 | 2.3 | —7½ | 10.0 | — | 150 | 7/— |
| | 220P | 2.0 | 0.2 | 150 | 4,000 | 2.3 | —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 | 180 | 1,500 | 3.0 | —18 | 22.0 | — | 450 | 12/— |
| | *41MP | 4.0 | 1.0 | 200 | 2,600 | 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 | 200 | 1,200 | 4.0 | —23 | 45.0 | 500 | 1,000 | 16/6 |
| | **62OT | 6.0 | 1.6 | 400 | 1,400 | 2.3 | —95 | 62.5 | 1,500 | 5,000 | 30/— |
| | **66OT | 6.0 | 4.5 | 500 | 1,000 | 2.5 | —120 | 120.0 | 1,000 | 11,000 | 105/— |
| | †DP | 16.0 | 0.25 | 200 | 2,800 | 6.0 | —7½ | 28.0 | 300 | 1,250 | 14/— |
| Dario | TB062 | 2.0 | 0.18 | 150 | 3,000 | 2.0 | —10½ | 13.0 | — | 350 | 4/9 |
| | TB122 | 2.0 | 0.2 | 150 | 3,600 | 3.5 | —4½ | 6.0 | — | 150 | 4/9 |
| | TB052 | 2.0 | 0.15 | 150 | 4,200 | 1.2 | —18 | 6.0 | — | 200 | 4/9 |
| | TB032 | 2.0 | 0.19 | 150 | 2,000 | 1.5 | —30 | 12.0 | — | 450 | 4/9 |
| | TFO04 | 4.0 | 1.0 | 200 | 6,000 | 1.3 | —16 | 12.0 | 1,500 | 600 | 8/6 |
| Ferranti | L2 | 2.0 | 0.1 | 150 | 6,800 | 1.6 | —4½ | 9.0 | — | 140 | 7/— |
| | *LP4 | 4.0 | 1.0 | 250 | 870 | 5.4 | —36 | 48.0 | 750 | 2,500 | 16/6 |
| Fotos | PO1 | 2.0 | 0.22 | 150 | 2,250 | 2.0 | —12½ | — | — | — | 5/6 |
| | BD0 | 2.0 | 0.2 | 150 | 1,500 | 2.0 | —24 | — | — | — | 6/6 |
| Hivac | P220 | 2.0 | 0.2 | 150 | 4,700 | 3.0 | —4½ | 6.0 | — | 175 | 5/6 |
| | PP220 | 2.0 | 0.2 | 150 | 2 300 | 3.0 | —10½ | 12.5 | — | 250 | 6/6 |
| | PX230 | 2.0 | 0.3 | 150 | 1,850 | 3.5 | —12 | 17.5 | — | 450 | 7/6 |
| | *ACL | 4.0 | 1.0 | 200 | 2,350 | 4.3 | —10 | 17.1 | 700 | 675 | 12/6 |
| Lissen | LP2 | 2.0 | 0.2 | 150 | 3,500 | 3.5 | —6 | 9.0 | — | 200 | 8/9 |
| | P220 | 2.0 | 0.2 | 150 | 4,000 | 1.75 | —13½ | 7.6 | — | 150 | 7/3 |
| | PX240 | 2.0 | 0.4 | 200 | 1,500 | 3.0 | —32 | 25.0 | — | 800 | 8/— |
| Marconi | LP2 | 2.0 | 0.2 | 150 | 3,900 | 3.9 | —4½ | 11.5 | — | 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 | 1.0 | 200 | 2,860 | 4.2 | —9 | 20.0 | 400 | 650 | 14/— |
| | **PX4 | 4.0 | 1.0 | 250 | 830 | 6.0 | —34 | 48.0 | 750 | 2,500 | 16/6 |
| | **PX25 | 4.0 | 2.0 | 400 | 1,265 | 7.5 | —31 | 62.5 | 530 | 5,500 | 25/— |
| | **PX25a | 4.0 | 2.0 | 400 | 880 | 6.9 | —100 | 62.5 | 1,600 | 8,000 | 25/— |
| | **DA60 | 6.0 | 4.0 | 500 | 833 | 3.0 | —135 | 120.0 | 1,150 | 11,000 | 110/— |
| | **DA100 | 4.0 | 2.7 | 1,000 | 1,400 | 3.2 | —146 | 100.0 | 1,400 | 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 | 5.8 | — | 150 | 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 | 3.8 | —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 | 2,500 | 16/6 |
| | **PP5/400 | 4.0 | 2.0 | 400 | 1,500 | 6.0 | —32 | 62.5 | 510 | 5,900 | 25/— |
| | †DC2/P | 35.0 | 0.1 | 200 | 2,650 | 3.8 | —10 | 17.0 | 800 | 650 | 14/— |
| Micromesh | *PA1 | 4.0 | 1.0 | 200 | 1,050 | 12.0 | —9 | 40.0 | 260 | 1,250 | 16/6 |
| Mullard | PM2a | 2.0 | 0.2 | 150 | 3,600 | 3.5 | —7 | 6.0 | — | 150 | 7/— |
| | PM2 | 2.0 | 0.2 | 150 | 4,400 | 1.7 | —12 | 6.0 | — | 150 | 7/— |
| | PM202 | 2.0 | 0.2 | 150 | 2,000 | 8.5 | —15 | 14.0 | — | 350 | 12/— |
| | *104v | 4.0 | 1.0 | 200 | 4,850 | 3.3 | —8.5 | 8.8 | 1,000 | — | 14/— |
| | *104v | 4.0 | 1.0 | 200 | 3,000 | 4.0 | —12 | 20.0 | 600 | 550 | 14/— |
| | **054v | 4.0 | 1.0 | 200 | 1,250 | 4.0 | —28 | 30.0 | 1,000 | 1,300 | 16/6 |
| | **AC064 | 4.0 | 1.0 | 200 | 2,850 | 3.5 | —14 | 17.0 | 800 | 400 | 16/— |
| | **AC044 | 4.0 | 1.0 | 200 | 2,000 | 3.0 | —21 | 20.0 | 1,000 | 620 | 16/— |
| | **D010 | 6.0 | 0.85 | 400 | 2,850 | 0.8 | —130 | 25.0 | 5,200 | 2,500 | 25/— |
| | **D020 | 7.5 | 1.1 | 425 | 2,000 | 2.5 | —66 | 40.0 | 1,650 | 4,000 | 30/— |
| | **D024 | 4.0 | 2.0 | 400 | 1,390 | 6.5 | —34 | 63.0 | 540 | 5,000 | 25/— |
| | **D025 | 6.0 | 1.1 | 400 | 800 | 3.8 | —112 | 63.0 | 1,800 | 7,000 | 30/— |
| | **D026 | 4.0 | 2.0 | 400 | 600 | 6.3 | —92 | 63.0 | 1,500 | 7,500 | 25/— |
| | D060 | 6.0 | 4.0 | 500 | 1,000 | 3.5 | —95 | 120.0 | 800 | 11,000 | 110/— |
| Osram | LP2 | 2.0 | 0.2 | 150 | 3,900 | 3.9 | —4½ | 11.5 | — | 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 | 1.0 | 200 | 2,860 | 4.2 | —9 | 20.0 | 400 | 650 | 14/— |
| | **DX4 | 4.0 | 1.0 | 250 | 830 | 6.0 | —34 | 48.0 | 750 | 2,500 | 16/6 |
| | **PX25 | 4.0 | 2.0 | 400 | 1,265 | 7.5 | —31 | 62.5 | 530 | 5,500 | 25/— |
| | **PX25a | 4.0 | 2.0 | 400 | 880 | 6.9 | —100 | 62.5 | 1,600 | 8,000 | 25/— |
| | **DA60 | 6.0 | 4.0 | 500 | 833 | 3.0 | —135 | 120.0 | 1,150 | 11,000 | 110/— |
| | **DA100 | 4.0 | 2.7 | 1,000 | 1,400 | 3.2 | —146 | 100.0 | 1,400 | 30,000 | 210/— |
| | †DL | 16.0 | 0.25 | 200 | 2,660 | 4.5 | —8 | 25.0 | 350 | 600 | 14/— |
| Ostar-Ganz | *U020 | 250 | 0.02 | 300 | 3,700 | 3.0 | —12 | 7.0 | 1,700 | 1,500 | 16/6 |
| | *L1525 | 250 | 0.02 | 300 | 1,850 | 3.0 | —28 | 20.0 | 1,300 | 1,500 | 17/— |
| | *K2060 | 250 | 0.02 | 300 | 1,000 | 5.0 | —40 | 40.0 | 1,000 | 3,000 | 25/6 |
| | *K3560 | 250 | 0.04 | 220 | 500 | 6.0 | —50 | 50.0 | 1,000 | 4,000 | 25/6 |
| Philco | *45 | 2.5 | 1.5 | 250 | 1,750 | 2.0 | —50 | 27.0 | 1,850 | 780 | 8/— |
| | *10 | 7.5 | 1.25 | 425 | 5,000 | 8.0 | —39 | 18.0 | 2,200 | 1,600 | 25/— |
| | †12A | 5.0 | 0.25 | 180 | 6,000 | 8.5 | —13½ | 7.0 | 2,000 | 260 | 9/6 |
| | *50 | 7.5 | 1.25 | 450 | 1,800 | 3.8 | —84 | 55.0 | 1,500 | 4,600 | 28/— |
| | *71A | 5.0 | 0.25 | 180 | 1,850 | 3.0 | —40 | 20.0 | 2,000 | 700 | 6/— |
| Pix | 20 | 2.0 | 0.16 | 150 | 4 800 | 1.2 | —14 | 5.0 | — | 150 | 6/0 |
| | 120 | 2.0 | 0.2 | 150 | 3,900 | 1.8 | —11 | 12.0 | — | 200 | 8/6 |
| | *AC-P | 4.0 | 1.0 | 200 | 3,600 | 2.5 | —11 | — | — | — | 11/6 |

| Maker. | Type. | Fil. volts. | Fil. amps. | Anode volts. | Impedance. | Slope Ma/V. | Grid bias. | Anode current. | Bias res. | Output mW. | Price. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Six-Sixty | 220P | 2.0 | 0.2 | 150 | 4,800 | 1.5 | —10 | 6.0 | — | 150 | 7/- |
| | 220PA | 2.0 | 0.2 | 150 | 3,700 | 3.5 | —4½ | 8.0 | — | 150 | 7/- |
| | 220SP | 2.0 | 0.2 | 150 | 2,060 | 3.4 | —15 | 14.0 | — | 300 | 12/- |
| | 240SP | 2.0 | 0.4 | 150 | 1,900 | 3.5 | —15 | 15.0 | — | 500 | 12/- |
| | *4LAC | 4.0 | 1.0 | 200 | 5,000 | 3.2 | —6 | 7.0 | 850 | — | 14/- |
| | *4PAC | 4.0 | 1.0 | 200 | 3,170 | 3.8 | —12 | 19.0 | 550 | 500 | 14/- |
| | **4SPAC | 4.0 | 1.0 | 200 | 1,250 | 4.0 | —25 | 28.0 | 9,000 | 1,000 | 16/6 |
| | **HV4/2 | 4.0 | 1.0 | 250 | 1,080 | 6.0 | —30 | 48.0 | 600 | 2,500 | 16/6 |
| Tritron | ZD2 | 2.0 | 0.15 | 150 | 5,000 | 1.0 | —15 | 10.0 | — | 150 | 4/6 |
| | UD2N | 2.0 | 0.22 | 150 | 2,000 | 2 | —15 | 15.0 | — | 500 | 4/6 |
| | F235 | 2.0 | 0.33 | 200 | 3,600 | 2.5 | —12 | 18.0 | — | 550 | 4/6 |
| | **E425 | 4.0 | 0.3 | 250 | 2,600 | 2.0 | —32 | 20.0 | — | 1,000 | 7/- |
| | **K435 | 4.0 | 0.65 | 250 | 1,300 | 3.5 | —40 | 40.0 | 600 | 2,500 | 12/6 |
| | **K480 | 4.0 | 2.0 | 550 | 2,500 | 8.0 | —36 | 45.0 | 800 | 5,000 | 22/6 |
| | **E450 | 4.0 | 3.0 | 400 | 1,250 | 5.0 | —50 | 120.0 | 500 | 12,000 | 45/- |
| | *E430 | 4.0 | 1.0 | 200 | 3,600 | 3.0 | —15 | 15.0 | 1,000 | 350 | 8/6 |
| Tungsram | P215 | 2.0 | 0.15 | 150 | 3,300 | 1.5 | —9 | 10.0 | — | 250 | 4/9 |
| | LP220 | 2.0 | 0.2 | 150 | 3,800 | 3.8 | —4.5 | 4.0 | — | 200 | 4/9 |
| | SP220 | 2.0 | 0.2 | 150 | 2,200 | 3.0 | —15 | 15.0 | — | 350 | 4/9 |
| | *AP495 | 4.0 | 1.0 | 250 | 2,500 | 4.0 | —18 | 20.0 | 900 | 900 | 11/3 |
| | **SP414 | 4.0 | 0.15 | 200 | 1,700 | 3.0 | —12 | 12.0 | 1,000 | 450 | 9/- |
| | **P430 | 4.0 | 0.3 | 250 | 2,200 | 2.5 | —30 | 25.0 | 1,200 | 800 | 11/6 |
| | **P460 | 4.0 | 0.6 | 220 | 1,100 | 3.5 | —35 | 50.0 | 700 | 1,500 | 13/6 |
| | **P4100 | 4.0 | 1.0 | 400 | 1,400 | 5.0 | —37 | 40.0 | 1,000 | 3,500 | 14/- |
| | *P2018 | 20.0 | 0.18 | 200 | 2,500 | 4.0 | —18 | 20.0 | 900 | 900 | 13/- |
| | 112 | 5.0 | 0.25 | 180 | 4,700 | 1.8 | —18.5 | 7.5 | 2,000 | 275 | 11/6 |
| | 171 | 5.0 | 0.25 | 180 | 1,750 | 1.8 | —40 | 20.0 | 2,000 | 800 | 11/6 |
| | 45 | 2.5 | 1.5 | 275 | 1,750 | 2.0 | —56 | 36.0 | 1,500 | 2,000 | 7/- |
| | PX2100 | 7.5 | 1.25 | 425 | 5,000 | 1.6 | —39 | 18.0 | 2,000 | 1,000 | 30/- |
| | 50 | 7.5 | 1.25 | 460 | 1,860 | 2.1 | —85 | 55.0 | 1,800 | 4,600 | 30/- |
| 362 | LP2 | 2.0 | 0.2 | 180 | 5,000 | 3.0 | —6 | 6.0 | — | 500 | 4/- |
| | P2 | 2.0 | 1.2 | 180 | 3,000 | 3.0 | —10 | 9.0 | — | 800 | 4/6 |
| | *ACPX4 | 4.0 | 1.0 | 250 | 2,000 | 4.0 | —16 | 40.0 | 400 | 2,500 | 9/- |
| | **ACPX4a | 4.0 | 1.0 | 250 | 2,000 | 4.0 | —16 | 40.0 | 400 | 2,500 | 9/- |
| | *MPX20 | 20.0 | 0.18 | 250 | 2,000 | 4.0 | —16 | 40.0 | 400 | 2,500 | 9/- |

## PENTODE OUTPUT VALVES

| Maker. | Type. | Fil. volts. | Fil. amps. | Anode volts. | Screen volts. | Slope m.a./v. | Grid bias. | Bias res. ohms. | Anode and screen current. | Output mW. | Base pins. | Price. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Clarion | PN2 | 2.0 | 0.2 | 150 | 150 | 1.8 | —7.5 | — | 6.7 | 500 | 5 | 8/6 |
| | *ACPN | 4.0 | 1.0 | 250 | 200 | 2.8 | —12 | 400 | 30.0 | 2,000 | 5 | 10/6 |
| | **ACPN | 4.0 | 1.0 | 250 | 200 | 2.8 | —12 | 400 | 30.0 | 2,000 | 5 | 10/6 |
| | *ADPN | 20.0 | 0.18 | 250 | 200 | 2.8 | —15 | 500 | 30.0 | 2,500 | 5 | — |
| Cossor | 220 PT | 2.0 | 0.2 | 150 | 150 | 2.5 | — 9 | — | 23.0 | 1,000 | 4 & 5 | 13/6 |
| | 220 HPT | 2.0 | 0.2 | 150 | 150 | 2.5 | —4½ | — | 9.5 | 500 | 5 | 13/6 |
| | 230 PT | 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 | 18/6 |
| | *42MP/Pen. | 4.0 | 1.0 | 250 | 250 | 7.0 | —5½ | 150 | 38.0 | 3,400 | 5 | 18/6 |
| | **PT41 | 4.0 | 1.0 | 250 | 200 | 3.0 | —12½ | 350 | 360 | 2,600 | 5 | 18/6 |
| | **PT41E | 4.0 | 1.0 | 400 | 300 | 2.3 | —40 | 1,100 | 36.0 | 3,600 | 5 | 22/6 |
| | †DP/Pen. | 10.0 | 0.25 | 250 | 250 | 3.5 | —15 | 460 | 36.0 | 3,000 | 5 | 18/6 |
| | *40PPA | 40.0 | 0.2 | 150 | 150 | 4.0 | —25 | 600 | 42.0 | — | 7 | 18/6 |
| Dario | TC432 | 2.0 | 0.2 | 150 | 150 | 2.5 | —4½ | — | 11.5 | 420 | 4 & 5 | 10/- |
| | TCH432 | 2.0 | 0.3 | 150 | 150 | 1.6 | —10 | — | 19.0 | 600 | 4 & 5 | 10/- |
| | *TE634 | 4.0 | 1.35 | 250 | 250 | 2.7 | —22 | 500 | 45.0 | 3,400 | 7 | 12/6 |
| | *TE534 | 4.0 | 1.1 | 250 | 250 | 2.5 | —15 | 500 | 31.0 | 2,500 | 5 | 12/6 |
| | **TE434 | 4.0 | 1.1 | 250 | 250 | 3.5 | —14 | 325 | 43.0 | 3,400 | 5 | 12/6 |
| | **TC434 | 4.0 | 0.25 | 300 | 200 | 1.7 | —25 | 1,000 | 24.0 | 2,000 | 5 | 12/6 |
| | *TE4320 | 20.0 | 0.2 | 200 | 100 | 5.0 | —20 | 420 | 45.0 | 3,400 | C | 12/6 |
| | *TE4313 | 13.0 | 0.2 | 200 | 100 | 8.0 | —14 | 470 | 30.5 | 2,000 | C | 12/6 |
| Ferranti | *PT4 | 4.0 | 1.0 | 250 | 250 | 7.0 | — 6 | 150 | 38.0 | 2,500 | 7 | 18/6 |
| | *PTS | 26.0 | 0.3 | 250 | 250 | 6.0 | —7½ | 200 | 38.0 | 2,500 | 7 | 18/6 |
| | *PTA | 13.0 | 0.6 | 250 | 250 | 7.0 | — 6 | 150 | 38.0 | 2,500 | 7 | 18/6 |
| Hivac | Y220 | 2.0 | 0.2 | 150 | 150 | 2.5 | —4½ | 330 | 13.5 | 500 | 5 | 10/6 |
| | Z220 | 2.0 | 0.2 | 150 | 150 | 2.5 | —4½ | 200 | 22.0 | 750 | 5 | 10/6 |
| Lissen | PT235 | 2.0 | 0.2 | 150 | 150 | 1.6 | — 6 | — | 10.0 | 400 | 4 | 12/6 |
| | PT2a | 2.0 | 0.2 | 150 | 150 | 2.5 | —10 | — | 21.0 | 1,100 | 4 | 12/6 |
| | PT250 | 2.0 | 0.5 | 250 | 250 | 3.0 | —15 | — | 47.0 | 2,500 | 5 | 16/- |
| | **PT425 | 4.0 | 0.25 | 200 | 150 | 2.5 | —10 | 400 | 25.0 | 1,000 | 4 | 16/- |
| | *AC/PT | 4.0 | 1.25 | 250 | 200 | 4.0 | — 8 | 230 | 35.0 | 3,000 | 5 & 7 | 18/6 |
| | †PT16 | 16.0 | 0.25 | 250 | 200 | 4.0 | — 8 | 230 | 35.0 | 3,000 | 5 | 18/6 |
| | PT611 | 6.0 | 0.11 | 200 | 150 | 2.0 | — 7 | 500 | 15.0 | 650 | 4 | 16/- |
| Marconi | PT2 | 2.0 | 0.2 | 150 | 150 | 2.5 | —4½ | — | 8.5 | 500 | 5 | 13/6 |
| | PT2/k | 2.0 | 0.2 | 150 | 150 | 2.5 | —4½ | — | 8.5 | 500 | 5 | 13/6 |
| | *MPT4 | 4.0 | 1.0 | 250 | 200 | 3.0 | —11 | 300 | 37.0 | 2,900 | 5 & 7 | 18/6 |
| | *MPT4/k | 4.0 | 1.0 | 250 | 250 | 3.0 | —13 | 320 | 40.0 | 3,200 | 5 & 7 | 18/6 |
| | **PT4 | 4.0 | 1.0 | 250 | 250 | 2.9 | —16 | 400 | 40.0 | 2,800 | 6 | 18/6 |
| | **PT25 | 4.0 | 2.0 | 400 | 200 | 4.0 | —22 | 300 | 73.0 | 10,000 | 5 | 45/- |
| | **PT25H | 4.0 | 2.0 | 400 | 400 | 6.5 | —16 | 210 | 75.0 | 10,000 | 5 | 45/- |
| | †DPT | 16.0 | 0.25 | 200 | 200 | 3.0 | —10 | 220 | 46.5 | 2,000 | 5 | 18/6 |
| | *N30 | 13.0 | 0.3 | 250 | 250 | 3.9 | —16 | 420 | 38.0 | 3,200 | 7 | 18/6 |
| Mazda | Pen 220 | 2.0 | 0.2 | 150 | 150 | 2.5 | —4½ | — | 10.6 | 600 | 5 | 13/6 |
| | Pen.220a | 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 | 140 | 38.0 | 3,400 | 7 | 18/6 |
| | †DC2/Pen. | 35.0 | 0.1 | 250 | 250 | 2.5 | —13 | 350 | 35.0 | 2,300 | 5 | 18/6 |
| | *Pen.3520 | 35.0 | 0.2 | 250 | 250 | 7.0 | — 8 | 165 | 54.0 | — | 7 | 18/6 |

# VALVE DATA CHART

| Maker. | Type. | Fil. volts. | Fil. amps. | Anode volts. | Screen volts. | Slope m.a./v. | Grid bias. | Bias res. ohms. | Anode and screen current. | Output mW. | Base pins | Price. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Micromesh | Pen.B1 | 2.0 | 0.2 | 150 | 150 | 2.5 | —4.5 | — | 9.8 | 500 | 5 | 13/6 |
| | *7A2 | 4.0 | 1.2 | 250 | 250 | 3.2 | —17.5 | 330 | 40.0 | 3,000 | 7 | 18/6 |
| | **Pen A1 | 4.0 | 1.6 | 250 | 250 | 3.0 | —16.5 | 460 | 39.0 | 2,850 | 5 | 18/6 |
| (Brimar) | *7D8 | 40.0 | 0.2 | 135 | 135 | 3.8 | —20 | 500 | 48 | 2,500 | 7 | 18/6 |
| Mullard | PM22 | 2.0 | 0.3 | 150 | 150 | 1.3 | —10 | — | 19.0 | 600 | 4 & 5 | 10/6 |
| | PM22a | 2.0 | 0.2 | 150 | 150 | 2.5 | —4½ | — | 11.5 | 425 | 5 | 13/6 |
| | PM22c | 2.0 | 0.3 | 150 | 150 | 3.0 | —20 | — | 25.0 | 1,450 | 5 | 13/6 |
| | *Pen 4VA | 4.0 | 1.0 | 250 | 250 | 3.5 | —22 | 500 | 44.0 | 3,400 | 5 & 7 | 18/6 |
| | **PM24a | 4.0 | 0.28 | 300 | 200 | 2.0 | —22½ | 1,000 | 23.5 | 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 | 40.0 | 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 | 600 | 59.0 | 10,000 | 5 | 45/- |
| | †Pen 20 | 20.0 | 0.18 | 200 | 200 | 2.5 | —15 | 450 | 34.0 | 1,500 | 5 & 7 | 18/6 |
| | *Pen 26 | 24.0 | 0.2 | 200 | 100 | 3.1 | —19 | 400 | 48.0 | 2,000 | 8B.C. | 18/0 |
| Osram | PT2 | 2.0 | 0.2 | 150 | 150 | 2.5 | —4½ | — | 9.5 | 500 | 5 | 13/6 |
| | PT2/k | 2.0 | 0.2 | 150 | 150 | 2.5 | —4½ | — | 9.5 | 500 | 5 | 13/6 |
| | *MPT4 | 4.0 | 1.0 | 250 | 200 | 3.0 | —11 | 300 | 37.0 | 2,900 | 5 & 7 | 18/6 |
| | *MPT4/k | 4.0 | 1.0 | 250 | 250 | 3.0 | —13 | 320 | 40.0 | 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 | 300 | 73.0 | 10,000 | 5 | 45/- |
| | **PT25b | 4.0 | 2.0 | 400 | 400 | 6.5 | —16 | 210 | 75.0 | 10,000 | 5 | 45/6 |
| | †DPT | 16.0 | 0.25 | 200 | 200 | 3.0 | —10 | 220 | 46.5 | 2,000 | 5 | 18/6 |
| | *N30 | 13.0 | 0.3 | 250 | 250 | 3.9 | —15 | 420 | 36.0 | 3,200 | 7 | 18/6 |
| Ostar-Ganz | *PT3 | 250 | 0.02 | 250 | 250 | 3.5 | —20 | 880 | 24.0 | 1,500 | 7 | 18/9 |
| | M43 | 250 | 0.03 | 250 | 200 | 3.2 | —24 | 550 | 46.0 | 3,500 | 7 | 19/6 |
| Philco | *36E | 6.3 | 0.3 | 180 | 135 | 1.0 | —34 | 300 | 11.5 | 525 | A | 14/- |
| | *41E | 6.3 | 0.4 | 200 | 180 | 1.8 | —14 | 1,150 | 12.5 | 650 | A | 14/- |
| | *42E | 6.3 | 0.65 | 250 | 250 | 2.2 | —16½ | 400 | 41.5 | 3,000 | A | 14/- |
| | *47E | 2.5 | 1.5 | 250 | 200 | 2.5 | —16½ | 450 | 37.0 | 2,500 | A | 13/6 |
| | 33E | 2.0 | 0.26 | 135 | 135 | 1.5 | —13½ | — | 14.5 | 700 | A | 15/3 |
| | *18E | 14.0 | 0.7 | 250 | 250 | 2.3 | —16½ | 400 | 41.5 | 3,000 | A | 18/6 |
| | *43E | 25.0 | 0.3 | 95 | 95 | 2.0 | —15 | 600 | 25.0 | 900 | A | 18/- |
| Pix | **425 | 4.0 | 0.25 | 180 | 180 | 2.5 | — | — | — | — | 5 | 12/6 |
| Six-Sixty | 220 Pen. | 2.0 | 0.2 | 150 | 150 | 2.5 | —4½ | — | 11.0 | 425 | 5 | 13/6 |
| | 230 Pen. | 2.0 | 0.3 | 150 | 150 | 1.3 | —10½ | — | 17.0 | 400 | 5 | 13/6 |
| | *4 Pen. A.AC | 4.0 | 1.0 | 250 | 250 | 3.5 | —22 | 500 | 44.0 | 3,400 | 5 & 7 | 18/6 |
| | **4 Pen. M | 4.0 | 1.0 | 250 | 250 | 3.0 | —18 | 500 | 37.0 | 3,000 | 5 | 18/6 |
| | **4 Pen. SP | 4.0 | 0.27 | 300 | 200 | 2.0 | —22½ | 1,000 | 23.5 | 1,900 | 5 | 18/6 |
| Tritron | P215 | 2.0 | 0.15 | 150 | 150 | 1.5 | —15 | — | 10.5 | 500 | 5 | 10/6 |
| | P225 | 2.0 | 0.2 | 150 | 150 | 2.0 | — 4 | — | 10.0 | 500 | 5 | 10/6 |
| | **P425 | 4.0 | 0.25 | 300 | 200 | 2.0 | —20 | 800 | 26.0 | 1,650 | 5 | 12/6 |
| | **P435 | 4.0 | 1.1 | 250 | 250 | 3.0 | —15 | 380 | 42.0 | 2,800 | 5 | 13/6 |
| | **P460 | 4.0 | 2.0 | 550 | 200 | 6.0 | —40 | 800 | 52.0 | 8,000 | 5 | 30/- |
| | *P440N | 4.0 | 1.1 | 250 | 250 | 3.5 | —15 | 550 | 28.0 | 2,000 | 5 | 12/6 |
| | *P441N | 4.0 | 1.1 | 250 | 250 | 4.0 | —22 | 600 | 37.0 | 3,800 | 5 | 13/6 |
| | *P2020N | 20.0 | 0.18 | 200 | 200 | 2.5 | —18 | 750 | 24.0 | 1,350 | 5 | 12/6 |
| | *P2460 | 24.0 | 0.16 | 200 | 100 | 8.0 | —18 | 350 | 52.0 | 3,500 | 5 | 13/6 |
| Tungsram | P220 | 2.0 | 0.2 | 200 | 150 | 2.5 | — 6 | — | 8.0 | 400 | 5 | 10/- |
| | P230 | 2.0 | 0.3 | 200 | 150 | 2.0 | —16 | — | 16.0 | 600 | 5 | 10/- |
| | **PP415 | 4.0 | 0.15 | 250 | 150 | 2.0 | —16 | 1,000 | 16.0 | 600 | 5 | 14/9 |
| | **PP431 | 4.0 | 0.3 | 300 | 200 | 2.6 | —42 | 1,700 | 25.0 | 1,200 | 5 | 14/9 |
| | **PP4101 | 4.0 | 1.1 | 250 | 250 | 3.5 | —22 | 500 | 45.0 | 2,500 | 5 | 14/9 |
| | **PP4100 | 4.0 | 1.0 | 400 | 300 | 3.0 | —40 | 850 | 47.0 | 3,000 | 5 | 14/9 |
| | *APP4100 | 4.0 | 1.0 | 400 | 300 | 3.0 | —40 | 850 | 47.0 | 3,000 | 5 | 14/9 |
| | *APP4130 | 4.0 | 1.3 | 250 | 250 | 2.7 | —22 | 620 | 43.0 | 2,500 | 5 | 14/9 |
| | *APP4120 | 4.0 | 1.2 | 350 | 250 | 3.5 | —18 | 450 | 40.0 | 3,000 | 5 | 14/9 |
| | *PP2018 | 20.0 | 0.18 | 200 | 200 | 2.5 | —18 | 730 | 25.0 | 1,400 | 5 | 14/9 |
| | *PP4018 | 40.0 | 0.18 | 180 | 180 | 3.0 | —22 | 420 | 54.0 | 3,400 | 7 | 14/9 |
| | *PP4118 | 40.0 | 0.18 | 180 | 180 | 0.5 | —10 | 250 | 42.0 | 3,000 | 7 | 14/0 |
| | 2A5 | 2.5 | 1.75 | 250 | 250 | 2.2 | —16.5 | 400 | 40.5 | 3,000 | A | 12/- |
| | 42 | 6.3 | 0.7 | 250 | 250 | 2.2 | —16.5 | 400 | 40.5 | 3,000 | A | 12/- |
| | 43 | 25.0 | 0.3 | 135 | 135 | 2.3 | —20 | 600 | 41.0 | 2,000 | A | 12/- |
| | 47 | 2.5 | 1.75 | 250 | 250 | 2.5 | —16.5 | 450 | 37.0 | 2,700 | A | 12/- |
| 362 | ME2 | 2.0 | 0.2 | 200 | 150 | 2.0 | — 6 | — | 10.0 | 500 | 4 & 5 | 10/- |
| | *ACME4 | 4.0 | 1.0 | 250 | 180 | 2.8 | — 8 | 180 | 44.0 | 3,000 | 5 | 13/- |
| | **ACME4a | 4.0 | 1.0 | 250 | 180 | 2.8 | — 8 | 180 | 44.0 | 3,000 | 4 | 18/- |
| | *MME20 | 20.0 | 0.18 | 250 | 180 | 2.8 | — 8 | 180 | 44.0 | 3,000 | 5 | 18/- |

## FREQUENCY CHANGERS

| Maker. | Type. | Circuit. | Fil. volts. | Fil. amps. | Anode volts. | Screen volts. | Oscillator volts. | Conv. cdt. ma./v. | Grid bias. | Base pins. | Price. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Cossor | 210PG | Heptode | 2.0 | 0.1 | 150 | 80 | 150 | 1.0 | 0—9 | 7 | 18/6 |
| | *41MPG | Heptode | 4.0 | 1.0 | 250 | 100 | 100 | 1.2 | —1½—20 | 7 | 20/- |
| | *13PGA | Heptode | 13.0 | 0.3 | 250 | 100 | 200 | — | —1½—20 | 7 | 20/- |
| Dario | *TE504 | Octode | 4.0 | 0.65 | 250 | 90 | 90 | 0.65 | —1—20 | 7 | — |
| | TB5013 | Octode | 13.0 | 0.2 | 250 | 90 | 90 | 0.65 | —1—20 | — | — |
| Ferranti | VHT2 | Heptode | 2.0 | 0.1 | 150 | 70 | 120 | — | 0—9 | 7 | 18/0 |
| | *VHT4 | Heptode | 4.0 | 1.0 | 200 | 100 | 200 | — | —1—25 | 7 | 20/- |
| | *VHTS | Heptode | 13.0 | 0.3 | 200 | 100 | 200 | — | —1—25 | 7 | 20/- |
| Lissen | FC2 | Triode Hexode | 2.0 | 0.2 | 150 | 70 | 100 | 0.4 | 0—10 | 7 | 18/6 |
| | *AC/FC | Triode Hexode | 4.0 | 1.4 | 250 | 100 | 150 | 0.65 | —1—20 | 7 | 20/- |
| Marconi | X30 | Heptode | 2.0 | 0.1 | 150 | 70 | 70 | 0.2 | 0—9 | 7 | 18/0 |
| | MX40 | Heptode | 4.0 | 1.0 | 250 | 100 | 150 | 0.5 | —3—30 | 7 | 20/- |
| | *X30 | Heptode | 13.0 | 0.3 | 250 | 100 | 150 | 0.8 | —3—30 | 7 | 20/- |

| Maker. | Type. | Circuit. | Fil. volts. | Fil. amps. | Anode volts. | Screen volts. | Oscillator volts. | Conv. cdt. ma./v. | Grid bias. | Base pins. | Price. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Mazda .. .. | *AC/TP .. | Triode Pentode | 4.0 | 1.25 | 250 | — | 250 | — | — | 9 | 20/- |
| | *TP2620 .. | Triode Pentode | 26.0 | 0.2 | 250 | — | 250 | — | — | 9 | 20/- |
| Micromesh .. | *15A2 .. .. | Heptode . | 4.0 | 0.7 | 250 | 100 | 200 | 0.6 | —3—40 | 7 | 20/- |
| (Brimar) | *15D1 .. .. | Heptode . | 13.0 | 0.2 | 250 | 100 | 200 | 0.6 | —3—40 | 7 | 20/- |
| Mullard .. .. | FC2 .. .. | Octode .. | 2.0 | 0.14 | 150 | 70 | 150 | — | —2 | 7 | 15/- |
| | FC4 .. .. | Octode .. | 4.0 | 0.65 | 250 | 85 | 85 | — | — | 7 | 20/- |
| | *TP4 .. .. | Triode Pentode | 4.0 | 1.25 | 250 | 150 | 150 | — | — | 9 | 20/- |
| | FC13 .. | Octode . | 13.0 | 0.2 | 250 | 90 | 90 | — | — | 8 S.C. | 20/- |
| Osram .. .. | X21 .. .. | Heptode .. | 2.0 | 0.1 | 150 | 70 | 70 | 0.2 | 0—9 | 7 | 18/6 |
| | *MX40 .. | Heptode .. | 4.0 | 1.0 | 250 | 100 | 150 | 0.5 | —3—30 | 7 | 20/- |
| | *X30 .. .. | Heptode .. | 13.0 | 0.3 | 250 | 100 | 150 | 0.8 | —3—30 | 7 | 20/- |
| Ostar-Ganz .. | G5 .. .. | Heptode .. | 250 | 0.02 | 250 | 75 | 250 | — | —1—30 | 7 | 17/6 |
| Philco .. .. | *6A7 .. .. | Heptode .. | 6.3 | 0.3 | 250 | 100 | 180 | .5 | —3 | A | 10/- |
| Tridtron .. .. | G407 .. .. | Octode .. | 4.0 | 0.65 | 200 | 70 | 70 | 0.6 | — | — | 15/6 |
| Tungsram .. | MH200 .. | Heptode .. | 2.0 | 0.06 | 150 | 75 | 120 | 0.28 | 0—22 | 7 | 15/- |
| | *MH1118 .. | Heptode .. | 10.0 | 0.18 | 200 | 100 | 130 | 0.47 | V.Mu. | 7 | 16/- |
| | *MH4105 .. | Heptode .. | 4.0 | 1.0 | 250 | 100 | 150 | 0.52 | V.Mu. | 7 | 16/- |
| | 2A7 .. .. | Heptode .. | 2.5 | 0.8 | 250 | 100 | 150 | 0.52 | V.Mu. | A | 14/- |
| | 6A7 .. .. | Heptode .. | 6.3 | 0.3 | 250 | 100 | 150 | 0.52 | V.Mu. | A | 14/- |

## DIODE COMBINATION VALVES

| Maker. | Type. | Description. | Fil. volts. | Fil. amps. | Anode volts. | Screen volts. | Triode "M." | Slope mA/V. | Grid volts. | Bias Res. | Anode current. | Output mW. | Base pins. | Price. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cossor | *DD4 .. | DD . | 4.0 | 0.5 | — | — | — | — | — | — | — | — | 5 | 5/6 |
| | *DDT .. | DDT .. | 4.0 | 1.0 | 200 | — | 41 | 2.4 | —3 | 850 | 3.4 | — | 7 | 15/6 |
| | *DD Pen.. | DDP .. | 4.0 | 1.0 | 250 | 200 | — | 2.7 | —1 | —40 | 7.0 | — | 7 | 20/- |
| | *DDT .16 | DDT .. | 16.0 | 0.25 | 200 | — | 40 | 2.5 | —3 | 200 | 16.0 | — | 7 | 15/6 |
| | *13DHA .. | DDT .. | 13.0 | 0.2 | 200 | — | 125 | 1.5 | —1 | — | — | — | 7 | 15/6 |
| Dario .. | *TH444 .. | SD Tetrode | 4.0 | 1.1 | 200 | 33 | — | 3.0 | — | — | 0.4 | — | 7 | 13/6 |
| | TE4 .. | DD .. | 4.0 | 0.65 | — | — | — | — | — | — | — | — | 5 | — |
| | TB13 .. | DD .. | 13.0 | 0.2 | — | — | — | — | — | — | — | — | — | — |
| Ferranti | H2D .. | DDT .. | 2.0 | 0.1 | 150 | — | 20 | 1.3 | —3 | — | 2.0 | — | 5 | 9/- |
| | *H4D .. | DDT .. | 4.0 | 1.0 | 200 | — | 39 | 2.7 | —2 | 500 | 4.0 | — | 7 | 15/6 |
| | *H8D .. | DDT .. | 13.0 | 0.3 | 200 | — | 39 | 2.7 | —3 | 750 | 4.0 | — | 7 | 15/6 |
| | *PT4D .. | DDP .. | 26.0 | 0.3 | 250 | 250 | — | 6.0 | —7½ | 230 | 33.0 | 2,500 | 7 | 21/- |
| | *PT4D .. | DDP .. | 13.0 | 0.6 | 250 | 250 | — | 7.0 | —6 | 180 | 33.0 | 2,500 | 7 | 21/- |
| | *8D .. | DD .. | 4.0 | 0.3 | — | — | — | — | — | — | — | — | 5 | 12/6 |
| Hivac .. | DDT220 | DDT .. | 2.0 | 0.2 | 150 | — | 20 | 1.6 | —3 | — | 2.5 | — | 5 | 7/6 |
| | *AC/DDT | DDT .. | 4.0 | 1.0 | 200 | — | 35 | 2.3 | —3 | 750 | 4.0 | — | 7 | 12/6 |
| | AC/DD | DD .. | 4.0 | 1.0 | — | — | — | — | — | — | — | — | 5 | 8/6 |
| Lissen .. | L2D .. | SDT .. | 2.0 | 0.1 | 150 | — | 18 | 1.5 | —4 | — | 2.0 | — | 5 | 10/6 |
| | L2DD .. | DDT .. | 2.0 | 0.1 | 150 | — | 18 | 1.5 | —4½ | — | 2.0 | — | 5 | 9/- |
| | AVC2 .. | SD Tetrode | 2.0 | 0.15 | 150 | 100 | — | 1.0 | 0 | — | 2.0 | — | 4 | 17/6 |
| | AC/AVC | SD Tetrode | 4.0 | 1.0 | 200 | 150 | — | 2.0 | —1½ | 500 | 3.0 | — | 5 | 20/- |
| Marconi | HD21 .. | DDT .. | 2.0 | 0.1 | 150 | — | 27 | 1.5 | —3 | — | 1.8 | — | 5 | 9/- |
| | HD22 .. | DDT .. | 2.0 | 0.1 | 150 | — | 27 | 1.6 | —3 | — | 1.8 | — | 5 | 9/- |
| | *MHD4 .. | DDT .. | 4.0 | 1.0 | 200 | — | 40 | 2.2 | —3 | 800 | 3.0 | — | 7 | 15/6 |
| | *DHD .. | DDT .. | 16.0 | 0.25 | 200 | — | 40 | 2.7 | —3 | 800 | 3.0 | — | 7 | 15/6 |
| | *DH30 .. | DDT .. | 13.0 | 0.3 | 200 | — | 80 | 4.5 | —2 | 500 | 3.8 | — | 7 | 15/6 |
| Micromesh (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 |
| Mazda | HL21/DD | DDT .. | 2.0 | 0.15 | 150 | — | 32 | 1.5 | —3 | — | 2.5 | — | — | 9/- |
| | L2/DD .. | DDT .. | 2.0 | 0.1 | 150 | — | 16 | 1.0 | —4½ | — | 3.0 | — | 5 | 9/- |
| | L21/DD | DDT .. | 2.0 | 0.15 | 150 | — | 19 | 1.9 | —4½ | — | 3.2 | — | 5 | 9/- |
| | *AC/HLDD | DDT .. | 4.0 | 1.0 | 250 | — | 36 | 2.6 | —3 | 700 | 4.3 | — | 7 | 15/6 |
| | †19DC2/ HLDD | DDT .. | 26.0 | 0.1 | 250 | — | 30 | 3.0 | —3 | 700 | 3.75 | — | 7 | 15/6 |
| | *HLDD 1320 | DDT .. | 13.0 | 0.2 | 250 | — | 30 | 2.0 | —3 | 700 | 3.75 | — | 7 | 15/6 |
| | *AC/ HLDDD | DDD | 4.0 | 1.0 | 250 | — | 35 | 2.7 | —3 | 700 | 4.3 | — | 7 | 16/6 |
| | *AC2/Pen DD | DDP .. | 4.0 | 2.0 | 250 | 250 | — | 8.0 | —5 | 150 | 32.0 | 3,400 | 7 | 21/- |
| | *Pen DD 4020 | DDP .. | 40.0 | 0.2 | 250 | 250 | — | 7.0 | —5 | 150 | 32.0 | 3,400 | 7 | 21/- |
| | *DD020 . | DD .. | 6.0 | 0.2 | — | — | — | — | — | — | — | — | 5 | 5/6 |
| Mullard | TDD2a .. | DDT .. | 2.0 | 0.1 | 150 | — | 30 | 1.4 | —3 | — | 2.0 | — | 5 | 9/- |
| | *2D4 . | DD .. | 4.0 | 0.65 | — | — | — | — | — | — | — | — | 5 (T.O.) | 5/6 |
| | *2D4A .. | DD .. | 4.0 | 0.65 | — | — | — | — | — | — | — | — | 5 | 5/6 |
| | *8D4 . | SD Tetrode | 4.0 | 1.0 | 200 | 100 | — | 3.0 | —1 | 800 | 0.4 | — | 7 | 20/- |
| | *TDD4 .. | DDT .. | 4.0 | 1.0 | 200 | — | 30 | 2.0 | —3½ | 1,000 | 3.5 | — | 7 | 15/6 |
| | †TDD25 . | DDT .. | 20.0 | 0.18 | 200 | — | 30 | 2.0 | —4 | 1,000 | 4.0 | — | 7 | 18/6 |
| | †8D20 . | SD Tetrode | 20.0 | 0.18 | 200 | 100 | — | 3.0 | —1 | 200 | 5.0 | — | 7 | 20/- |
| | *2D13 .. | DD .. | 13.0 | 0.2 | — | — | — | — | — | — | — | — | 8s.c. | 5/6 |
| 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 | 800 | 3.0 | — | 7 | 15/6 |
| | †DHD .. | DDT .. | 16.0 | 0.25 | 200 | — | 40 | 2.2 | —3 | 800 | 3.0 | — | 7 | 15/6 |
| | *DH30 . | DDT .. | 13.0 | 0.3 | 200 | — | 80 | 4.5 | —2 | 500 | 2.8 | — | 7 | 15/6 |

# VALE DATA CHART

| Maker. | Type. | Description. | Fil. volts. | Fil. amps. | Anode volts. | Screen volts. | Triode "M." | Slope mA/V | Grid Volts. | Bias res. | Anode current. | Output mW. | Base pins. | Price |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ostar-Ganz .. | B2 .. | DD .. | 25.0 | 0.02 | — | — | — | — | — | — | — | — | 7 | 17/6 |
| Six-Sixty .. | 210DDT | DDT .. | 2.0 | 0.1 | 150 | — | 16.5 | 1.4 | —3 | — | 2.0 | — | 5 | 9/- |
| | 4DDTAC | DDT .. | 4.0 | 1.0 | 200 | — | 30 | 2 | —3 | 800 | 3.5 | — | 7 | 15/6 |
| Triotron . | B430N .. | SD Tetrode | 4.0 | 1.0 | 200 | 60 | — | 3.0 | —2½ | 800 | 3.0 | — | 7 | 13/6 |
| | B2030N .. | SD Tetrode | 20.0 | 0.18 | 200 | 60 | — | 3.0 | —2½ | 800 | 3.0 | — | 7c | 13/6 |
| | D401 .. | DD .. | 4.0 | 0.65 | — | — | — | — | — | — | — | — | 5 | 4/6 |
| Tungsram . | *DS4101 | SD Tetrode | 4.0 | 1.0 | 200 | 90 | — | 0.7 | —3 | — | 0.8 | — | 7 | 16/- |
| | *DDT4160 | DDT .. | 4.0 | 1.6 | 200 | — | 40 | 3.0 | —2½ | 800 | 3.0 | — | 7 | 12/6 |
| | *DD465 .. | DD .. | 4.0 | 0.65 | 100 | — | — | — | — | — | — | — | 5 | 4/6 |
| | *D418 .. | D .. | 4.0 | 0.18 | 100 | — | — | — | — | — | — | — | 5 | 4/- |
| | *DD818 .. | DD .. | 8.0 | 0.18 | 100 | — | — | — | — | — | — | — | 5 | 4/6 |
| | 55 .. | DDT .. | 2.5 | 1.4 | 250 | — | 8.3 | 1.1 | —20 | 2,500 | 8.0 | — | A | 13/- |
| | 2A6 .. | DDT .. | 2.5 | 1.5 | 250 | — | 100 | 1.1 | —2 | 2,500 | 0.8 | — | A | 12/- |
| | *DP1018 | DDP .. | 10.0 | 0.18 | 250 | 150 | — | 1.3 | —3 | 1,400 | 2.3 | — | A | 16/- |

## DOUBLE OUTPUT VALVES

| Maker. | Type. | Circuit. | Fil. volts. | Fil. amp | Anode volts. | Screen volts. | Average current. | Grid bias. | Power output mW. | Base pins. | Price. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Cossor .. .. | 220B .. .. | Class B .. | 2.0 | 0.2 | 120 | — | 6 | 0 | 1,250 | 7 | 14/- |
| | 240B .. .. | Class B .. | 2.0 | 0.4 | 120 | — | — | 0 | 2,000 | 7 | 14/- |
| Dario .. .. | TB402 .. | Class B . | 2.0 | 0.2 | 150 | — | 7.0 | 0 | 1,200 | 7 | 10/6 |
| Ferranti .. .. | HP2 .. .. | Class B .. | 2.0 | 0.4 | 150 | — | 7.0 | 0 | 2,000 | 7 | 14/- |
| Fotos .. .. | FB12 .. | Class B .. | 2.0 | 0.22 | 150 | — | 7.0 | 0 | 1,200 | 7 | 10/- |
| | FB20 .. | Class B .. | 2.0 | 0.44 | 150 | — | 8.0 | 0 | 2,000 | 7 | 11/- |
| 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 | —9 | 2,000 | 7 | 19/6 |
| Lissen .. .. | BB240 .. | Class B . | 2.0 | 0.4 | 150 | — | 7.0 | 0 | 3,500 | 7 | 14/- |
| | BB240A .. | Class B . | 2.0 | 0.4 | 150 | — | 7.0 | —3 | 3,500 | 7 | 14/- |
| | BB220A .. | Class B . | 2.0 | 0.2 | 150 | — | 5.0 | —3 | 2,500 | 7 | 14/- |
| | QP240 .. | QPP .. .. | 2.0 | 0.4 | 150 | 150 | 5.0 | —15 | 1,500 | 7 | 22/6 |
| 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 | —1 | 2,850 | 7 | 14/- |
| | PD220a .. | Class B .. | 2.0 | 0.2 | 150 | — | 7.0 | —6 | 2,800 | 7 | 14/- |
| | QP240 .. | QPP .. .. | 2.0 | 0.4 | 150 | 150 | 9.0 | —9 | 1,500 | 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 | 1,500 | 7 | 14/- |
| Osram .. .. | 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 |
| Philco .. .. | 19 .. .. | Class B .. | 2.0 | 0.26 | 135 | — | 8 | 0 | 2,100 | A | 14/- |
| | *79 .. .. | Class B .. | 6.3 | 0.6 | 180 | — | 15 | 0 | 5,500 | A | 19/- |
| Triotron .. | E220B . | Class B . | 2.0 | 0.3 | 150 | — | 6.0 | 0 | 1,350 | 7 | 9/6 |
| Tungsram .. | CB220 . | Class B .. | 2.0 | 0.2 | 150 | — | 7.0 | 0 | 2,000 | 7 | 11/- |
| | PX4GB .. | Class B .. | 2.0 | 3.0 | 400 | — | 108 | 0 | 21,000 | 5 | 14/6 |
| | *DG2018 | Class B . | 20.0 | 0.18 | 200 | — | 57 | 0 | 7,000 | 8 | 14/- |
| 362.. .. .. | BA2 .. .. | Class B .. | 2.0 | 0.2 | 150 | — | 5.0 | 0 | 1,500 | 7 | 9/- |
| | BX2 .. .. | Class B .. | 2.0 | 0.4 | 150 | — | 7.0 | 0 | 3,000 | 7 | 9/- |

## H.T. RECTIFYING VALVES

| Maker. | Type. | Fil. volts. | Fil. amps. | Anode volts max. (RMS). | Output mA. | Price. |
|---|---|---|---|---|---|---|
| Clarion .. .. .. | UF4 .. .. | 4.0 | 1.0 | 250 + 250 | 60 | 4/6 |
| | UH4 .. .. | 4.0 | 1.0 | 250 | 40 | 4/6 |
| | *UDP .. .. | 40.0 | 0.18 | 350 + 350 | 100 | 4/6 |
| | *UDH .. .. | 20.0 | 0.18 | 250 | 60 | 4/6 |
| Cossor .. .. .. | 506 BU .. . | 4.0 | 1.0 | 250 + 250 | 60 | 12/6 |
| | 442BU . .. | 4.0 | 2.5 | 350 + 350 | 120 | 15/- |
| | 460 BU .. | 4.0 | 2.5 | 500 + 500 | 120 | 20/- |
| | *40SUA .. .. | 40.0 | 0.2 | 250 | 75 | 12/6 |
| Dario .. .. .. | SW1 .. .. | 4.0 | 1.0 | 400 | 60 | 6/6 |
| | PW1 .. .. | 4.0 | 1.0 | 250 + 250 | 60 | 7/6 |
| | PW2 .. .. | 4.0 | 1.0 | 350 + 350 | 120 | 9/6 |
| | PW3 .. .. | 4.0 | 2.0 | 500 + 500 | 120 | 12/- |
| | *TW1 .. .. | 20.0 | 0.2 | 250 | 75 | — |
| Ferranti .. .. .. | R4 .. .. .. | 4.0 | 2.5 | 350 + 350 | 120 | 15/- |
| | R4a .. .. .. | 4.0 | 2.5 | 500 + 500 | 120 | 20/- |
| | *R8 .. .. .. | 20.0 | 0.3 | 250 | 75 | 12/6 |

**EIGHT OUT OF TWELVE USE**

| Maker | Type. | Fil. volts. | Fil. amps. | Anode volts max. (RMS). | Output mA. | Price. |
|---|---|---|---|---|---|---|
| Hivac | UU 120/350 | 4.0 | 2.5 | 350 + 350 | 120 | 10/- |
| | UU 120/500 | 4.0 | 2.5 | 500 + 500 | 120 | 15/- |
| Lissen | UU 41 | 4.0 | 1.0 | 300 + 300 | 80 | 12/6 |
| | UU 42 | 4.0 | 2.5 | 350 + 350 | 120 | 15/- |
| | UU 43 | 4.0 | 2.5 | 500 + 500 | 120 | 20/- |
| | *U 16 | 16.0 | 0.25 | 300 | 40 | 12/6 |
| | U 650 | 6.0 | 0.5 | 300 | 40 | 12/6 |
| Marconi | U 10 | 4.0 | 1.0 | 250 + 250 | 60 | 12/6 |
| | U 12 | 4.0 | 2.5 | 350 + 350 | 120 | 15/- |
| | *MU 13 | 4.0 | 2.5 | 350 + 350 | 120 | 15/- |
| | U 14 | 4.0 | 2.5 | 500 + 500 | 120 | 20/- |
| | *MU 14 | 4.0 | 2.5 | 500 + 500 | 120 | 20/- |
| | *U 30 | 26.0 | 0.3 | 250 + 250 (VD) | 120 | 15/- |
| | GU 1 | 4.0 | 3.0 | 1000 | 250 | 25/- |
| Mazda | *UU 2 | 4.0 | 1.0 | 250 + 250 | 60 | 12/6 |
| | *UU 3 | 4.0 | 2.0 | 250 + 250 | 60 | 12/6 |
| | UU 120/350 | 4.0 | 2.5 | 350 + 350 | 120 | 15/- |
| | UU 120/500 | 4.0 | 2.5 | 500 + 500 | 120 | 20/- |
| | *UU 4020 | 40.0 | 0.2 | 250 + 250 | 75 | 12/6 |
| | *U 4020 | 40.0 | 0.2 | 250 | 75 | 12/6 |
| | OR 2 | 2.0 | 1.0 | 1000 | 10 | 15/- |
| | MU 1 | 4.0 | 2.4 | 1500 | 150 | 25/- |
| Micromesh | R 1 | 4.0 | 1.0 | 250 + 250 | 60 | 12/6 |
| | R 2 | 4.0 | 2.3 | 350 + 350 | 120 | 15/- |
| | R 3 | 4.0 | 2.5 | 500 + 500 | 120 | 20/- |
| | IA 7 | 4.0 | 2.3 | 350 + 350 | 120 | 15/- |
| (Brimar) | *ID 5 | 40.0 | 0.2 | 250 | 75 | 12/6 |
| Mullard | DW2 | 4.0 | 1.0 | 250 + 250 | 60 | 12/6 |
| | DW 3 | 4.0 | 2.0 | 350 + 350 | 120 | 15/- |
| | DW 4 | 4.0 | 2.0 | 500 + 500 | 120 | 20/- |
| | *IW 2 | 4.0 | 1.2 | 250 + 250 | 60 | 12/6 |
| | *IW 3 | 4.0 | 2.4 | 350 + 350 | 120 | 15/- |
| | *IW 4 | 4.0 | 2.4 | 500 + 500 | 120 | 20/- |
| | *UR 1 | 20.0 | 0.2 | 250 | 75 | 12/6 |
| | *UR 2 | 30.0 | 0.2 | 250 + 250 | 120 | 15/- |
| Osram | U 16 | 4.0 | 1.0 | 250 + 250 | 60 | 12/6 |
| | U 12 | 4.0 | 2.5 | 350 + 350 | 120 | 15/- |
| | *MU 13 | 4.0 | 2.5 | 350 + 350 | 120 | 15/- |
| | U 14 | 4.0 | 2.5 | 500 + 500 | 120 | 20/- |
| | *MU 14 | 4.0 | 2.5 | 500 + 500 | 120 | 20/- |
| | *U 30 | 26.0 | 0.3 | 250 + 250 (VD) | 120 | 15/- |
| | GU 1 | 4.0 | 3.0 | 1000 | 250 | 25/- |
| Ostar-Ganz | *EG 50 | 250 | 0.02 | 250 | 50 | 12/- |
| | *EG 100 | 250 | 0.02 | 250 | 120 | 14/6 |
| | *NG 50 | 150 | 0.04 | 150 (VD) | 50 | 22/6 |
| | *NG 100 | 150 | 0.04 | 150 (VD) | 100 | 24/- |
| Philco | 80 | 5.0 | 2.0 | 550 + 550 | 135 | 8/- |
| | 81 | 7.5 | 1.25 | 700 | 85 | 20/- |
| | 82 | 2.5 | 3.0 | 500 + 500 | 125 | 11/- |
| | *84 | 6.3 | 0.6 | 225 + 225 | 50 | 12/6 |
| | *12Z3 | 12.6 | 0.3 | 230 + 230 | 60 | 12/- |
| | *25Z5 | 25.0 | 0.3 | 230 + 230 | 100 | 14/6 |
| | *5Z3 | 5.0 | 3.0 | 500 + 500 | 250 | 11/- |
| Philips | 1801 | 4.0 | 0.6 | 250 + 250 | 30 | 12/6 |
| | 1821 | 4.0 | 1.0 | 250 + 250 | 60 | 12/6 |
| | 1807 | 4.0 | 2.0 | 350 + 350 | 120 | 18/- |
| | 1561 | 4.0 | 2.0 | 500 + 500 | 120 | 20/- |
| | 586 K | 4.0 | 1.0 | 300 + 300 | 75 | 20/- |
| | 1560 | 5.0 | 2.0 | 300 + 300 | 125 | 22/6 |
| | 1817 | 4.0 | 4.0 | 350 + 350 | 300 | 50/- |
| | 378 | 4.0 | 1.0 | 220 | 40 | 15/- |
| | 505 | 4.0 | 1.0 | 400 | 60 | 15/- |
| | 1562 | 7.5 | 1.25 | 750 | 110 | 35/- |
| Pix | 40/250 | 4.0 | 0.6 | 250 + 250 | 40 | 8/6 |
| | 500 | 4.0 | 1.0 | 300 + 300 | 60 | 12/6 |
| | 120/500 | 4.0 | 2.0 | 500 + 500 | 120 | 15/6 |
| Six-Sixty | W 402 | 4.0 | 1.0 | 250 + 250 | 40 | 12/6 |
| | W 120/350 | 4.0 | 2.0 | 350 + 350 | 120 | 15/- |
| | W 120/500 | 4.0 | 2.0 | 500 + 500 | 120 | 20/- |
| | W 60/250 | 4.0 | 2.0 | 250 + 250 | 60 | 12/6 |
| | *IH 60/250 | 4.0 | 2.0 | 250 + 250 | 60 | 12/6 |
| | *IH 120/350 | 4.0 | 2.0 | 350 + 350 | 120 | 15/- |
| | *IH 120/500 | 4.0 | 2.0 | 500 + 500 | 120 | 20/- |
| Triotron | G 429 | 4.0 | 0.3 | 250 | 30 | 6/- |
| | G 431 | 4.0 | 0.6 | 250 + 250 | 30 | 6/6 |
| | G 470 | 4.0 | 1.0 | 300 + 300 | 75 | 7/6 |
| | G 4120 | 4.0 | 2.0 | 500 + 500 | 120 | 12/6 |
| | G 4120 N | 4.0 | 2.0 | 500 + 500 | 120 | 12/6 |
| | *G 3070 | 30.0 | 0.18 | 250 | 70 | 9/6 |
| | *G 3412 | 33.0 | 0.18 | 250 (VD) | 60 | 10/6 |
| Tungsram | V 495 | 4.0 | 1.1 | 500 | 100 | 6/- |
| | PV 495 | 4.0 | 1.1 | 300 + 300 | 70 | 10/- |
| | PV 4201 | 4.0 | 2.0 | 600 + 600 | 180 | 15/- |
| | *APV 4208 | 4.0 | 2.0 | 350 + 350 | 120 | 12/- |
| | *V 2180 | 20.0 | 0.18 | 250 | 35 | 10/- |
| | *V 2118 | 20.0 | 0.18 | 250 | 70 | 10/- |
| | *PV 4018 | 40.0 | 0.18 | 220 (VD) | 100 | 10/- |
| | *PV 3018 | 40.0 | 0.18 | 250 (VD) | 100 | 10/- |
| | 81 | 7.5 | 1.25 | 750 | 110 | 17/6 |
| | 80 | 5.0 | *2.0 | 300 + 300 | 125 | 7/- |
| | 25Z5 | 25.0 | 0.3 | 125 + 125 | 100 | 13/- |
| 362 | RB 41 | 4.0 | 1.0 | 300 + 300 | 50 | 7/6 |
| | RB 42 | 4.0 | 2.0 | 500 + 500 | 100 | 10/- |

# VALVE DATA CHART

## BARRETTERS

| Maker. | Type. | Current (amps.). | Voltage range. | Base. | Price. |
|---|---|---|---|---|---|
| Marconiphone .. .. | 251 | 0.25 | 100–180 | 4-pin | 12/6 |
| | 301 | 0.3 | 140–220 | E.S. | 12/6 |
| Osram .. .. .. .. | 251 | 0.25 | 100–180 | 4-pin | 12/6 |
| | 301 | 0.3 | 140–220 | E.S. | 12/6 |
| | 302 | 0.3 | 115–200 | E.S. | 12/6 |
| | 303 | 0.3 | 86–129 | E.S. | 12/6 |
| Philips .. .. .. .. | 1904 | 0.1 | 35–80 | 4-pin | 12/6 |
| | 1933 | 0.1 | 50–160 | 4-pin | 15/0 |
| | 1927 | 0.18 | 40–130 | 4-pin | 12/6 |
| | 1928 | 0.18 | 100–220 | 4-pin | 12/6 |
| | C2 | 0.2 | 40–100 | Mullard 8 S.C. | 12/6 |
| | C1 | 0.2 | 85–225 | Mullard 8 S.C. | 15/0 |
| | 1920 | 0.25 | 35–75 | 4-pin | 12/6 |
| | 1934 | 0.25 | 85–100 | 4-pin | 15/0 |
| | 1941 | 0.3 | 110–240 | 4-pin | 15/0 |
| | 1909 | 0.62 | 10–50 | 3-pin | 12/6 |
| | 1331 | 1.5 | 10–45 | 4-pin | 6/0 |

## METAL RECTIFIERS—H.T. TYPES

| Maker. | Type. | Max smoothed D.C. output. | | Max. current output (mA). | Maximum A.C. Input. | | | | Condensers. | | Price. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Half-wave. | | Voltage-doubler | | Capacity of each (volt-doubler). | Working voltage D.C. | |
| | | Volts. | mA. | | Volts. | mA. | Volts. | mA. | | | |
| Westinghouse .. | H.T. 5 | 120 | 20 | 30 | 135 | 30 | 80 | 60 | 4 mfd. | 200 | 12/6 |
| | H.T. 8 | 250 | 60 | 60 | 375 | 90 | 200 | 200 | 4 mfd. | 350 | 18/6 |
| | H.T. 9 | 300 | 60 | 60 | — | — | 240 | 200 | 4 mfd. | 400 | 21/0 |
| | H.T. 10 | 200 | 100 | 100 | 250 | 150 | 150 | 300 | 8 mfd. | 250 | 21/0 |
| | H.T. 11 | 500 | 120 | 150 | — | — | 300 | 550 | 6 mfd. | 500 | 35/0 |
| | H.T. 12 | 200 | 80 | 40 | 250 | 80 | 140 | 120 | 4 mfd. | 200 | 17/6 |
| | H.T. 13 | 150 | 25 | 40 | 150 | 40 | — | — | Res. condenser 8 mfd. | 350 | 17/6 |

## WESTECTORS

| Maker. | Type. | Class. | Max. safe input voltage. | Max. current output. | Price. |
|---|---|---|---|---|---|
| Westinghouse .. .. | W.4 | Half-wave | 24V peak carrier | 0.25mA | 7/6 |
| | W.6 | Half-wave | 36V peak carrier | 0.25mA | 7/6 |
| | WX.6 | Half-wave | 36V peak carrier | 0.1mA | 7/6 |
| | WM.24 | Full-wave, centre tapped | 24V each side of C.T. | 0.5mA | 10/0 |
| | WM.26 | Full-wave, centre tapped | 36V each side of C.T. | 0.5mA | 10/0 |

# SALES LETTERS

## 52 Suggestions for Circulars — One a Week for a Year

The busy dealer who wishes to circularise the public in his district has difficulty sometimes in finding time to compose a suitable letter. He may also have trouble in finding a suitable subject.

The draft letters in the following pages have been prepared with the idea of helping him. As this is an ANNUAL, there are fifty-two suggestions—one per week for a year, if necessary.

The letters are arranged in alphabetical order under their titles. The dealer who wants an idea for, say, an H.P. letter, or one dealing with Records, can quickly find what he wants.

At the same time, the retailer who simply wants an idea can just look over the titles and pick out what appeals to him.

Dealers are expected to use the draft letters as suggestions and to adapt them to their own purposes. It would not be possible, of course, to provide "ready-to-wear" circulars which did not need slight alteration to make them fit.

A number of the letters could be used almost as they stand for the copy of a Press advertisement, and many dealers may find them useful in this way.

There are ideas among them, too, which will suggest windows to the man who is looking for display ideas.

Any retailer who cannot find what he wants here is welcome to get in touch with THE BROADCASTER SERVICE BUREAU, which is always ready to help subscribers with their circular letters.

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**Accumulator "Spring Clean."**

DEAR SIR,—We have carefully examined your battery, and though it is wearing well—one of the advantages of having it correctly charged at regular intervals—we would recommend that you have it "spring-cleaned" next time it is charged.

The cost of this is only nominal, —— pence, but it is well worth while.

Spring-cleaning other parts of a radio installation also pays well. If you think your reception is not quite up to the original standard, why not let us overhaul it?

Think about it, and when we next deliver your accumulator, we will ask your decision.

P.S.—If it is urgent, you can telephone us or call personally and have the trouble dealt with straight away.

**Advertisement Follow-up.**

DEAR SIR,—There is so much more one can say in a letter than in an advertisement that I am writing to you direct, although I daresay you have noticed my announcements in the local paper each week.

Advertisements are rather impersonal and they have to compete for your interest against a lot of other matter.

It is because I think your personal interest is worth competing for that I am writing this. I want to say that everything in my advertisements applies especially to you.

I stock all the best radio receivers, and frankly I want to sell you one. If you would like to buy one, or are even considering it, please may I bring one along to your home and leave it for the evening?

Then if you like it, keep it and buy it. Or if you don't, I'll take it away. But I'm sure you'll like it.

**Bargain Entertainment.**

DEAR MADAM,—Most shops have bargains to offer now and again. But I have bargains all the time. Just look over the table below and you will see what I mean.

| | s. | d. |
|---|---|---|
| One hour at a kinema costs ... ... | 0 | 6 |
| One hour at a football match costs ... | 1 | 0 |
| One hour at a concert costs ... ... | 1 | 6 |
| One hour with a magazine costs ... | 0 | 6 |
| One hour's motoring costs ... ... | 2 | 6 |
| One hour's dancing costs ... ... | 2 | 6 |
| One hour's Radio costs only ... ... | 0 | 2 |

That is why I am confident in saying a new radio set, by making your listening so much more enjoyable, might easily save you money.

It is a point worth considering. Come and see our new sets and think it over. And as for paying for this economy, well our hire-purchase terms are very reasonable.

**Bargains for Regular Customers.**

DEAR SIR,—You'll have first choice of the non-proprietary and second-hand bargains on the enclosed list if you call Saturday. None of them will be put on show until Monday.

Every article is guaranteed to be in perfect working order—if it isn't, you get your money back. Some things are new, and second-hand and shop-soiled stuff is plainly marked.

Nothing on the list can be repeated, so come along to-morrow and take your pick while you can.

P.S.—If you want to know more about something on the list, call and examine it. I shan't try to sell you anything you don't want.

**Better Charging.**

DEAR SIR,—When a lady goes to the butchers, she can check whether she is getting full value by watching the scales or weighing the meat when she gets home.

But it is no use weighing an accumulator to see if it is properly charged. It takes a month or two to show if a battery is properly handled, although

## SALES LETTERS

of course, you can see in a week if your battery is undercharged.

A badly-handled accumulator wears out much more quickly than one that is properly looked after, so you see it pays to go to a reliable man.

I think you will agree that if a battery-charging business grows steadily without any such inducements as cut-prices being offered to customers, it proves that the service is reliable.

My business has grown in this way but I am still in a position to charge accumulators for a number of extra people. I should very much like you to be one of these, so why not bring in your battery for a trial charge ?

**Battery Delivery.**

DEAR SIR,—There is no need now for you to carry that heavy accumulator to a shop to have it charged. If you will just let us know by 'phoning, calling personally or by means of the enclosed postcard, we shall be pleased to collect your battery at any time you wish, and when it is recharged deliver it ready for use to your door.

I would like to point out by the way, that a badly handled accumulator wears out much more quickly than one that is properly looked after.

So you see it pays to go to a reliable man, and as I am specialising in battery recharging I think I can claim to be able to deal efficiently with your battery if you will give me a trial.

**Canvassers and New Sets.**

DEAR SIR,—Now that winter has arrived it is no longer possible to play tennis or amuse oneself in the open air.

Of course, there is dancing, the theatre and the kinema—but one does not always wish to be out.

Then it is that a radio set shows its real worth —for a set is many forms of entertainment rolled into one.

You can dance to a radio set, or it will provide you with vaudeville, plays, opera, news, and a hundred other interesting things.

If you are thinking about getting a new radio set, you are welcome to come and look over my stock of 1935 models. I shall not pester you to buy. Alternatively I will personally demonstrate one in your own home, if you wish.

Perhaps your existing set needs seeing to. I have a fully equipped department for this kind of work.

One of my representatives will be in your district shortly. If any of these ideas appeal to you he will be glad to give you further information on any points.

**Christmas Reminder.**

Just a reminder, Sir ! To-morrow is Christmas Eve. Is everything connected with your wireless set all right ? Accumulator and high tension batteries fresh ? What about an extension speaker for the other room ? And some more flex ?

If you like we can turn your set into a radio-gramophone by the addition of a playing desk which will allow you to hear records via the loud-speaker. Or if you are already equipped for gramophone music, what about one or two of the jolly new Christmas records ? Drop in and let us play some of them over to you.

We shall be open till ten to-night, and ten-thirty to-morrow—but please don't leave it till the last minute.

With sincere good wishes for a Merry Christmas and a Prosperous New Year.

**Christmas Set Sales.**

DEAR SIR,—Being a busy man, you know the mental anguish—it almost amounts to that—of thinking out what gift to buy for each member of the family at Christmas.

The job is easy enough for a woman who likes shopping, but it is certainly an ordeal for the average man.

The solution is for him to buy something to please everyone—one gift for the whole family.

A radio set, a gramophone or a radiogram answer this purpose admirably, and they not only give pleasure at Christmas, but all the year round.

If this idea appeals to you, call in at our showrooms and look over our big stock of 1935 models. Alternatively let us send a man to demonstrate a set in your own home.

But don't leave it too long. Christmas is coming.

**Customers' Friend.**

DEAR SIR,—I will be perfectly frank with you, I have been asking my customers for the names and addresses of friends who they know have not got radio sets.

One of them—you will appreciate that I cannot mention any names—has put me on to you.

" I am willing to try anything once ; " probably you have said this many times, and now I would like to take you at your word with regard to radio.

May I bring along one of the latest sets and demonstrate it in your home ? If you will tell me some of the kinds of music you are interested in, I will pick out a special broadcast for you.

I promise not to pester you to buy, but out of fairness to yourself I think you ought to hear one of the new sets. What about it ?

**D.C.—A.C. Changeover.**

DEAR SIR,—If you were thinking of getting a new radio set, you have probably been wondering what you can do about the recent announcement that the electricity in this district is shortly to be changed from D.C. to A.C.

Well, there is no need to give up the idea, although I would not advise you to get a D.C. mains set because it would be no use, of course, when the change comes.

Battery-driven sets are one solution, but the best idea is a universal set which will run off either A.C. or D.C. mains of any standard voltage. One of these sets would give you the benefit of mains reproduction now and would work just as well after the changeover. In addition, if you moved or went away to stay, it would suit any district you went to providing there was electricity there.

As you know, the actual date of the change is very indefinite. But I can definitely demonstrate one of these universal sets any night you like. What about some time next week ?

**Electricity Coming to the District.**

DEAR SIR,—Very shortly now, as you know, —— will be a modern electrified town. How does this affect you ?

Well, apart from the fact that you will be able to equip your house with electric light, there is the question of radio. The advantages of mains radio in brief are that no battery or accumulator is necessary, the reproduction is the best possible, upkeep costs are very low, and radio can always be had at the touch of a switch.

A wide selection of the best mains sets are available for your inspection at any time at our showrooms. And you can come and see and talk about them without obligation. Alternatively, we can arrange a demonstration for you in your own home if you are already on the mains.

The electrification of —— is a big opportunity for you to have the set you want. When may we hear from you, please ?

**Enquiry Through Makers.**

DEAR SIR,—When you recently wrote to (name of manufacturer), besides sending you the information you asked for, this firm got into touch with us—their local agents.

They said they wanted to be certain you had been given all the information you required, and asked us to make sure.

Is there anything further you want to know ? Catalogues can tell you a lot, but the best way is to see a thing.

Without bothering whether you buy or not, it would be a great pleasure for us to give you a demonstration.

You are welcome to come into the shop and

ask for one whenever you like. Or if you will let us know the instrument you are particularly interested in, we will arrange a demonstration in your own home.

May we hear from you please ?

**Entertainment Club.**

DEAR SIR,—The happy entertainment radio or gramophone can bring—of course you want it. What you do not want is a hole in your pocket as a result of the purchase.

This is why our Home Entertainment Club has been formed—to enable you to promise yourself the Christmas present you want and know that you will not miss the money.

On becoming a member of the Entertainment Club you choose the set, gramophone, radiogram, records or whatever you want. Particulars of these are then placed on our special register and you are given a Payment Card.

Odd sixpences and shillings are paid in on this card from time to time so that at Christmas you have very little if anything to pay. If there is anything to pay, we can always arrange easy terms.

The sooner you enrol the better, for you will have more money in the club when the time comes if you join early.

We are giving a special extra present to everyone who enrols early. Don't miss this. Why not come in to-morrow and talk this idea over with us. And if you have any radio problems, bring them in at the same time—we are always pleased to give free advice.

**Exhibition Follow-up.**

DEAR SIR,—The Radio Show at —— is ending, and leaves you wondering which of the new goods are suitable for this district, so we have prepared a special display of new lines all suitable for this district and chosen with careful attention to local needs.

If you saw a set at the Exhibition, or heard about one, or have seen it in an advertisement and want to know more about it, please come along and examine it. You will not be bothered about buying anything. If you have any friends who are interested in radio, please bring them along too.

And, by the way, if you are thinking of buying a set, the terms this year are just a attractive as the instruments themselves—very reasonable, in fact.

**Extension Speakers.**

DEAR SIR,—Everyone knows how inconvenient it is to have the radio set in one room when one wants to listen in another. Yet it is not always possible or desirable to move the receiver from room to room.

As a solution to this problem I would like to suggest that you treat yourself to an extension speaker. Some of my customers have even gone to the extent of having half-a-dozen speakers in different rooms so that they can listen almost anywhere.

Why not try one extra speaker for a start in the bedroom, the kitchen, or the dining-room ? If you wish I can loan you an instrument to see how you like the idea.

Extension speakers make it possible to get much more value from your radio. I am sure you will like the idea if you try it. But borrowing a speaker will put you under no obligation.

**Family Radio at Christmas.**

DEAR SIR AND MADAM,—With all the good things you are buying for December 25 you are certain to have just as merry a Christmas as we could wish you. And we do wish you a very merry one.

But what about afterwards ? Christmas boxes that have turned to *empty* boxes are so plentiful on Boxing Day. Chocolate boxes with no "chocs.", cigarette boxes with no "fags," bottles from which the spirit has departed.

That is why we are suggesting a "No Regrets" present for the whole family—something which will last and give enjoyment for months and years to come.

You have guessed we mean a radio set, because you know we sell them. But we are making this suggestion quite honestly and without being biased too much by the fact that we are rather depending on you to help pay for our turkey !

But, joking apart, radio gives lasting enjoyment for the whole family. If you can drop in during the coming week, we will show you how inexpensively the whole business can be arranged —and how really good the modern receiver is.

**Goodwill Follow-up to a Complaint.**

DEAR SIR,—Please accept my apologies for the annoyance you were caused by the trouble you had with your . . .

I am just as annoyed as you were. More so. Because, apart from the fact that I want to please you personally, I must admit that a satisfied customer is the best publicity a shop can have. What is more, every service call I make costs me money, without bringing anything (or "and only brings very little" *if a service charge has been made*) in return.

How is the —— behaving now ? Are you fully satisfied ? It should last you for at least . . .

I dislike complaints, for they reflect on my good name and service. I am proud to say they are few ; when they come, as yours did, I try to do the right thing.

Since you called, some very good new records (*or other apparatus, such as extension speakers*) have come in. Why not drop in and let me know how the . . . is going, and hear one or two at the same time.

**Gramophones and Radiograms.**

DEAR SIR,—You have probably often wished at the end of some particularly tuneful item in the evening's programme that you could hear it again whenever you wanted to.

Well, a gramophone gives you that power. It will give you command performances all your own, for your favourite orchestras, singers and humorists have all recorded their best selections.

You can mingle gramophone and wireless to make a programme exactly to your personal taste and mood.

There are three ways of doing this. You can buy a radio-gramophone (we have some in stock at only £ . . . ) ; you can add a playing desk to your radio set and listen to records from your loudspeaker (£ . . . to £ . . . ) ; or you can have a portable acoustic gramophone which will do also for the garden and picnics in summer.

Come and listen to all three and see which you would like.

**H.P. and Income Tax.**

DEAR SIR,—In view of the fact that the Tax Collector is prowling around just now, may I suggest to you an inexpensive form of entertainment—and an inexpensive way of paying for it ?

Even if you have not got a set, you do not want me to go into a lot of details about what radio provides. The B.B.C. broadcasts two alternative programmes for about twelve hours a day—good stuff, too.

A new set will enable you to get a lot of extra enjoyment from this, and will help you save money on other forms of more expensive entertainment.

As for the money side, a receiver costs only a few pence weekly to run, and you can get one for as little as . . . shillings down and monthly instalments of only . . .

Now, what form of entertainment gives better value than that ?

**Holidays and Children.**

DEAR SIR,—A teacher told me the other day that after the long summer holidays, it takes a week or two to get children back into the hab it of concentrating easily on their work.

"If only they could do half-an-hour's study every day or so through the holidays," he said, "things would be ever so much easier for them, and for the teachers, too, when the new term began."

Of course, nobody wants to make children do ordinary homework during holidays, but a little concentration everyday would certainly seem a good idea. And if we only realised it, radio provides the excuse for it. There is much even

## SALES LETTERS

in grown-up programmes that children can and will listen to. Radio never needs censoring, and it is real education, very often.

So if you have not got a set, might I suggest you think this idea over. And if you already possess one, why not a special inexpensive receiver for the children? You will not need an extra licence, you know.

**Holiday Overhauls.**

DEAR SIR,—When they return from holidays, many people find that their radio batteries have run down and the set is not working.

This, of course, is easily avoided by leaving the battery with your dealer to be charged and returned the day you come home. If your set is a battery receiver, may I suggest you do this when you go away this year?

A still better idea—and this applies whether your set is battery or mains driven—is to leave the complete receiver with your retailer for overhaul while you are on holiday.

We have arranged to do this for our customers this year, and the service is proving very popular. We collect, overhaul, and redeliver for an inclusive sum of 00s. Batteries are charged at our usual rates. Of course, no repairs which will cost more than the usual overhaul fee will be executed without your seeing an estimate first.

Will you please post us the enclosed card now, telling us when we may collect your receiver and when to redeliver it? Thank you.

**Home Constructors.**

DEAR SIR,—Many wise people at the moment who are anxious to do something towards getting a new radio do not want to commit themselves to pay out regular sums on an instalment purchase.

Nor do they desire to pay cash. What can they do?

My suggestion is that they buy the new set by instalments, instead of paying for it by instalments. In other words, that they pay cash each week for some small part, and have also the pleasure of building the instrument themselves.

This is quite possible, even for the least technically minded. A man with any knowledge of radio will glory in it. How does the idea appeal to you? If you would like to discuss it further, please come and see me at any time to suit yourself.

P.S.—One or two of my customers, who prefer to buy a "ready-made" set, have adopted the idea of getting one by paying in weekly sums before actually buying it. This certainly relieves the drain on the pocket when the time comes.

**Housewives Need Radio.**

DEAR SIR,—The average housewife is on her feet nearly all day, and a little wireless and armchair indolence does her good. That is what one of the papers said the other day, and I am sure you will agree.

An intelligent woman needs something to think about besides housework. She does not get the chance of meeting so many people every-day as we men do. Radio helps her to keep broadminded. And it helps her to be bright and cheery when we come home.

How is the radio in your home? Is it providing the lady of the house with the tonic that it should? Or is it a nuisance because it is old or needs repairing?

If it needs an expert's tender care, or if you are thinking about getting a new set, look in and see us. You will earn a lady's blessing and probably enjoy your listening more yourself, too.

**Leaflets and Offering Demonstration.**

DEAR SIR,—Whether you have a wireless set or not, you are sure to be interested in the marvellous things the new 1935 receivers will do.

Probably you have not time to come in and see these at my shop, so I am sending you some literature about those which are most suitable for this district.

You may not be wanting a new set just now, but that is no reason why you should not look through these leaflets.

Some day you are almost certain to require a set, and I would like you to know as soon as possible about these 1935 instruments. If there is one which particularly interests you, please let me demonstrate it in your home.

Honestly I think it will be worth your while to hear one. So do please try to spare me a few moments. Can you make it next week?

**Leaflets Follow Up.**

DEAR SIR,—You may remember that I wrote you a short while ago, enclosing some pamphlets describing 1935 sets and suggesting a demonstration.

I have not yet heard from you and I want to make it quite clear that if you accept this invitation you will be under no obligation.

You would enjoy listening to one of the modern receivers in your own home, I feel sure. So I am repeating the invitation.

No matter at what time you would like a demonstration, I will willingly fix it up.

Call in and let me know, or send a postcard, sometime this week.

**Lonely Housewives.**

DEAR SIR,—If you have ever spent a day at home alone during the week, you will begin to understand what a lonely kind of life the average housewife leads.

Even if she does meet anyone, it is generally only a neighbour or one of the tradespeople.

This may or may not apply to the lady of your house. Probably it does. So why not get her a radio set to provide her with music and a little company in the lonely hours while you are away?

Suggest it to her. And if she likes the idea, perhaps both of you would like to come along to the showrooms and look at the large selection of instruments we have. There will be no obligation involved.

Alternatively, we can send a set round for you to test in your own home. When may we hear from you please?

**New Branch.**

DEAR SIR,—Have you seen the new radio shop just opened at . . . . ?

Dealing at a new shop is sometimes risky, but this is a business which has been established for . . . years. Your (name of district where other branch is) friends will tell you about our branch there. The success of that shop is one reason for opening the new branch here.

We are giving the same service here. We have a full stock of radio and are agents for . . . We charge accumulators carefully at reasonable rates.

When you come along to see us we are going to make a special effort to serve you well, because not only has this shop to establish a good reputation, but it has to maintain that established by the other branch.

Confidentially, there is a little rivalry between the two branches also, so please visit us as soon as you can.

**New House Occupiers.**

DEAR MADAM,—Naturally in your new home you want everything to be in keeping. And if you can spare me a moment, I would like to pass on to you a tip or two about radio—for you must have a radio set, mustn't you?

It is not easy to listen enjoyably to noises which come from something which irritates the eyes. So you will be glad to hear that it is possible to have your radio just as much a part of the furnishing scheme as your curtains or your lamps.

Receivers which will satisfy the technical demands of any man are now available in the most attractive cabinets. There are plain sets in oak and walnut, and period sets too. There are instruments with maple and ebony inlays.

There are black bakelite and polished chromium receivers, and others finished in all sorts of soft pastel shades of moulded cabinets. There are sets in unpolished woods which look lovely with light furniture.

If you are looking for a set to match a room, please come and look at our stocks. I shall be delighted to bring any of them along for you to see how they fit in—and you can hear them at the same time.

**New Management.**

DEAR SIR,—You may have noticed that what was ——'s shop in the High Street (or wherever it is) has changed hands. May I introduce to you the new manager—Mr. ——.

You'll find that he really does know something about radio. He ought to, for he's been at it . . . years.

If you have been one of the friends of this shop in the past, you shall receive the attention due to an old customer. On the other hand, if you have a grouse against this business (though it is hardly likely), please come along and let us clear things up.

You may be having trouble with your set at the moment. If you are, why not give the new manager the opportunity to prove his ability?

Anyway, call in and make his acquaintance next time you are passing.

**New Sets for Old Listeners.**

DEAR SIR,—Some people have an infallible instinct for picking winners, consequently when they have a radio set, it lasts for years with very little attention at all.

They are lucky in one way, these people. But in another way they are not. They get faithful service from a set, but they seldom trouble to hear a new receivor because their old one keeps on working.

I am wondering whether you are one of these people who pick winners. If you are and would like to compare the reproduction of a 1936 receiver with your own, I shall be pleased to help.

Call at the shop, or write and say what kind of set you would like to hear and I will send it along and give you a thorough demonstration any time you like. What about trying this experiment next week?

**Non-Listeners.**

DEAR SIR,—Do you know what you are missing by not having a radio set?

Please forgive me for asking such an impertinent question. Although I listen to radio all day and every day, I am so enthusiastic about it I hate to think some people seldom hear one note of it.

If you can spare a moment to look at the enclosed page from the "Radio Times"—the official programme paper of the B.B.C.—you will almost certainly see something you would like to have heard.

Would you like to have a "sample listen" one evening? I can easily lend you a set without any obligation on your part.

You can get in touch with me by writing telephoning, or calling. When may I expect to hear from you? There are some very good programmes in the next few days.

**November and Fog.**

DEAR SIR,—Foggy days are coming; days when reaching the office is nearly a morning's work, when getting home may take half the afternoon.

When this is so, what is the use of trying to get to a theatre in the evening? What is the use of trying to find your way round a golf course on Saturday or Sunday? Even in the ten minutes' walk to the kinema, you may easily get lost three times!

The only things that do not get lost out of doors this weather are ether waves. They find their way as quickly and safely as ever from the broadcasting station into your home.

That, in a nutshell, is the solution of the foggy weather entertainment problem—a radio set. Sit at home by your fire and enjoy music and song in comfort. I shall be pleased to demonstrate any of the latest sets in your home if you care to call, 'phone, or drop me a postcard saying when I may bring one along.

**P.A. for Local Dances.**

DEAR SIR,—If you are running a dance or social any time this year, how would you like to have Roy Fox and his Band, or Jack Hylton and his Boys playing for you?

This is not really so impossible as it sounds. You can have all the best artists if you employ a "Radio Orchestra."

The tunes on the best gramophone records, when reproduced by a first-class public address equipment are ideal for dancing. Very often, too, a "Radio Orchestra" is cheaper than an actual band.

So if you are running a dance this year may I quote you a figure for bringing along all the best dance bands to provide the music? Please write, or 'phone, or call and talk the matter over without obligation at any time to suit yourself.

**P.A. in Summer.**

DEAR SIR,—Music will always brighten almost any occasion, as you no doubt know by experience.

For this reason, I am wondering if I can be of service to you in connection with your forthcoming (fete, garden party, carnival, sports meeting, etc.).

At quite a reasonable figure I can supply apparatus which will broadcast speeches, provide record music, or relay the music of a band.

I shall be pleased to give you further details without obligation at any time you like to get in touch with me. May I have the pleasure of giving you a quotation please?

**Part Exchange.**

DEAR SIR,—When I sold you your present set it was the latest thing in radio. I believe you were very pleased with it, and naturally I was proud to sell it to you.

But progress in radio has been almost as rapid recently as wireless waves themselves. And what was the best possible when you first had your set is now somewhat out-of-date.

I am not suggesting that your set does not provide you with a lot of very good fun even now—you are the best judge of that—but I do suggest that you would enjoy even more listening with one of the latest models.

If you like I will demonstrate one for you up against your present receiver, so that you can hear the difference. Then perhaps, if you like the new one, we can "do a deal" about part-exchanging the old one.

Think it over and let me know, but do not leave it too long because your old set is dropping in value daily now.

**Programme Selling.**

DEAR SIR,—Don't forget that . . . is broadcasting at 7.30 on Friday night, and that there's a musical show called . . . at nine.

And that at 2.50 on Saturday there will probably be a running commentary on . . . with an . . . programme at 9.40 in the evening.

You'll certainly find all these vastly entertaining. There will be many equally good next week.

If you can't beg, borrow or acquire a receiver there is still time to call and pay the first deposit on one for the week-end. But if you already have a good set, make sure that it is working really well.

Any way, whether you wish to buy a new set, or improve your present one, my experience is always at your service.

**Radio Furniture for Flats.**

DEAR SIR,—You can save a lot of space in a compact home by having a radio set which forms part of some other piece of furniture.

Some of the best firms of manufacturers are

## SALES LETTERS

now making sets of this kind. For instance, you can have your receiver as part of a bookcase or in the form of an occasional table.

There are sets which have clocks built in as part of them, and others which hide cocktail cabinets. Loudspeaker lamps and combined clocks and speakers are comparatively common. Radio has even been combined with small pianos. These combination receivers cannot all be described in a letter, but if you want a radio set and a space problem is involved, maybe I shall be able to assist you. Anyway, I shall be pleased to try.

**Radio-Gramophones.**

DEAR SIR,—As you are a regular record customer and a radio enthusiast, it has occurred to me that you may be interested in the new 1935 radio-gramophones.

These instruments are really good value for money. They reproduce radio and records with a purity of tone which excels all ordinary gramophones, and they are better than the large majority of sets in case of control.

Naturally I would like to supply you with one of these instruments, not only because I would like to make the sale, but because I feel sure that such a purchase would give you many hours of pleasure.

Whether you are considering buying a radio-gramophone or not, I think you owe it to yourself to come along and hear the new instruments. I shall be pleased to demonstrate them to you at any time, and I assure you that a visit to these showrooms will place you under no obligation whatever.

**Recital Invitation.**

DEAR SIR,—£5,000 worth of artists will be represented in the programme of a concert I am giving at the . . . hall on . . . (date).

Among those who have promised to be present are (names of Mayor and Mayoress and other local celebrities) and I would certainly like you to hear . . . (name of artist) who will appear in person, as well as the wonderful recital of record music I have been able to arrange.

Accordingly I am enclosing two tickets for you for the evening. All you have to do is to write your name and address plainly on the back and present them at the door.

I am selling two rows of the best seats with the object of passing the cash to the . . . hospital. If you would like any of these, the minimum price is . . . shillings each.

In any case do please come along and hear this recital.

**Records at Christmas.**

DEAR SIR,—If you or your friends are musical, what would make a better present (most people give themselves presents, too!) than gramophone records.

I am not going to attempt to describe the new discs in a letter. But I am enclosing the latest lists which will give you some idea of the riches of music that await the music lover.

You can have a single record costing only shillings, or an album which is expensive but which justifies the expense.

If you care to call in, you can play any of these discs in our audition room before buying.

And if there is any special kind of record you want, we shall be pleased to make some suggestions.

**Records on a Radio Set.**

DEAR SIR,—Has it occurred to you that by means of the set we had the pleasure of installing for you a little while ago, you can provide yourself with an additional source of entertainment, quite independent of the wealth of programmes the B.B.C. supplies.

You can be a millionaire and have the world's greatest artists perform in your house just when you want them.

All you require is to have your radio set converted into a radiogram, by means of a pick-up and motor, or a complete playing desk.

This conversion costs from about twenty shillings upwards. I shall be pleased to give you further details if you are interested.

**Record Supplement Enclosed.**

DEAR SIR,—Which of the new records of the month—detailed in the lists herewith—would you like to have played over to you?

Come along to the shop any time to suit yourself, and pick those you would like to add to your collection.

Or if you are too busy, telephone and let us demonstrate by wire! You will not get the full musical values of a record this way, but at least you will be able to judge whether the record appeals to you.

As the girl said to her young man: When are you going to give us a ring?

**Reviving Old Customers.**

DEAR SIR,—Do you realise it was two years ago you bought a set from me? Yes, it is true. Two years ago this week you had it installed.

How is the set working? Are you still satisfied with it? And have you heard any of the latest models?

I would like to demonstrate some of the new sets to you, and then perhaps we could do something about taking your old set in part-exchange.

Prices have dropped considerably since you first became a customer of mine, and sets have improved tremendously. Prices will not drop any more, however, and I cannot see how sets *can* improve still further.

Why not come and hear some—or let me bring one along to compare with your existing set in your own house? You have been satisfied with the treatment you have received in the past, I believe, and I assure you that if you accept this offer it places you under no obligation at all.

**Running Commentaries.**

DEAR SIR,—Just a reminder that the . . . (Boat Race, Grand National or whatever it is) is being broadcast on . . . day at . . . p.m.

This is one of the outstanding sports events of the year, and one which I am sure you will like to hear unless you are lucky enough to be attending the actual event.

Have you got a set and is it working—or may we tune it up for you?

If you have no receiver you can come along to our shop to listen; we will loan you a set for the occasion for a moderate fee (or free if you are thinking of buying one); or you can pay the first deposit on one now and have it installed and working in time for the event.

Now what are you going to do? You certainly must not miss this outstanding broadcast.

**Service and Maintenance.**

DEAR SIR,—Everyone with a car realises it needs "decoking" occasionally; everyone who owns a house has it redecorated regularly.

But many people who own good radio receivers expect them to go on for ever without attention.

I am not suggesting that you are this kind of person. If I thought you were, I would not be sending you this letter, which is about a maintenance plan for radio sets.

As part of my business I have a Service Department which is fitted out completely for overhauling sets and is run by a competent service engineer. And I have two suggestions to make to you.

One is that for the modest fee of . . . I guarantee to keep your set in full working order for a year, giving you a minimum of three visits by my man.

The other is that you take a note of my 'phone number, or place the enclosed card inside your set, and ring me when you have any trouble.

Naturally I prefer the former idea, but please adopt which you prefer. The main thing is to take your radio troubles to experts, and not to let amateurs fiddle with your radio.

**Show at Shop.**

DEAR SIR,—Have you seen ——'s (name of district) own Radio Show yet ?

As you may know, it started on . . . day, and now it is such a big success that it is being continued until next Saturday.

You can see there some . . . (number) or more receivers and radio-gramophones specially chosen for their suitability for this district, and brought straight from the National Exhibition at Olympia. You can hear and compare any of them in a comfortable demonstration room, and you can arrange to try them at home.

Courteous assistants are ready to answer your every question, and you need never feel that you are under any obligation.

You will be very welcome whenever you call—anytime up to eight in the evening or 1 p.m. on Wednesday (or whatever day is early closing).

**Stock of New Sets.**

DEAR SIR,—"Will the listener who is dissatisfied with his present radio receiver call at ——'s showrooms, where a new instrument is lying in stock awaiting his attention?"

That is the S.O.S. in this broadcast, and here is the news.

I have now got a good stock of the . . . sets for which there is such a demand this year, and I would very much like you to have one.

You can hear it here or at home, which you like. You can pay cash or have it on hire-purchase, which you prefer.

But if you want one—or think you may—please let me know soon. It is so disappointing to both of us if I have to tell you they are all gone.

**Summer-time Ends.**

DEAR SIR,—Now that "daylight saving" is over for this year, evenings are going to be darker and one is faced with the problem of what to do indoors.

Being rather blassed on this subject, I have only one suggestion to make—but it is a good one. You have guessed right ; the answer is Radio.

I am not going to bore you with a lot of high-flown talk about radio. You know as well as I do the amazing variety of good things that are broadcast nowadays.

All I will say is that I sell the best means of tapping this vast source of evening entertainment, and if you want radio for the darker evenings, I shall be pleased to do something about it.

I can't say fairer than that, can I ?

**Visit to National Show.**

DEAR SIR,—A party of local listeners is coming with me on an organised trip to the Radio Show at . . . this year, and I am wondering if you would like to be one of them.

I am providing free tickets for the party and the cost of the journey works out at only . . . shillings per head.

Frankly, I want to have as many people in the party who actually wish to get new radio sets—although I am not going to pester anyone with requests to buy.

We are thinking of having a meal and going on to a theatre afterwards. Would you like me to put your name on the list? If so, perhaps you will drop in at the shop or send me a postcard. I will send you full details when the party is finally fixed up.

**Wedding-Present Radio.**

DEAR SIR,—Just as there are rings to fit every finger, so there are radio sets to suit every home.

So if any of your friends are getting married during this month of marriages, may we suggest radio as an ideal wedding present ? You could not give anything more calculated to please everyone or more useful in a new home.

Not that a new radio set would not be welcome in many established homes. When is your wedding anniversary or that of your parents, for instance? Radio is just the gift to commemorate it.

Maybe you can think of a better excuse than any of these for getting a set. If you can, please come and tell us. We shall be just as pleased to hear it as you will be to hear some of the sets we would like to demonstrate to you.

**Winter Evenings.**

DEAR SIR,—How are you going to spend your evenings this winter ?

It is not possible to go out every night of the week, and for the evenings when you are alone at home a radio set is an admirable companion.

It is equally useful as a source of entertainment when friends drop in unexpectedly, as they so often do. And as far as news and national events are concerned, not to mention the time signals, radio is almost a necessity.

Big improvements have been made in radio recently. Both reproduction and cabinet work have reached a very high standard.

So that you can see this is no exaggeration, I am enclosing a few leaflets about the latest sets.

In case you would like to know something more about any of these, I would like to extend to you an invitation to call in at my shop any time and see and hear these instruments. Or if you would like to extend an invitation to me, I will willingly demonstrate one in your own home.

# RECOMMENDED RADIO TEXT BOOKS

**These Books may be obtained from Odhams Press, Ltd., Technical Book Dept., 85, Long Acre, London, W.C.2.**

*Prices quoted do not include postage. Five per cent. should be added to the price of the book in all cases to cover this item.*

| | s. | d. |
|---|---|---|
| **Mast and Aerial Construction for Amateurs.** By F. J. AINSLEY, A.M.I.C.E. This book contains the essential points of outdoor, indoor and frame aerials. Second Edn. 70 diagrams and illustrations. (1924) .. .. .. | 1 | 6 |
| **Wireless Receivers, the Principles of their Design.** By C. W. OAKLEY, M.A., M.Sc. Deals with the fundamental principles involved in the design of wireless receivers .. .. | 2 | 6 |
| **The Physical Principles of Wireless.** By J. A. RATCLIFFE, M.A. Second Edn. .. .. | 2 | 6 |
| **Radioactivity and Radioactive Substances.** By J. CHADWICK, M.Sc. With a Foreword by Sir ERNEST RUTHERFORD, F.R.S. An introduction to the study of radioactive substances and their radiations. (1931) .. .. | 2 | 6 |
| **Continuous Wave Wireless Telegraphy.** By B. E. G. MITTELL, A.M.I.E.E. A non-mathematical introduction to wireless telegraphy from the engineer's point of view. (1923) .. .. .. .. .. | 2 | 6 |
| **Wireless Valve Receivers and Circuits in Principle and Practice.** By R. D. BANGAY and N. ASHBRIDGE, B.Sc., A.M.I.C.E. A book that will add to the pleasure of the wireless experimenter by extending his theoretical knowledge of the whys and wherefores of valve receivers. (1925) .. .. .. | 2 | 6 |
| **Wireless, its Principles and Practice.** By ROBERT W. HUTCHINSON, M.Sc. Gives a clear insight into the fundamentals of wireless and its practical working to-day, based on sound scientific principles. (1933) .. .. .. | 3 | 6 |
| **Automobile and Radio Batteries.** A Practical, Up-to-date Handbook. By HAROLD H. U. CROSS, E.E. Being the second edition, enlarged, of "Automobile Batteries." 53 illustrations .. .. .. .. | 3 | 6 |
| **Radio Data Charts.** By R. T. BEATTY, M.A., B.E., D.Sc. (1930) .. .. .. .. | 4 | 6 |
| **Wireless Telephony: A Simplified Explanation.** By R. D. BANGAY. Reliability of information, thoroughness of treatment, and simplicity of expression are the outstanding features of the book. 79 diagrams and illustrations. 2/6. De Luxe edition, with 25 plates. (1923) .. .. .. .. .. | 5 | 0 |
| **The Wireless Manual.** By Captain JACK FROST. Contains simple explanations of wireless reception, and gives instructions regarding the selection and maintenance of all kinds of wireless accessories, etc. Fully illustrated. Third Edn., revised by HOWARD V. GIBBONS. (1932) .. .. .. .. | 5 | 0 |
| **Primary Batteries: Their Theory, Construction and Use.** By W. R. COOPER, M.A., B.Sc. Second Edn., revised and enlarged .. .. | 5 | 0 |
| **Modern Radio Communication.** By J. H. REYNER. Specially written to cover the syllabus of the City and Guilds Examination. Illustrated. Fourth Edn. Thoroughly revised .. .. .. .. .. | 5 | 6 |
| **Radio Engineering.** By WEDMORE AND REYNER .. .. .. .. .. | 7 | 0 |
| **The Cable and Wireless Communications of the World.** By F. J. BROWN, C.B., C.B.E., M.A., B.Sc. (Lond.). Director of The International Cable Companies' Association. Second Edn. (1930) .. .. .. .. | 7 | 6 |
| **The Electron Theory: A Popular Introduction to the New Theory of Electricity and Magnetism.** By E. E. FOURNIER, B.Sc. (Lond.), A.R.C.Sc., M.R.I.A. With a Preface by G. JOHNSTONE STONEY, M.A., D.Sc., F.R.S. Frontispiece and 35 Diagrams. (1925) .. | 7 | 6 |
| **Elementary Principles of Wireless Telegraphy and Telephony.** By R. D. BANGAY. An indispensable textbook for wireless students and beginners. Well illustrated. (1930) .. | 7 | 6 |
| **Selenium Cells.** The Construction, Care, and Use of Selenium Cells, with special reference to the "Fritts" Cell. By T. W. BENSON. 18 illustrations. (1919) .. .. .. | 9 | 0 |
| **Elem. Manual of Radio-Teleg. and Radio-Teleph.** By FLEMING .. .. .. .. .. | 10 | 6 |
| **Testing Radio Sets.** By J. H. REYNER, M.Inst.R.E. Of the greatest value both to the amateur experimenter and the professional designer. Second Edn. (1932) .. | 10 | 6 |
| **Navigational Wireless.** By S. H. LONG, D.Sc., M.I.E.E. The book fills a hitherto vacant place in the literature of wireless, as it is the first dealing in the English language with direction finding by means of a single frame. (1927) .. .. .. .. .. .. | 12 | 6 |
| **The Theory of the Induction Coil.** By E. TAYLOR-JONES, D.Sc., F.Inst.P. An Exposition on the Theory Underlying the Operation of the Modern Induction Coil. 93 illustrations. (1921) .. .. .. .. .. .. | 12 | 6 |
| **Induction Coil Design.** By M. A. CODD. 161 illustrations. (1922) .. .. .. .. | 15 | 0 |
| **Electric Rectifiers and Valves.** By Prof. A. GUNTHER SCHULZE. A physical and practical study of rectifiers and valves. (1927) | 15 | 0 |
| **Foundations of Radio.** By RUDOLPH L. DUNCAN. Covers only the elementary theory of electricity and allied subjects that apply to and comprise the essentials of Radio. (1931) .. .. .. .. .. | 15 | 6 |
| **Wireless Principles and Practice.** By L. S. PALMER. (1928) .. .. .. .. .. | 18 | 0 |
| **Elements of Radio Communication.** By JOHN H. MORECROFT, of Columbia University. Practically no mathematical training more advanced than Algebra is required for the mastery of this elementary text. (1929) .. | 18 | 6 |
| **Wireless Direction Finding.** (Second Edition.) By B. KEEN, B.Eng. (Hons.), Sheffield, A.M.I.E.E. Deals with the principles of the subject and describes the principles of Direction and Position Finding in this country. Numerous photographs and diagrams. (1927) | 21 | 0 |
| **Wireless Telegraphy and Telephony.** By TURNER. New Edn. (1931) .. .. | 25 | 0 |
| **Handbook of Technical Instruction for Wireless Telegraphists.** By H. M. DOWSETT. Fourth Edn. (1930) .. .. .. .. .. | 25 | 0 |
| **The History of Radio Telegraphy and Telephony.** By G. G. BLAKE, M.I.E.E., F.Inst.P. A comprehensive and unbiased review of the historical aspect of Wireless Telegraphy and Telephony. (1929) .. .. .. .. | 25 | 0 |
| **Electrical Condensers.** By PHILIP R. COURSEY, B.Sc., F.Inst.P., M.I.E.E. A complete treatise on the design, construction and uses of electrical condensers. 514 illustrations and 8 inset plates. (1927) .. .. .. | 37 | 6 |
| **Principles of Radio Communication.** By JOHN H. MORECROFT, assisted by A. PINTO and W. A. CURRY. Second Edition. 831 illustrations. (1927) .. .. .. .. | 37 | 6 |
| **Radio Telegraphy and Telephony.** By RUDOLPH L. DUNCAN, M.Inst. of Radio En. Everything relative to Broadcasting and reception and of broadcasting units is described. (1931) .. .. .. | 46 | 6 |

# POSTAL REGULATIONS

## INLAND

### 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.

| | |
|---|---|
| Not exceeding 2 lb. | 6d. |
| 2 lb. to 5 lb. | 9d. |
| 5 lb. to 8 lb. | 1s. 0d. |
| 8 lb. to 11 lb. | 1s. 3d. |
| 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, but a declaration of contents for customs purposes must be made.

### POSTCARDS.

No card may exceed 5⅞ in. long and 4⅛ in. wide, or be less than 4 in. long and 2¾ in. wide. Postcards must be of stiff material and must not be folded or enclosed in a cover of any kind.

### 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 ½d. to 2d. respectively.

### SAMPLES.

There is no inland rate for samples, which must be sent at either letter or parcel rate.

### 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.

### 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.

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.

## POSTAL REGULATIONS

### 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 | 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, 8d. 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 11 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, 8d.

### 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.

# MAINS AND BATTERY SET MARKET SURVEY

*By courtesy of "Electrical Trading"*

During the past year there has been an increase of approximately 4·4 per cent. in the number of mains set prospects. Nearly half the homes of Great Britain (47·8) are now on the mains.

For quick reference the figures for England are grouped under County headings. London precedes the English counties, and separate general headings are given to Wales, Scotland and Northern Ireland.

Figures are official, except where marked with an asterisk (*).

Time-controlled A.C. supply is shown thus (†).

Where there is a bracket across the A.C. and D.C. columns with only one figure beneath it, no reliable division of the total is available.

| Homes. | Great Britain. | England. | Wales. | Scotland. |
|---|---|---|---|---|
| Total .. | 11,297,795 | 9,422,415 | 649,210 | 1,226,170 |
| On A.C. .. | 4,312,556 | 3,796,524 | 222,872 | 295,160 |
| On D.C. .. | 1,080,244 | 909,482 | 66,034 | 104,728 |
| Unwired .. | 5,904,995 | 4,716,409 | 360,304 | 828,282 |

| 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... .. | 29,857 | 10,000† | 12,000 | — |
| Bermondsey Cpn. .. | 17,000 | — | 15,500 | — |
| Bethnal Green Cpn .. | 21,500* | 6,600* | — | — |
| Brompton and Kensington E. S. Co .. .. | 11,420* | 10,276*† | — | — |
| Charing Cross E. S. Co | — | — | — | — |
| Chelsea E. S. Co. .. | 12,094 | 4,139† | 4,228 | — |
| Chiswick E. S. Cpn .. | 10,334 | 282*† | 6,014* | 4,038 |
| City of London E. L. Co. | (Negligible residential area. Total consumers : 15,591 A.C., and 3,662 D.C.). | | | |
| County of London E. S. Co. .. .. .. | (See Essex). | | | |
| Fulham Cpn. .. .. | — | — | — | — |
| Hackney Cpn .. .. | 40,000 | 30,000*† | — | 10,000 |
| Hammersmith Cpn. .. | — | — | — | — |
| Hampstead Cpn. .. | 18,287 | 18,000† | — | — |
| Hornsey Cpn .. .. | 22,576 | — | 15,092 | — |
| Islington Cpn. .. .. | 50,429* | 29,664† | — | — |
| Kensington and Knightsbridge E.C. Co. | 7,640 | 2,002† | 5,415 | — |
| London E. S. Cpn. .. | — | — | — | — |
| London and Home Counties J. E. A. .. | (See Surrey). | | | |
| Metropolitan E. S. Co. .. | — | — | — | — |
| Notting Hill E. L. Co. .. | 23,000 | 3,400† | 10,900 | — |
| Poplar Cpn. .. .. | 23,300* | — | 21,000* | 2,300 |
| St. James and Pall Mall E. L. Co. .. .. | — | 4,780† | 702 | — |
| St. Marylebone Cpn. .. | 17,500 | 5,400† | 9,460 | — |
| St. Pancras Cpn. .. | 31,964 | 24,324*† | | 7,640 |
| Shoreditch Cpn .. | 25,186 | — | 17,086 | — |
| South London E. S. Cpn. .. .. .. | — | 21,400† | — | — |
| South Met. E. L. and P. Co. .. .. .. | — | 40,000† | — | — |
| Southwark Cpn. .. | 20,100* | — | 2,353 | — |
| Stoke Newington Cpn. | 15,000 | — | 11,174 | — |
| Stepney Cpn. .. .. | 54,657 | — | 23,178 | — |
| Westminster E. S. Cpn. | — | — | — | — |
| Woolwich Cpn. .. | 33,000* | 14,630* | 400* | 17,970 |
| **BEDFORDSHIRE** | | | | |
| Bedford Cpn. .. | 23,000 | 18,218† | — | 4,782 |
| Beds, Cambs and Hunts E. Co. | 13,200 | 5,761† | — | 7,439 |
| First Garden City, Ltd | (See Hertfordshire) | | | |
| Luton Cpn. .. .. | 32,500 | 10,200 | 7,560 | 14,740 |
| Rushden and Dist. E. S. Co. .. .. .. | (See Northamptonshire) | | | |
| **BUCKINGHAMSHIRE** | | | | |
| Aylesbury Cpn. .. | 15,000 | 9,500† | 750 | 4,750 |
| Chesham E. L. and P. Co. .. .. .. | 9,500 | 4,850* | — | 4,650 |
| Cookham and Dist. E. Cpn. .. .. .. | (See Berkshire) | | | |
| Luton Cpn. .. .. | (See Bedfordshire) | | | |
| Northampton E. L. and P. Co. .. .. | (See Northamptonshire) | | | |

| Name of Supply Authority | Total No. of House-holders in Area | Number of Households on A.C | on D.C. | Without Supply. |
|---|---|---|---|---|
| Slough and Datchet E. S. Co. .. .. .. | 13,000 | 5,810* | — | 7,190 |
| Wycombe (Boro') E. L. and P. Co. .. .. | 10,117 | 1,500* | 4,370* | 4,247 |
| **BERKSHIRE** | | | | |
| Abingdon E. S. Co. .. | 5,250 | 1,545† | — | 3,705 |
| Ascot Dist. G. and E Co. .. .. .. | 6,850 | 695† | 1,080 | 5,075 |
| Cookham and Dist. E. Cpn. .. .. .. | 4,350 | 2,125† | — | 2,225 |
| Maidenhead Cpn. .. | 7,400* | 2,100*† | 1,400* | 3,900 |
| Reading Cpn. .. .. | 28,797 | 4,000† | 2,200 | 22,597 |
| Thames Valley E. S. Co. | 9,270 | 1,531† | — | 7,739 |
| Wantage E. . Co. .. | 1,836 | 374† | — | 1,462 |
| Windsor E. Inst. Co. .. | 5,050 | 1,700†* | 500* | 2,850 |
| Yorktown G and E Co. | (See Surrey) | | | |
| **CAMBRIDGESHIRE AND ELY** | | | | |
| Beds Cambs. and Hunts E. Co. .. .. | (See Bedfordshire) | | | |
| Cambridge E. S. Co. .. | 20,000 | 12,433† | — | 7,567 |
| Newmarket E. L. Co. | — | 803† | — | — |
| Peterborough Cpn. .. | (See Northamptonshire) | | | |
| Wisbech E. L and P. Co. | 4,132 | — | 702 | 3,430 |
| **CHESHIRE** | | | | |
| Alderley Edge and Wilmslow E. Board .. | 4,360 | 1,750†* | 500* | 2,110 |
| Altrincham E. S., Ltd. | 15,950 | 9,176* | — | 6,774 |
| Birkenhead Cpn. .. | 45,000 | 12,666† | 20,755 | 11,579 |
| Bredbury and Romily U.D.C. .. .. | 3,500 | 3,000† | — | 500 |
| Cheadle and Gatley U.D.C. .. .. | 6,300 | 5,000† | — | 1,300 |
| Chester Cpn. .. .. | 18,556* | 12,919† | 120 | 5,517 |
| Congleton U.D.C. .. | 5,169 | 2,220† | — | 2,949 |
| Connah's Quay .. | 1,500* | 550* | — | 950 |
| Crewe Cpn. .. .. | 12,649 | 5,900† | 2,163 | 3,588 |
| E. Co. of Macclesfield .. | 15,500 | 2,036†* | 3,700* | 9,764 |
| Hazel Grove and Bramhall U.D.C. .. .. | 4,300 | 3,150† | — | 1,150 |
| Hoylake U.D.C .. | 5,780 | 4,795† | — | 985 |
| Manchester Cpn. .. | (See Lancashire) | | | |
| Marple U.D.C .. | 2,790 | 782† | — | 2,008 |
| Mersey Power Co. .. | 23,659 | 14,300† | — | 9,359 |
| Mid-Cheshire E. S. Co. | 19,500 | 5,580† | 2,535 | 11,385 |
| North Wales and South Cheshire J. E. A. .. | — | — | — | — |
| N.W. Midlands J.E.A. | (See Staffordshire) | | | |
| Sale U.D.C. .. .. | 6,212 | 4,490† | — | 1,722 |
| Stalybridge, Hyde, Mossley and Dukinfield T. and E. Board .. | 33,367 | 12,690† | 100 | 15,580 |
| Stockport Cpn. .. | 39,100 | 8,194† | 8,000 | 22,906 |
| Wallasey Cpn. .. | 25,140 | 22,800† | — | 2,340 |
| Warrington Cpn. .. | (See Lancashire) | | | |
| Wirral R.D.C. .. .. | (Operated by Birkenhead Cpn.). | | | |

# SET MARKET SURVEY

| Name of Supply Authority | Total No. of Householders in Area | Number of Households on A.C. | on D.C. | Without Supply. |
|---|---|---|---|---|
| **CORNWALL** | | | | |
| Bude E. S. Co. | 1,450* | 250 | 900 | 300 |
| Bodmin E. L. and S. Co. | 1,079 | — | 418 | 661 |
| Callington and Dist. E. S. Co. | 650 | 307† | — | 283 |
| Camborne E. S. Co. | 4,056 | 812† | — | 3,244 |
| Delabole E. L. S. Co. | 300 | — | 250 | —50 |
| East Cornwall E. S. Co. | 15,700 | 1,821† | — | 13,879 |
| Falmouth E. S. | 3,372 | — | 1,033 | 2,340 |
| Launceston and Dist. E. S. Co. | 1,297 | — | 812 | 485 |
| Liskeard G. and E. Co. | 1,187 | 568† | — | 619 |
| Looe E. Co. | 850 | — | 552 | 298 |
| Newquay E. L. and P. Co. | 1,970 | 1,390† | — | 580 |
| Penzance and Dist. E. S. Co. | 3,200 | 1,115† | — | 2,085 |
| St. Austell and Dist. E. L. and P. Co. | 11,200 | 1,600† | 400 | 9,200 |
| Truro E. S. Co. | 3,800 | 834† | — | 2,966 |
| West Cornwall E. S. Co. | 28,674 | 6,857† | — | 21,817 |
| **CUMBERLAND** | | | | |
| Carlisle Cpn. | 22,364 | 9,151† | 1,091 | 11,122 |
| Mellom R.D.C. | 2,000 | 700 | — | 1,300 |
| Penrith E. S. Co. | 2,400† | — | 600* | 1,800 |
| South Cumberland Co. | 6,129 | 1,550*† | — | 4,579 |
| Thornthwaite L. Co. | 150 | — | 87 | 63 |
| Whitehaven Cpn. | 5,600* | 600 | 3,500 | 1,600 |
| Workington Cpn. | 6,000 | 2,271 | — | 3,729 |
| **DERBYSHIRE** | | | | |
| Ashbourne Cpn. | — | — | — | — |
| Belper U.D.C. | 2,696 | 1,724 | — | 972 |
| Burton-on-Trent Cpn. | (See Staffordshire) | | | |
| Burton Cpn. | 3,836 | 105† | 2,668 | 1,063 |
| Chesterfield Cpn. | 16,500 | 8,492† | 5,314 | 2,694 |
| Clowne E. S. Co. | 1,600 | 674 | — | 900 |
| Derby Cpn. | 44,600 | 23,689 | 200 | 10,711 |
| Derbyshire and Notts E. P. Co. | 125,000 | 28,000† | 1,600 | 95,400 |
| Glossop (Urban E. S. Co.) | 5,600 | — | 985 | 4,615 |
| Long Eaton U.D.C. | 6,600 | 3,800† | 1,600 | 1,200 |
| Mansfield Cpn. | (See Nottinghamshire) | | | |
| New Mills | 2,000* | 400* | — | 1,600 |
| Stalybridge, Hyde, Mossley and Dukinfield T. and E. Bd. | (See Cheshire) | | | |
| Staveley E. S. Co. | 2,000 | 1,600 | — | 400 |
| Worksop Cpn. | (See Nottinghamshire) | | | |
| **DEVONSHIRE.** | | | | |
| Barnstaple Cpn. | 4,019 | — | 2,300 | 1,719 |
| Bideford and Dist. E. S. Co. | 8,330 | 1,875 | — | 6,455 |
| Bradworthy (Non Statv.) | — | — | 45 | — |
| Braunton E. L. and P. Co. | 1,500 | — | 700 | 800 |
| Brixham G. and E. Co. | 2,350 | — | 680* | 1,670 |
| Budleigh Salterton E. L. and P. Co. | — | — | 690* | — |
| Chudleigh E. L. and P. Co. | 650 | 205† | — | 445 |
| Culm Valley E. S. Co. | 3,750* | 1,153† | — | 2,597 |
| Dartmouth and Kingswear (Urban E. S. Co.) | 2,120 | 784† | 3 | 1,333 |
| Dawlish E. L. and P. Co. | 1,500 | 1,191† | — | 309 |
| East Devon E. Co. | 10,650* | 4,100* | 32* | 6,518 |
| Exeter Cpn. | 23,002 | 15,648† | — | 7,364 |
| Exe Valley E. Co. | — | 1,300* | 60* | — |
| Holsworthy E. S. Co. | 350* | — | 200* | 150 |
| Ilfracombe E. L. and P. Co. | 3,650* | — | 1,025* | 2,625 |
| Ivybridge E. S. Co. | 510 | — | 220 | 290 |
| Lynton and Lynmouth E. L. Co. | 800* | 543 | — | 257 |
| Paignton E. L. & P. Co. | 5,564 | 3,874† | — | 1,790 |
| Plymouth Cpn. | 60,796 | 37 380† | 2,500 | 20,916 |
| Plympton St. Mary R.D.C. | 6,500 | 3,300† | — | 3,200 |
| Salcombe G. and E. Co. | 2,280 | 260* | 25* | 1,995 |
| Seaton and Dist. E. L. Co. | 1,570 | — | 850* | 720 |
| Teignmouth E. L. Co. | 6,441 | 2,815 | — | 3,626 |
| Tiverton Cpn. | 2,000 | — | 770 | 1,230 |
| Torquay Cpn. | [25,000 | 13,000† | — | 12,000 |
| West Devon E. S. Co. | — | 2,600† | 70 | — |

| Name of Supply Authority | Total No. of Householders in Area | Number of Households on A.C. | on D.C. | Without Supply. |
|---|---|---|---|---|
| **DORSETSHIRE.** | | | | |
| Blandford Forum and Dist. E. S. Co. | 1,100 | 489 | — | 611 |
| Bournemouth and Poole E. S. Co. | (See Hampshire) | | | |
| Bridport Cpn. | 5,000 | 1,170† | — | 3,830 |
| Dorchester Cpn. | 2,032 | — | 856 | 1,176 |
| Lyme Regis Cpn. | 850 | — | 650 | 200 |
| Portland Cpn. | 2,200 | 920* | — | 1,280 |
| Sturminster Newton (Wessex Co.) | — | 177 | — | — |
| Swanage G. and E. Co. | 1,750* | 1,440* | — | 310 |
| Weymouth and Melcombe Regis Cpn. | 5,950 | 1,730* | 3,300* | 920 |
| **DURHAM.** | | | | |
| Annfield Plain U.D.C. | 4,000 | 3,000* | — | 1,000 |
| Auckland U.D.C. | — | — | — | — |
| Crook U.D.C. | 5,492 | 3,840 | — | 1,652 |
| Darlington Cpn. | 19,530 | 10,640† | 1,000 | 7,890 |
| Newcastle Cpn. | 244 | 244 | — | — |
| North Eastern E. S. Co. | (See Northumberland.) | | | |
| Seaham Harbour U.D.C. | 5,492 | 3,840 | — | 1,652 |
| South Shields | 28,000 | 20,000* | — | 2,000 |
| Stockton on Tees Cpn. | 10,501 | 8,831† | 50 | 7,680 |
| Stanley U.D.C. | — | — | — | — |
| Sunderland Cpn. | 25,500 | 10,906 | — | 14,594 |
| Tanfield U.D.C. | 2,300 | 1,930 | — | 370 |
| West Hartlepool Cpn. | 18,700 | 4,800* | 4,800* | 9,100 |
| **ESSEX.** | | | | |
| Barking Cpn. | 16,695 | 12,079† | — | 4,616 |
| Brentwood and Dist. E. Co. | 6,000 | 4,200*† | — | 1,800 |
| Chelmsford (County of London Co.) | 7,980 | 5,290† | — | 2,690 |
| Clacton U.D.C. | 7,000 | 3,002† | 3,643 | 455 |
| Colchester Cpn. | 26,900 | 20,166† | | 6,741 |
| County of London E. S. Co. | — | 120,000† | — | — |
| East Anglian E. S. Co. | (See Norfolk.) | | | |
| East Ham Cpn. | 30,000 | 8,000† | 17,500 | 4,500 |
| Electric Supply Cpn. | 9,200 | 4,800*† | — | 4,000 |
| Frinton-on-Sea E. L. and P. Co. | 780 | — | 750 | 30 |
| Grays Thurrock U.D.C. | 3,795 | 1,924† | 1,716 | 155 |
| Harwich Cpn. | 3,636 | 3,000 | — | 636 |
| Ilford Cpn. | 35,000 | 11,683† | 19,135 | 4,182 |
| Leyton Cpn. | 30,300 | 12,800*† | 8,000* | 8,800 |
| North Met. E. P. S. Co. | (See Middlesex.) | | | |
| Saffron Walden Cpn. | 1,850 | 338† | 263 | 1,249 |
| Southend-on-Sea Cpn. | 31,500 | 18,450† | 11,035 | 2,015 |
| Tilbury U.D.C. | 3,000 | 2,332† | — | 668 |
| Walthamstow Cpn. | 33,727 | 17,000*† | 6,500* | 10,227 |
| West Ham Cpn. | 52,500 | 35,495† | — | 17,005 |
| Wickford and Dist. E. S. Co. | 2,250 | 1,074† | — | 1,176 |
| **GLOUCESTERSHIRE.** | | | | |
| Bourton-on-the-Water E. L. and P. Co. | 300 | — | 250 | 50 |
| Cheltenham Cpn. | 14,800 | 7,423† | — | 7,377 |
| Cirencester E. S. Co. | 1,800 | 614 | — | 1,186 |
| Gloucester Cpn. | 19,700 | 6,233† | 2,290 | 11,177 |
| Northleach (Non. Statv) | — | — | 176 | — |
| Stroud E. S. Co. | 2,250 | 1,020† | — | 1,230 |
| Tetbury (Wessex Co.) | 460 | 253 | — | 207 |
| Tewkesbury E. L. Co. | 1,200* | 1,050* | — | 150 |
| Thornby and Dist. E. Co. | — | 309† | — | — |
| Warmley R.D.C. | 2,030 | 1,488† | — | 542 |
| West Gloucestershire P. Co. | 37,797 | 5,910*† | — | 31,887 |
| **HAMPSHIRE.** | | | | |
| Aldershot Cpn. | 5,000 | 1,000† | 1,000 | 3,000 |
| Alton and Dist. E. Co. | — | — | — | — |
| Andover (Wessex Co.) | 3,100 | 960 | — | 2,140 |
| Basingstoke | 9,286 | 3,289† | | 5,997 |
| Bournemouth and Poole E. S. Co. | 46,000 | 20,000 | 1,000 | 25,000 |
| Fareham U.D.C. | 3,265 | 2,204† | — | 1,051 |
| Farnham G. and E. Co. | (See Surrey.) | | | |
| Gosport and Alverstoke E. L. Co. | 9,000* | — | 3,590* | 5,410 |
| Lymington E. L. and P. Co. | 3,050 | 1,100 | — | 1,950 |
| Milford-on-Sea E. S. Co. | 1,000 | — | 470* | 530 |
| Melton and Barton-on-Sea E. S. Co. | 2,000 | 900† | — | 1,100 |

| Name of Supply Authority | Total No. of House-holders in Area | Number of Households on A.C. | on D.C. | Without Supply |
|---|---|---|---|---|
| Petersfield E. L. and P. Co. | 1,475* | 1,194* | — | 281 |
| Portsmouth Cpn | 83,271 | 51,801† | — | 31,470 |
| Ringwood E. S. Co. | 2,021 | 1,050*† | — | 971 |
| Southampton Cpn. | — | — | — | — |
| West Hampshire E. Co. | 20,250 | 4,500*† | — | 15,750 |
| Whitechurch G. and E. Co. | 600 | 175* | — | 425 |
| Winchester Cpn. | 7,025 | 1,535† | 2080 | 4310 |
| **HEREFORDSHIRE.** | | | | |
| Ledbury E. S. Co. | 936 | 360*† | — | 576 |
| Leominster E. S. Co. | 1,450 | 440† | — | 1 010 |
| Shropshire, Worcestershire and Staffordshire E. P. Co. | — | — | — | — |
| **HERTFORDSHIRE** | | | | |
| Aylesbury Cpn. | (See Buckinghamshire) | | | |
| Colne Valley E. S. Co | (See Middlesex) | | | |
| First Garden City. Ltd (Letchworth) | 8,000 | 3,800† | 800 | 4,000 |
| Luton Cpn. | (See Bedfordshire) | | | |
| North Met. E. P. S. Co. | (See Middlesex) | | | |
| Northwood E. L. and P. Co. | (See Middlesex) | | | |
| Watford Cpn. | 30,000 | 16,000† | — | 14,000 |
| Welwyn Garden City E. S. Co. | 2,785 | 2,724† | — | 61 |
| **HUNTINGDONSHIRE** | | | | |
| Beds, Cambs and Hunts E. Co. | (See Bedfordshire) | | | |
| Peterborough Cpn. | (See Northamptonshire) | | | |
| **ISLANDS** | | | | |
| Douglas (I. o' M.) Cpn. | 5,810 | 1,162† | 2,758 | 1,890 |
| Guernsey (States of Guernsey Elec Dept.) | 5,500 | — | 2,900* | 2,600 |
| Isle of Man E. Board | 7,000 | 1,100† | — | 5,900 |
| Isle of Wight E. L. and P. Co. | 24,046 | 9,788† | — | 14,258 |
| Jersey E. Co. | — | 3,372 | — | — |
| **KENT** | | | | |
| Ashford U.D.C. | 8,000 | 6,000† | — | 2,000 |
| Beckenham U.D.C. | 14,100 | 13,200 | — | 900 |
| Bexley U.D.C. | — | 16,949† | — | — |
| Bromley Cpn. | 12,000 | 8,280† | — | 3,720 |
| Canterbury Cpn. | 6,611 | 648 | 3,965 | 1,998 |
| Chislehurst E. S. Co. | 2,500* | 1,100† | — | 1,400 |
| Dartford Cpn. | 7,216 | 670† | 3,091 | 3,440 |
| Dover Cpn. | 10,300 | 6,600† | — | 3,700 |
| Erith U.D.C. | 8,500 | 6,650† | — | 1,850 |
| Faversham Cpn. | 3,020 | — | 1,200* | 1,826 |
| Folkestone E. S. Co. | 12,000* | 3,724† | 3,000 | 5,276 |
| Gillingham Cpn. | 15,000 | 10,234† | — | 4,766 |
| Gravesend U.D.C. | 9,050* | 7,500† | | 1,550 |
| Herne Bay and Dist. E. S. Co. | 5,000 | 2,000† | — | 3,000 |
| Hythe (from Folkestone) | — | 2,157† | — | — |
| Isle of Thanet E. S. Co. | 15,840 | 570* | 5,900* | 9,370 |
| Kent E. P. Co. | — | 12,216† | — | — |
| Maidstone Cpn. | 10,000 | 8,000† | 2,000 | 3,000 |
| Ramsgate and Dist. E. S. Co. | 9,000 | — | 3,686 | 5,314 |
| Sevenoaks and Dist. E. Co. | 13,290* | 6,913† | — | 6,377 |
| Sheerness and Dist. E. S. Co. | — | — | — | — |
| Sidcup (Foots Cray E. S. Co.) | 4,000 | 1,794† | — | 2,200 |
| South East Kent E. P. Co. | — | 2,364† | — | — |
| South Metropolitan E. L. and P. Co. | (See London) | | | |
| Tonbridge U.D.C. | 6406 | 2,780† | 320 | 3,306 |
| Tunbridge Wells Cpn. | 14,000 | 9,000† | — | 5,000 |
| Weald E. S. Co. | 27,500 | 7,000† | — | 20,500 |
| West Kent E. Co. | — | 19,000† | — | — |
| Whitstable E. Co. | 4,300* | 3,200*† | — | 1,100 |
| **LANCASHIRE** | | | | |
| Accrington Cpn. | 23,314 | 10,557 | — | 12,757 |
| Ashton-in-Makerfield U.D.C. | 4,300 | 600† | — | 3,700 |
| Ashton-under-Lyne Cpn. | 15,000 | 3,500† | 2,000 | 9,500 |
| Atherton U.D.C. | 4,700 | 2,300† | — | 2,400 |

| Name of Supply Authority | Total No. of House-holders in Area | Number of Households on A.C. | on D.C. | Without Supply. |
|---|---|---|---|---|
| Bacup Cpn. | 6,138 | 2,691† | — | 3,447 |
| Barrow-in-Furness Cpn. | 21,000 | 3,374† | 4,953 | 12,673 |
| Birkdale and Dist. E. S. Co. | 4,750* | 509 | 3,013 | 1,228 |
| Blackburn Cpn. | 47,644 | 12,975† | 1,400 | 33,269 |
| Blackpool Cpn. | 41,230 | 26,652† | — | 14,578 |
| Bolton Cpn. | 48,861 | 19,407† | 2,323 | 27,131 |
| Brierfield U.D.C. | 2,500 | 972† | — | 1,528 |
| Burnley Cpn. | 27,400 | 9,659† | 7,196 | 10,545 |
| Bury Cpn. | 14,000 | 6,000† | — | 8,000 |
| Cark and Dist. E. Co. | 1,600 | 476† | — | 1,124 |
| Clitheroe Cpn. | 6,375 | 1,699† | — | 4,676 |
| Colne Cpn. | 9,010 | 1,756† | 2,503 | 4,781 |
| Darwen Cpn. | 10,450 | 1,400 | 4,771 | 4,279 |
| Eccles Cpn. | 10,800 | 3,650*† | — | 7,150 |
| Farnworth | 7,811 | 3,700* | 1,460* | 2,651 |
| Fleetwood Cpn. | 5,652 | 3,921† | 1,583 | 148 |
| Formby U.D.C. | 2,250 | 1,751† | — | 499 |
| Grange U.D.C. | 656 | 520† | — | 136 |
| Haslingden | 5,000 | 3,550 | — | 1,450 |
| Heywood Cpn. | 7,704 | 1,703† | 734 | 5,267 |
| Hendley U.D.C. | 5,226 | 1,146† | — | 4,080 |
| Hurton-with-Roby (B.I.C.) | 1,188 | 788† | — | 400 |
| Lancashire E. P. Co. | 68,881 | 29,000† | — | 39,881 |
| Lancaster Cpn. | 15,074 | 5,686† | — | 10,388 |
| Leigh Cpn. | 11,600 | 4,086† | 786 | 6,728 |
| Littleborough U.D.C | 3,587 | 1,320† | — | 2,267 |
| Liverpool Cpn. | 248,908 | 68,672† | 22,890 | 157,347 |
| Lytham St. Anne's Cpn. | 6,720 | 4,575*† | 1,400* | 745 |
| Manchester Cpn. | 193,679 | 69,112† | 3,420 | 121,147 |
| Mersey Power Co. | (See Cheshire) | | | |
| Middleton Cpn. | 7,821 | 2,842† | 1,380 | 3,029 |
| Milnrow | 2,500 | 1,250*† | — | 1,250 |
| Morecambe and Heysham Cpn. | 7000 | 6,000† | — | 1,000 |
| Nelson Cpn. | 10,100 | 7,973† | — | 2,127 |
| Newton-in-Makerfield U.D.C. | 5,000 | 1,899† | — | 3,101 |
| Oldham Cpn. | 55,050 | 36,938† | 1,895 | 16,217 |
| Padiham U.D.C. | 3,200 | 800† | — | 2,400 |
| Preesall | 603 | 450 | — | 153 |
| Prescot (British Insulated Cables, Ltd.) | 2,500 | 1,088† | — | 1,412 |
| Preston Cpn. | 39,000 | 22,950† | — | 16,050 |
| Radcliffe U.D.C. | 7,152 | 2,226† | 954 | 3,973 |
| Rawtenstall Cpn. | 7,800 | 4,136† | — | 3,664 |
| Rochdale Cpn. | 31,000 | 14,200† | — | 16,800 |
| St. Helens Cpn. | 27,675 | 8,191† | 4,710 | 14,774 |
| Salford Cpn. | 53,863 | 19,649† | 1,113 | 33,104 |
| Southport Cpn. | 17,000* | 11,879† | — | 5,121 |
| Stalybridge, Hyde, Mossley and Dukinfield T. and E. Board | (See Cheshire) | | | |
| Stretford and Dist. E. Board | 23,500 | 13,400* | 5,000* | 5,100 |
| Swinton and Pendlebury U.D.C. | 8,280 | 4,530† | 450 | 3,300 |
| Thornton Cleveleys U.D.C. | 3,370 | 2,880† | — | 490 |
| Todmorden | 6,782 | 2,100*† | — | 4,682 |
| Turton U.D.C. | 3,418 | 1,650† | — | 1,768 |
| Ulverston U.D.C. | 2,430 | 900† | — | 1,530 |
| Warrington Cpn. | 30,010 | 13,572† | 80 | 16,358 |
| West Lancs R.D.C. | 2,000 | 1,395† | — | 1,205 |
| Whiston (B.I.C.) | 2,476 | 1,728† | — | 748 |
| Whitworth U.D.C. | 2,200 | 1,550† | — | 700 |
| Wigan Cpn. | 34,388 | 9,947† | — | 24,441 |
| **LEICESTERSHIRE** | | | | |
| Kettering U.D.C. | (See Northamptonshire) | | | |
| Leicester Cpn. | 70,000 | 44,500*† | — | 25,500 |
| Leicestershire and Warwickshire E. P. Co. | 62,594 | 33,500† | — | 86,094 |
| Loughborough Cpn. | 7,854 | 3,098 | 3,782 | 974 |
| Melton Mowbray E. L. Co. | 2,756 | — | 1,484 | 1,272 |
| Tamworth Dist. E. S. Co. | (See Warwickshire) | | | |
| **LINCOLNSHIRE** | | | | |
| Barton-on-Humber E. S. Co. | 1,773 | — | 500 | 1,273 |
| Boston and Dist. E. S. Co. | 15,340 | 2,319† | — | 13,021 |
| Cleethorpes U.D.C. | 7,500 | 4,200† | — | 3,300 |
| Gainsborough U.D.C. | 5,400 | 1,000† | — | 3,800 |
| Grantham (Urban E. S. Co.) | 5,363 | — | 2,065 | 3,298 |
| Grimsby Cpn. | 28,300 | 9,300† | 8,570 | 10,430 |
| Lincoln Cpn. | 17,500 | 5,700† | 300 | 11,500 |
| Lincolnshire E. S. Co. | 3,159* | 700* | — | 2,459 |
| Louth Cpn. | 3,181 | 782† | — | 2,399 |
| Scunthorpe and Frodingham U.D.C. | 8,178 | 4,921 | — | 3,257 |

# SET MARKET SURVEY

| Name of Supply Authority | Total No. of Householders in Area | Number of Households on A.C. | on D.C. | Without Supply. |
|---|---|---|---|---|
| Sleaford U.D.C. | 1,900 | 350† | 650 | 900 |
| Spalding U.D.C. | 3,700 | 1,000 | — | 2,700 |
| Stamford (Urban E. S. Co.) | 2,710 | — | 923 | 1,787 |
| **MIDDLESEX** | | | | |
| Brentford E. S. Co. | 5,100* | 4,000* | — | 1,100 |
| Colne Valley E. S. Co. | 9,748 | 9,491† | — | 257 |
| Ealing Cpn. | 20,832 | 16,159† | — | 4,473 |
| Egham and Staines E. Co. | 29,700* | 9,892*† | — | 19,808 |
| Finchley Cpn. | 18,500 | — | 12,401 | 6,099 |
| Harrow E. L. and P. Co. | 10,000 | — | 7,800 | 2,200 |
| Hendon E. S. Co. | 33,084 | 30,388† | — | 2,696 |
| Heston and Isleworth Cpn. | — | — | — | — |
| Hornsey Cpn. | 23,000* | — | 16,500* | 6,500 |
| Northwood E. L. and P. Co. | 6,758 | 4,599† | — | 2,159 |
| North Met. E. P. S. Co. | — | 138,557† | — | — |
| Twickenham (London and Home Counties J. E. A.) | 32,429 | 16,163†† | 8,496 | 7,769 |
| Willesden Cpn. | 37,500 | 22,000*† | 500* | 15,000 |
| Woking E. S. Co. | (See Surrey). | | | |
| **NORFOLK** | | | | |
| Cromer (E. Anglian Co.) | 951 | — | 861 | 90 |
| East Anglian E. S. Co. | 104,729 | 16,729† | | 88,000 |
| East Dereham U.D.C. | 1,700 | 730† | — | 970 |
| Great Yarmouth Cpn. | 30,721 | 17,481† | — | 13,240 |
| King's Lynn Cpn. | 6,611 | 1,111† | 3,688 | 1,812 |
| Norwich Cpn. | 62,677* | 10,000*† | — | 52,677 |
| Sheringham (E. Anglian Co.) | 1,568 | 713 | — | 855 |
| Wisbech E. L. and P. Co. | (See Cambridgeshire) | | | |
| **NORTHAMPTONSHIRE** (Including Peterborough and Rutland) | | | | |
| Kettering U.D.C. | 19,219 | 8007† | 2,953 | 8,259 |
| Northampton E. L. and P. Co. | 57,000 | 27,500† | 1,500 | 28,000 |
| Peterborough Cpn. | 16,500 | 7,700† | 500 | 8,300 |
| Rushden and Dist. E. S. Co. | 11,000 | 3,500† | 700 | 6,800 |
| Wellingborough E. S. Co. | 8,500 | 3,082† | 300 | 5,111 |
| **NORTHUMBERLAND** | | | | |
| Amble U.D.C. | 1,200 | 1,014† | — | 186 |
| Hexham and Dist. E. S. Co. | 2,637 | 1,100* | — | 1,537 |
| North Eastern Supply Co. | 338,780 | 140,000† | 8,000 | 190,780 |
| Tynemouth Cpn. | 16,845 | 11,053 | — | 5,792 |
| **NOTTINGHAMSHIRE** | | | | |
| Derbyshire and Notts E. P. Co. | (See Derbyshire). | | | |
| East Retford Cpn. | 8,600* | 3,400*† | — | 5,200 |
| Long Eaton U.D.C. | (See Derbyshire). | | | |
| Mansfield Cpn. | 15,334 | 3,200† | 4,031 | 8,103 |
| Newark-on-Trent Cpn. | 5,625 | 3,080† | — | 2,545 |
| Nottingham Cpn. | 96,500 | 23,000† | 47,000 | 26,500 |
| Worksop Cpn. | 6,773 | 2,130† | 2,631 | 2,012 |
| **OXFORDSHIRE.** | | | | |
| Aylesbury Cpn. | (See Buckinghamshire). | | | |
| Banbury and Dist. E. S. Co. | — | — | — | — |
| Burford E. L. and P. Co. | 456 | 354† | 102 | — |
| Chipping Norton E. S. Co. | — | — | — | — |
| Oxford Cpn. | 17,094 | 9,921† | — | 7,173 |
| Reading Cpn. | (See Berkshire) | | | |
| Thames Valley E. S. Co. | (See Berkshire). | | | |
| Witney U.D.C. | 1,050 | 310† | 515 | 225 |
| Woodstock and Dist. E. D. Co. | 490* | 350* | — | 140 |
| **SHROPSHIRE.** | | | | |
| Market Drayton E. L. and P. Co. | 1,200 | — | 906 | 294 |
| N.W. Midlands J. E. A. | (See Staffordshire). | | | |
| Oswestry Cpn. | 3,100* | 800* | 750* | 1,550 |
| Shrewsbury Cpn. | 8,030 | — | 3,300 | 4,730 |
| Shropshire, Worcestershire and Staffordshire E. P. Co. | — | — | — | — |
| **SOMERSETSHIRE.** | | | | |
| Bath Cpn. | 16,173 | 6,000† | 300 | 9,873 |
| Bridgewater and Dist. E. S. and T. Co. | — | — | — | — |
| Bristol Cpn. | 94,110 | 45,500*† | — | 48,610 |
| Burnham and Dist. E. S. Co. | 1,200 | 940† | — | 260 |
| Mid Somerset E. S. Co. | 1,100* | 850*† | — | 250 |
| Minehead E. S. Co. | 5,226 | 2,391† | — | 2,835 |
| North Somerset E. S. Co. | 31,700 | 10,100*† | — | 21,600 |
| Porlock and Dist. E. S. Co. | 640 | 336† | — | 304 |
| South Somerset and Dist. E. Co. | 12,050* | 1,900*† | — | 10,150 |
| Wellington D. E. Co. | 2,150* | 520* | — | 1,630 |
| Taunton Cpn. | 11,500 | 500† | — | 11,000 |
| Weston-super-Mare and Dist. E. S. Co. | 8,000 | 3,000† | 1,352 | 3,648 |
| Yeovil E. L. and P. Co. | 5,270 | — | 1,630 | 3,640 |
| **STAFFORDSHIRE** | | | | |
| Burton-on-Trent Cpn. | 23,750 | 16,395† | — | 7,355 |
| Cannock U.D.C. | 11,000* | 4,750† | — | 6,250 |
| Chasetown and Dist. E. Co. | 6,960 | 4,527 | — | 2,433 |
| Leek Cpn. | 5,168 | 234† | 3,117 | 1,817 |
| Lichfield Cpn. | 3,944 | 2,131† | — | 1,813 |
| Market Drayton E. L. and P. Co. | (See Shropshire). | | | |
| Midland Elec. Cpn. for Power Distbn. | 77,000 | 23,500† | — | 53,500 |
| Newcastle under Lyme | 6,700* | 850*† | 2,250* | 3,600 |
| N.W. Midlands J.E.A. | 27,937 | 2,820† | — | 25,117 |
| Shropshire, Worcestershire and Staffordshire E. P. Co. | — | — | — | — |
| Stafford Cpn. | 6,000 | 3,500* | | 2,500 |
| Stoke-on-Trent Cpn. | 64,000 | 17,474† | 2,400 | 44,126 |
| Stone U.D.C. | 2,000 | 900† | — | 1,100 |
| Sutton Coldfield U.D.C. | (See Warwickshire). | | | |
| Tamworth Dist. E. S. Co. | (See Warwickshire). | | | |
| Uttoxeter U.D.C. | 2,500 | 920† | — | 1,580 |
| Walsall Cpn. | 32,890 | 17,016† | 290 | 15,584 |
| West Bromwich Cpn. | 17,748 | 4,987† | 2,387 | 10,374 |
| Wolverhampton Cpn. | 40,000 | 29,800*† | — | 10,200 |
| **SUFFOLK** | | | | |
| Aldeburgh E. S. Co. | 770 | — | 525 | 245 |
| Bungay G. and E. Co. | 750 | 528† | — | 222 |
| Bury St. Edmund's Cpn. | 5,469 | 2,619† | 5 | 2,845 |
| East Anglian E. S. Co. | (See Norfolk) | | | |
| East Suffolk E. D. Co. | 5,130* | 1,620*† | — | 3,510 |
| Felixstowe U.D.C. | 3,793 | 3,073† | 498 | 222 |
| Gt. Yarmouth Cpn. | (See Norfolk) | | | |
| Ipswich Cpn. | 28,650 | 9,058† | 7,000 | 12,592 |
| Lowestoft Cpn. | 13,100 | 1,800* | 6,110 | 5,190 |
| Mildenhall (Parker Bros.) | — | — | 255 | — |
| Newmarket E. L. Co. | — | — | — | — |
| Southwold (E. Anglian Co.) | 1,280 | 763† | — | 517 |
| Woodbridge and District E. L. Co. | 1,820 | 670† | — | 1,150 |
| **SURREY** | | | | |
| Barnes Cpn. | 11,000 | — | 10,000 | 1,000 |
| County of London E. S. Co. | (See Essex) | | | |
| Croydon Cpn. | 59,200 | 33,700*† | 5,400* | 20,100 |
| Dorking and Dist. E. S. Co. | 6,844 | 2,409 | 1,572 | 2,823 |
| Egham and Staines E. Co. | (See Middlesex) | | | |
| East Grinstead U.D.C. | (See Sussex) | | | |
| Epsom U.D.C. | 4,968 | 1,268† | 2,857 | 853 |
| Farnham G. and E. Co. | 6,300 | 2,556† | — | 3,944 |
| Guildford Cpn. | 16,900 | 10,150† | 600 | 6,150 |
| Horley and Dist. E. S. Co. | 4,500 | 1,413† | — | 3,087 |
| Kingston-on-Thames Cpn. | 10,000 | 8,410† | — | 1,590 |
| Leatherhead (J.E.A.) | 6,362 | 3,274† | 1,993 | 1,095 |
| London and Home Counties Joint Electricity Authority | 101,800 | 62,550† | 17,810 | 21,140 |
| Reigate | — | — | — | — |
| Richmond E. L. and P. Co. | 9,763 | 5,100*† | 500* | 4,163 |
| Sevenoaks and Dist. E. Co. | (See Kent) | | | |

| Name of Supply Authority | Total No. of House-holders in Area | Number of Households on A.C. | on D.C. | Without Supply. |
|---|---|---|---|---|
| Surbiton (J.E.A.) .. | 10,214 | 3,946† | 5,800 | 468 |
| Sutton (J.E.A.) .. | 43,824 | 35,118† | — | 8,706 |
| Walton .. .. .. | — | — | — | — |
| Weybridge (J.E.A.) .. | 1,746 | 1,547† | — | 199 |
| Wimbledon Cpn. .. | 29,247 | 28,077† | — | 1,170 |
| Woking E. S. Co. .. | 16,371 | 9,026† | — | 7,345 |
| Yorktown (Camberley) and Dist. G. and E. Co. .. .. .. | 7,100 | 1,750 | — | 5,350 |
| **SUSSEX** | | | | |
| Bexhill Cpn. .. .. | — | 185† | 5,732 | — |
| Bognor G. and E. Co... | 2,440 | 3,920† | — | 5,520 |
| Brighton Cpn. .. .. | 50,000 | 30,000† | 6,000 | 14,000 |
| Burgess Hill E. S. Co. .. | 2,250 | 950 | — | 1,300 |
| Central Sussex Elec. Co. and Associated Cos. (Steyning, Uckfield, etc.) .. .. .. | 21,000 | 4,000† | 940 | 15,160 |
| Chichester Cpn. .. | 8,000 | 36,600*† | — | 4,350 |
| East Grinstead U.D.C. | 2,200 | 778 | 1,006 | 416 |
| Eastbourne Cpn. .. | 14,872 | 14,200* | — | 672 |
| Hastings Cpn. .. .. | 22,600 | 17,000† | — | 5,600 |
| Horsham Cpn. .. .. | — | — | — | — |
| Horley and Dist. E. S. Co. .. .. .. | (See Surrey) | | | |
| Hove Cpn. .. .. .. | 16,606 | 5,000*† | 8,000* | 3,606 |
| Lewes and Dist. E. S. Co. .. .. .. | 3,350 | — | 1,591 | 1,759 |
| Newhaven and Seaford E. Co. .. .. | — | — | — | — |
| Peacehaven E. L. and P. Co. .. .. .. | 1,400 | 670† | — | 730 |
| Portsmouth Cpn. .. | (See Hampshire) | | | |
| Ringmer and Dist. E. Co. .. .. .. | 1,600 | 831† | — | 769 |
| Shoreham and Dist. E. L. and P. Co. .. | 6,000 | 2,280† | — | 3,720 |
| Sussex E. S. Co. (Crawley) .. .. | 1,500 | 450*† | 500 | 550 |
| Sussex E. S. Co. (Littlehampton) .. .. | 2,700 | — | 950* | 1,750 |
| Tunbridge Wells Cpn. | (See Kent) | | | |
| Weald E. S. Co. .. | (See Kent) | | | |
| Worthing Cpn. .. .. | 18,700 | 5,100* | 8,500* | 5,100 |
| **WARWICKSHIRE** | | | | |
| Birmingham Cpn. .. | 268,000 | 92,000† | 36,000 | 140,000 |
| Coventry Cpn. .. .. | 64,443 | 36,883† | — | 27,560 |
| Leamington and Warwick E. Co. .. .. | 5,060 | 505† | 643 | 3,912 |
| Leicestershire and Warwickshire E. P. Co. | (See Leicestershire) | | | |
| Midland E. Cpn. for Power Distribution .. | 75,100 | 21,000*† | — | 54,100 |
| Midland E. L. and P. Co. | 9,325* | 1,510† | 800 | 7,015 |
| Nuneaton Cpn. .. .. | 12,000 | 10,000† | | 2,000 |
| Rugby Cpn. .. .. .. | 6,000 | 4,559† | — | 1,441 |
| Sutton Coldfield Cpn. .. | 11,000 | 1,317† | 5,629 | 4,054 |
| Tamworth Dist. E. S. Co. | 7,800 | 6,060† | — | 1,440 |
| **WESTMORLAND** | | | | |
| Barrow-in-Furness Cpn. | (See Lancashire) | | | |
| Kendal Cpn. .. .. .. | 4,550 | 1,757† | 50 | 2,743 |
| Keswick E. L. Co .. | 1,020 | 860* | — | 160 |
| Windermere and Dist. E. S. Co. .. .. | 3,600 | 1,574 | — | 2,026 |
| **WILTSHIRE** | | | | |
| Amesbury E. L. and Gen. S. Co .. .. | 500* | — | 300* | 200 |
| Calne Cpn. .. .. | 970* | — | 231 | 739 |
| Malmesbury (Wessex Co.) .. .. .. | 892 | 326 | — | 566 |
| Marlborough Cpn. .. | 1,220 | — | 461 | 759 |
| Salisbury E. S. Co. .. | 7,500 | 600† | 2,996 | 3,904 |
| Swindon Cpn. .. .. | 21,500 | 6,061† | 6,757 | 8,682 |
| Tisbury E. S. Co. | 500 | — | 157 | 343 |
| Warminster(Wessex Co.) | 1,471 | 625 | — | 846 |
| West Wilts. E. L. and P. Co. .. .. | 19,485 | 9,287† | — | 10,198 |
| Wilton E. S. Co. .. | 500 | 131† | — | 369 |
| **WORCESTERSHIRE** | | | | |
| Lye and Wollescote U.D.C. .. .. | 625* | 500* | — | 125 |
| Kidderminster and Dist. E. S. Co. .. .. | 8,600 | 3,300† | 1,000 | 4,300 |
| Malvern U.D.C. .. | 4,684 | 2,255† | — | 2,429 |
| Midland Elec. Cpn. for Power Distribution. | (See Staffordshire). | | | |
| Worcester Cpn. .. | 14,000* | — | — | — |

| Name of Supply Authority | Total No. of House-holders in Area | Number of Households on A.C. | on D.C. | Without Supply. |
|---|---|---|---|---|
| **YORKSHIRE** | | | | |
| Adwick-le-Street U.D.C. | 5,000 | 3,650† | — | 1,350 |
| Askrigg and Reeth E. S. Co. .. .. .. | 443 | 260 | — | 185 |
| Barnoldswick U.D.C. .. | 3,482 | 794† | — | 2,688 |
| Barnsley Cpn. .. .. | 17,869 | 9,690† | 34 | 7,645 |
| Batley Cpn. .. .. | 10,233 | 3,774 | 1,396 | 5,063 |
| Bingley U.D.C. .. | 6,500 | 3,832† | — | 2,668 |
| Bradford Cpn. .. | 82,700 | 30,550† | 2,164 | 49,986 |
| Bridlington Cpn. .. | 5,600 | 4,000† | — | 1,600 |
| Brighouse Cpn. .. | 6,000 | 1,644† | — | 4,356 |
| Buckrose L. and P. Co. | 8,000* | 1,100*† | — | 6,900 |
| Craven Hydro-Elec. S. Co. .. .. .. | 361 | — | 337 | 24 |
| Darlington Cpn. .. | (See Durham) | | | |
| Dearne Dist. E. Board | 9,145 | 2,200*† | — | 6,945 |
| Dewsbury Cpn. .. | 15,000 | 5,000† | 600 | 9,400 |
| Doncaster Cpn. .. | 22,000 | 10,500*† | 350* | 11,150 |
| Earby U.D.C. .. .. | 1,661 | 681† | — | 980 |
| Elect. Distbtn. of Yorkshire, Ltd. .. .. | 213,500 | 67,000† | — | 146,500 |
| Elland U.D.C. .. .. | 3,370 | 1,020† | 1,130 | 1,220 |
| Eston U.D.C. .. .. | 6,924 | 5,427 | — | 1,497 |
| Guisborough U.D.C. .. | 1,400 | 1,150† | — | 250 |
| Hawes E. L. Co. .. | 261 | 206 | — | 55 |
| Halifax Cpn. .. .. | 27,963 | 11,427† | | 16,536 |
| Harrogate Cpn. .. .. | 20,000 | 12,190† | — | 7,810 |
| Haworth .. .. .. | 1,500* | 360* | — | 1,140 |
| Hebden Bridge U.D.C. | 2,050 | 980† | — | 1,070 |
| Heckmondwicke U.D.C. | 2,500 | — | 2,027 | 473 |
| Holmfirth U.D.C. .. | 3,071 | 2,388† | — | 683 |
| Honley .. .. .. | 1,645* | 1,215*† | — | 430 |
| Huddersfield Cpn. .. | 42,000 | 26,500† | — | 15,500 |
| Hull Cpn. .. .. | 90,000 | 25,664† | 23,870 | 40,466 |
| Ilkley U.D.C. .. .. | 2,700 | 2,098† | — | 602 |
| Ingleton E. L. and P. Co. .. .. .. | 700* | — | 200* | 500 |
| Keighley Cpn. .. .. | 13,200 | 7,670† | | 5,530 |
| Kettlewell E. S. Co. | 100 | — | 75 | 25 |
| Leyburn E. S. Co. .. | 250 | — | 235 | 15 |
| Middlesbrough Cpn. .. | 32,000 | 20,939† | — | 11,061 |
| Marborough U.D.C. .. | 4,093 | — | 3,282 | 811 |
| Mirfield U.D.C. .. | 3,500 | 2,050† | — | 1,750 |
| Morley Cpn. .. .. | 6,645 | 4,293† | — | 2,352 |
| Leeds Cpn. .. .. | 136,000 | 90,000† | — | 46,000 |
| New Mill U.D.C. .. | 1,100 | 930† | — | 170 |
| Normanton U.D.C. .. | 3,500 | 1,276† | — | 2,224 |
| North Eastern E. S. Co. | (See Northumberland) | | | |
| Pudsey Cpn. .. .. | 5,714 | 3,691† | — | 2,023 |
| Redcar Cpn. .. .. | 5,570 | 4,750† | — | 820 |
| Richmond E. S. Co. .. | 1,136 | 1,118† | — | 18 |
| Rotherham Cpn. .. | 28,000 | 15,700† | — | 12,300 |
| Scarborough Cpn. .. | 15,884 | 7,890† | — | 8,994 |
| Settle and Dist. E. Co. | 3,229 | 750† | — | 2,479 |
| Sheffield Cpn. .. .. | 125,000 | 100,000† | — | 25,000 |
| Shipley .. .. .. | — | — | — | — |
| Skelton and Brotton U.D.C .. .. | 3,196 | 2,496† | — | 700 |
| Skipton U.D.C. .. .. | 4,500 | 2,000† | — | 2,500 |
| Slaithwaite Cpn. .. | 1,510 | 750* | — | 760 |
| Spenborough U.D.C. .. | 4,050 | 1,592† | — | 2,458 |
| Stalybridge, Hyde Mossley and Dukinfield T. and E. Board .. | (See Cheshire) | | | |
| Tadcaster E. Co. .. | 1,200 | — | 475 | 725 |
| Wakefield Cpn. .. | 14,600 | 12,200† | — | 2,400 |
| Whitwood U.D.C. .. | 1,728 | 1,050† | — | 678 |
| Whitby .. .. .. | — | — | — | — |
| York Cpn. .. .. .. | 30,062 | 20,600† | 3,464 | 6,098 |
| Yorkshire E. P. Co. .. | — | — | — | — |
| **WALES AND MONMOUTH.** | | | | |
| Aberangell Hydro E. .. | 300 | — | 110 | 190 |
| Aberayron and Dist. E. S. Co. .. .. | 400 | — | 230 | 170 |
| Aberdare .. .. .. | — | — | — | — |
| Abertillery U.D.C. .. | 7,419 | 1,531 | 2,088 | 3,803 |
| Aberystwyth (Chiswick E.S. Cpn.) .. .. | 2,200 | — | 1,800 | 400 |
| Ammanford U.D.C. .. | 1,750 | — | 1,380* | 370 |
| Bangor Cpn. .. .. | 2,900 | 2,140*† | — | 760 |
| Barry Cpn. .. .. .. | 8,470 | 65 | — | 8,450 |
| Bedwas and Machen U.D.C. .. .. | 2,000 | 1,489 | — | 511 |
| Bedwellty .. .. | 7,500* | 2,700* | — | 4,800 |
| Bethesda U.D.C. .. | 1,500 | 750† | — | 750 |
| Bettws-y-Coed Cpn. | 192 | 170 | — | 22 |
| Blantawe E. S. Co. .. | 2,800 | — | 1,388 | 1,412 |
| Borth and Ynyslas E. S. Co. .. .. .. | 450 | — | 200 | 250 |
| Brecon Cpn. .. .. | 1,695 | — | 1,118 | 577 |
| Bridgend U.D.C. .. | 5,550 | 5,058 | — | 692 |
| Brynamman and Dist. E. S. Co. .. .. | 4,135 | 2,639† | — | 1,496 |

# SET MARKET SURVEY

| Name of Supply Authority | Total No. of Householders in Area | Number of Households on A.C. | on D.C. | Without Supply. |
|---|---|---|---|---|
| Caernarvon Cpn. .. | 2,356 | 1,761† | — | 595 |
| Caerphilly U.D.C. .. | 3,180 | 1,392 | — | 1,704 |
| Cardiff Cpn. .. .. | 52,233 | 42,298† | | 9,935 |
| Cardiff R.D.C. .. | 9,000 | 3,668 | — | 5,332 |
| Carmarthen E. S. Co. | 5,041 | 1,046 | 1,441 | 2,554 |
| Celynin E. L. Co. .. | 135 | — | 135 | — |
| Chepstow E. L. and P. Co. .. .. .. | 1,520* | 870* | — | 650 |
| Colwyn Bay U.D.C. .. | 4,775 | 3,350† | 800 | 625 |
| Conway Cpn. .. | 3,000 | 2,000† | — | 1,000 |
| Corwen E. L. Co. .. | — | 300 | — | — |
| Dolywern and Dist. E. S. Co. .. .. | — | 44 | — | — |
| Ebbw Vale U.D.C. .. | 6,095 | — | 5,820 | 275 |
| Elect. Distbtn. of N. Wales .. .. | — | — | — | — |
| Gellygaer U.D.C. .. | 8,899* | 7,250 | — | 1,649 |
| Grantawe U.D.C. .. | 2,975* | — | 536* | 2,439 |
| Gorseinon E. L. Co. .. | 6,250 | 2,400† | 769 | 3,021 |
| Hawarden Cpn. .. | 6,900† | 3,750*† | — | 3,150 |
| Holyhead (Anglesey) | 2,800* | 400*† | 910* | 1,490 |
| Llandilo .. .. | 478* | — | 250* | 228 |
| Llandloes E. L. Co. .. | 680 | — | 388 | 292 |
| Llandrindod Wells .. | 750 | — | 680 | 70 |
| Llandudno U.D.C. .. | 4,800 | 1,484 | 2,207 | 809 |
| Llanelly and Dist. E. S. Co. .. .. | — | — | — | — |
| Llanfairfechan .. | 850 | 540*† | — | 310 |
| Llangollen and Dist. E. L. and P. Co. .. | 800 | — | 320 | 480 |
| Llanrwst E. S. Co. .. | 1,082 | 207† | 300 | 575 |
| Llansantffraw E. S. Co. | 146 | — | 69 | 77 |
| Llantarnam U.D.C. .. | 1,600 | 1,350 | — | 250 |
| Machynlleth E. S. Co. | 510 | 262 | — | 248 |
| Maesteg U.D.C. .. | 5,800 | 5,000 | — | 800 |
| Menai Bridge U.D.C. .. | 681 | 345 | — | 336 |
| Merthyr E. T. and L. Co. .. .. .. | 16,000 | 1,500* | 2,600* | 11,900 |
| Mevagissey E. S. Co. .. | 580 | — | 350 | 230 |
| Milford Haven U.D.C. | 2,000 | 1,400 | — | 600 |
| Mold U.D.C. .. .. | 2,000* | — | 1,320* | 680 |
| Monmouth E. Co. .. | 1,100 | 500* | — | 600 |
| Mountain Ash U.D.C. .. | 8,200 | 8,050 | — | 150 |
| Mynyddislwyn U.D.C. | 3,500 | 3,110 | — | 390 |
| Neath Cpn. .. .. | 8,260 | 2,000 | — | 6,260 |
| Neath R.D.C. .. .. | 7,301* | 3,350* | — | 3,951 |
| Newport Cpn. .. .. | 23,332 | 12,472† | 7,784 | 2,876 |
| New Radnor E. Co. .. | 76 | — | 60 | 16 |
| North Wales and South Cheshire J.E.A. .. | — | — | — | — |
| Ogmore and Garw U.D.C. .. .. | 2,600 | 2,425† | — | 175 |
| Ogmore Valley E. L. and P. Co. .. .. | 3,000 | 2,700† | — | 300 |
| Penarth E. L. Co. .. | 4,688 | 113 | 1,795 | 2,750 |
| Penmaenmawr U.D.C. | 1,300 | 1,250† | — | 50 |
| Penrith E. L. Co. .. | — | — | 112 | — |
| Penyhont .. .. | 1,819 | 1,810 | — | 9 |
| Pontardawe R.D.C. .. | 6,800 | 3,300 | — | 3,500 |
| Pontypool E. L. and P. Co. .. .. .. | 7,000 | 1,350* | — | 5,650 |
| Pontypridd U.D.C. .. | 8,991 | 1,408 | 2,179 | 5,407 |
| Porthcawl E. Co. .. | 1,500 | 700* | — | 800 |
| Port Talbot Cpn. .. | 9,903 | 1,100 | — | 8,803 |
| Prestatyn Cpn. .. | 1,640 | 1,210† | — | 430 |
| Rhondda U.D.C. .. | 28,842 | 13,486 | — | 15,356 |
| Rhyl .. .. .. | — | — | — | — |
| Risca U.D.C. .. .. | 3,500 | 1,659 | — | 1,841 |
| Ruthin E. S. Co. .. | 885 | — | 618 | 267 |
| South Wales E. P. Co. | — | — | — | — |
| Swansea Cpn. .. .. | 37,000 | 1,500 | 20,864 | 14,636 |
| Tredegar U.D.C. .. | (Supply not yet commenced) | | | |
| West Cambrian P. Co. | 500 | — | 400 | 100 |
| Wrexham Cpn. .. | 5,240 | 3,462 | 850 | 928 |
| Ynll E. P. Co. .. .. | — | — | 1,800 | — |

## SCOTLAND

| | | | | |
|---|---|---|---|---|
| Aberdeen Cpn. .. | 46,000* | 18,000* | | 28,000 |
| Arbroath E. L. and P. Co. .. .. .. | 3,500 | 180 | 800 | 2,520 |
| Ayrshire Elec. Bd. | 71,295 | 25,900† | 3,220 | 42,170 |
| Beauly E. S. Co., Ltd. | 225* | — | 100* | 125 |
| Berwick-on-Tweed (Urban E. S. Co.) .. | 3,299 | — | 1,163 | 2,136 |
| Blair Atholl .. .. | 70 | — | 70 | — |
| Bo'ness Cpn. .. .. | 2,876 | — | 1,011 | 1,865 |
| Clyde Valley E. P. Co. | — | 71,657† | — | — |
| Coatbridge and Airdrie E. S. Co. .. .. | 15,061 | — | 1,182 | 13,879 |
| Crieff E. S. Co. .. | 1,400 | — | 239 | 1,161 |
| Dunny and Dunipace Cpn. .. .. .. | 1,150 | 561† | — | 589 |



| Name of Supply Authority | Total No. of Householders in Area | Number of Households on A.C. | on D.C. | Without Supply. |
|---|---|---|---|---|
| Dumbarton .. .. | — | — | — | — |
| Dumfries Cpn. .. | 5,848 | 1,134† | 1,941 | 2,773 |
| Dumfriesshire C.C. .. | 13,000 | 3,000† | — | 10,000 |
| Dunbarton C. C. .. | (Operated by Clyde Valley E. P. Co.). | | | |
| Dunblane and Dist. E.S. Co. .. .. .. | 800* | 400* | — | 400* |
| Duncans E. S. Co. .. | 625* | — | 404* | 221 |
| Dundee Cpn. .. .. | 47,316 | 7,200 | 3,702 | 36,414 |
| Dunoon and Dist. E. S. Co. .. .. .. | 4,000 | 1,802† | — | 2,198 |
| Edinburgh Cpn. .. | 111,233 | 37,100† | 9,290 | 64,783 |
| Elgin E. S. Co .. | 1,000 | — | 300 | 700 |
| Erlcht Water and E. P. Co. .. .. .. | — | — | — | — |
| Falkirk Cpn. .. .. | 7,100 | 2,900* | — | 4,200 |
| Fife E. P. Co. .. .. | 62,800 | 10,600† | — | 52,200 |
| Fort Augustus E. L. .. | — | — | 50 | — |
| Fort William E. L. Co. | 950* | — | 450* | 500 |
| Glasgow Cpn. .. .. | 249,000 | 37,000* | 40,000* | 172,000 |
| Grampian E. S. Co. .. | — | — | — | — |
| Grantown-on-Spey E. S. Co. .. .. .. | 400* | — | 287* | 113 |
| Greenock Cpn. .. | 23,784 | 5,250*† | 5,250* | 13,284 |
| Hamilton Cpn. .. | 8,200* | 800* | 1,000* | 6,400 |
| Hawick (Urban E. S. Co.) .. .. .. | 4,886 | — | 1,738 | 3,148 |
| Helensburgh Cpn. .. | (Operated by Clyde Valley E. P. Co.). | | | |
| Inverness Burgh .. | 6,310 | — | 3,187 | 3,123 |
| Kirkcaldy Cpn. .. | 10,200 | 2,200 | 800 | 7,200 |
| Kircudbright C.C. .. | 9,530 | 1,260 | 280 | 7,990 |
| Kirkwall Cpn. .. | 1,010 | — | 600 | 410 |
| Lairg E. S. Co .. | 270 | 50* | 50* | 170 |
| Lanarkshire C. C. .. | (Operated by Clyde Valley E. P. Co.). | | | |
| Lerwick Cpn. .. .. | 1,405 | — | 649 | 756 |
| Loch Leven E. S. Co. .. | — | — | — | — |
| Lochaber Power Co. .. | 112 | 112 | — | — |
| Lossiemouth and Branderburgh U.D.C. .. | 1,000 | — | 750 | 250 |
| Lothians E. P. Co .. | 26,493 | 6,919† | — | 19,580 |
| Motherwell and Wishaw Cpn. .. .. .. | 15,291 | — | 7,395 | 7,896 |
| Musselburgh and Dist. E. L. and T. Co. .. | 4,684 | 21† | 1,298 | 3,365 |
| North Berwick .. .. | 1,150* | 400*† | — | 750 |
| N. of Scotland E. L. and P. Co. .. .. .. | 2,230* | — | 500* | 1,730 |
| Oban .. .. .. | 1,740* | — | 950* | 790 |
| Paisley Cpn. .. .. | 22,000 | 12,000† | — | 10,000 |
| Perth Cpn .. .. | 9,200 | — | 4,030 | 5,170 |
| Peterhead E. Co. .. | 3,000 | 250 | — | 2,750 |
| Rothesay Cpn. .. | 3,000 | — | 900 | 2,100 |
| Ross-shire E. S. Co. .. | 5,250* | 2,178* | — | 3,072 |
| St. Andrew's E. S. .. | 2,425 | — | 840 | 1,585 |
| Scottish Central E. P. Co. .. .. .. | — | — | — | — |
| Scottish Midlands E. S. | 36,800 | 5,464† | — | 31,336 |
| Scottish Southern E. S. Co. .. .. .. | 15,578* | 1,600* | — | 13,978 |
| Skelmorlie E. S. Co. .. | 360 | 184† | — | 176 |
| Stirling Cpn. .. .. | 5,371 | — | 2,879 | 2,492 |
| Stornoway E. S. Co. .. | 1,250 | — | 240 | 1,010 |
| Strathclyde E. S. Co. .. | — | 34,000* | — | — |
| Tain Cpn. .. .. | 400 | 200* | — | 200 |
| Tobermory Cpn. .. | 260 | — | 132 | 128 |
| West Lothian C.C. .. | 3,000 | — | 778 | 2,222 |
| Wick Cpn. .. .. | 2,612 | — | 1,821 | 791 |
| Wigtownshire E. Co. .. | 6,934 | 883 | — | 6,051 |

## NORTHERN IRELAND

The figures given here, relating to a few supply undertakings in Northern Ireland, are included for purposes of comparison only. No attempt has been made to cover the above area adequately, and it has been found impossible to provide any figures which will, with any degree of accuracy, show the extent of domestic electrification.

The following figures are not included in the general summary given at the beginning of this Survey. They do not, therefore, affect the accuracy of the total Statistics for England, Scotland and Wales.

| | | | | |
|---|---|---|---|---|
| Antrim L. and P. Co. .. | 1,000 | 500 | — | 500 |
| Ballycastle E. L. and P. Co. .. .. .. | 400 | — | 250 | 150 |
| Ballyclare .. .. | 760* | — | 500* | 260 |
| Belfast Cpn. .. .. | 98,000 | 12,000 | 7,600 | 78,400 |
| Clogher (Tyrone) .. | 100* | — | 80* | 20 |
| Dromore E. L. and P. Co. .. .. .. | 720 | — | 660 | 60 |
| Elec. Board of N. Ireland | 124,100 | 14,165† | — | 109,035 |
| Fintona E. L. Co. .. | 250 | — | 120 | 130 |
| Fivemiletown .. .. | 200* | — | 150 | 50 |
| Larne E. L. and P. Co. | 3,600 | 500† | 1,000 | 2,000 |
| Limavady .. .. | 800* | 650* | — | 150 |
| Lisbellan E. L. Co. .. | — | — | 75 | — |
| Londonderry Cpn. .. | 8,255 | 1,541 | 1,973 | 4,741 |
| Magherra (Derry) .. | 250* | — | 125* | 125 |
| Mid-Ulster Motor Co. .. | — | — | 105 | — |
| Portrush U.D.C. .. | 1,006 | — | 670 | 336 |
| Portstewart U.D.C. .. | 920 | — | 688 | 232 |

# 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 recently the subject of a question in the House of Commons.

In reply, Sir Kingsley Wood, 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."

# P.O. LICENCE FIGURES

| COUNTRY. | Aug. 31, 1933. | Sept. 30, 1933. | Oct. 31, 1933. | Nov. 30, 1933. | Dec. 31, 1933. | Jan. 31, 1934. | Feb. 28, 1934. | Mar. 31, 1934. | April 30, 1934. | May 31, 1934. | June 30, 1934. | July 31, 1934. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Great Britain ... ... | 5,637,506 | 5,698,206 | 5,754,379 | 5,854,741 | 5,965,517 | 6,111,528 | 6,175,226 | 6,237,710 | 6,290,211 | 6,324,210 | 6,353,334 | 6,376,024 |
| | | | | | SUMMARY. | | | | | | | |
| England ... ... ... | 4,110,038 | 4,157,636 | 4,208,698 | 4,285,600 | 4,369,050 | 4,471,099 | 4,517,374 | 4,563,636 | 4,600,548 | 4,623,319 | 4,645,204 | 4,662,682 |
| Wales ... ... ... | 186,023 | 188,084 | 189,930 | 194,530 | 199,075 | 206,950 | 211,563 | 218,445 | 221,409 | 222,942 | 224,119 | 225,364 |
| Scotland ... ... ... | 394,097 | 403,327 | 412,272 | 425,772 | 439,242 | 455,771 | 462,762 | 466,609 | 475,176 | 483,485 | 486,496 | 488,752 |
| Northern Ireland ... ... | 50,809 | 51,531 | 52,063 | 53,265 | 54,731 | 56,395 | 57,688 | 58,508 | 59,032 | 59,316 | 59,561 | 59,835 |
| | | | | | ENGLAND. | | | | | | | |
| COUNTY. | | | | | | | | | | | | |
| London ... ... ... | 896,539 | 897,628 | 891,416 | 895,574 | 903,419 | 921,313 | 925,839 | 930,512 | 934,046 | 935,148 | 937,954 | 939,391 |
| Bedfordshire ... ... | 35,423 | 35,798 | 36,092 | 36,631 | 37,093 | 37,755 | 38,030 | 38,459 | 38,735 | 38,880 | 39,097 | 39,290 |
| Buckinghamshire ... | 38,653 | 39,087 | 39,305 | 40,066 | 40,754 | 41,924 | 42,542 | 42,815 | 43,273 | 43,908 | 44,144 | 44,131 |
| Berkshire ... ... ... | 51,577 | 51,493 | 51,773 | 52,402 | 53,112 | 53,880 | 54,237 | 54,528 | 54,831 | 54,973 | 55,150 | 55,124 |
| Cambridgeshire ... ... | 36,596 | 36,978 | 37,598 | 38,188 | 38,826 | 39,660 | 39,930 | 40,238 | 40,457 | 40,566 | 40,681 | 40,797 |
| Channel Isles ... ... | 10,992 | 11,166 | 11,386 | 11,551 | 11,839 | 12,120 | 12,247 | 12,405 | 12,465 | 12,581 | 12,615 | 12,866 |
| Cheshire ... ... ... | 90,927 | 91,728 | 92,582 | 94,294 | 95,460 | 97,187 | 97,841 | 98,650 | 99,493 | 99,908 | 100,275 | 100,381 |
| Cornwall ... ... ... | 29,341 | 29,798 | 30,446 | 31,340 | 32,055 | 33,060 | 33,387 | 33,710 | 34,134 | 34,394 | 34,582 | 34,822 |
| Cumberland ... ... | 22,799 | 23,202 | 23,710 | 24,406 | 25,143 | 25,956 | 26,235 | 26,558 | 26,710 | 27,156 | 27,371 | 27,475 |
| Derbyshire ... ... | 64,491 | 65,090 | 65,650 | 66,905 | 67,974 | 69,582 | 70,590 | 71,415 | 72,685 | 72,900 | 73,026 | 73,379 |
| Devonshire ... ... | 102,784 | 103,932 | 105,442 | 107,287 | 108,876 | 111,033 | 111,855 | 112,855 | 113,451 | 113,923 | 114,280 | 114,899 |
| Dorsetshire ... ... | 21,074 | 21,286 | 21,645 | 22,076 | 22,583 | 23,116 | 23,331 | 23,605 | 23,786 | 23,923 | 23,978 | 24,074 |
| Durham ... ... ... | 81,169 | 82,795 | 84,402 | 86,093 | 88,277 | 90,700 | 92,110 | 93,525 | 94,391 | 95,046 | 95,698 | 96,234 |
| Essex ... ... ... | 171,628 | 172,545 | 173,006 | 175,296 | 177,970 | 181,627 | 183,609 | 185,511 | 186,972 | 188,328 | 189,497 | 190,398 |
| Gloucestershire ... ... | 108,237 | 109,489 | 111,198 | 113,112 | 115,095 | 118,086 | 119,455 | 121,080 | 121,911 | 122,814 | 123,369 | 124,206 |
| Hampshire ... ... | 163,809 | 165,791 | 167,349 | 170,277 | 172,276 | 175,746 | 176,884 | 178,071 | 179,553 | 180,401 | 181,106 | 181,658 |
| Herefordshire ... ... | 13,517 | 13,656 | 13,742 | 13,994 | 14,136 | 14,408 | 13,002 | 13,098 | 13,157 | 13,221 | 13,247 | 13,266 |
| Hertfordshire ... ... | 82,041 | 82,677 | 83,042 | 83,969 | 84,862 | 86,118 | 86,857 | 87,388 | 87,940 | 88,377 | 88,664 | 88,989 |
| Huntingdon ... ... | 6,751 | 6,803 | 6,856 | 6,940 | 7,029 | 7,079 | 7,102 | 7,138 | 7,180 | 7,194 | 7,216 | 7,229 |
| Isle of Man ... ... | 5,945 | 6,013 | 6,051 | 6,169 | 6,292 | 6,378 | 6,333 | 6,392 | 6,452 | 6,485 | 6,470 | 6,499 |
| Kent ... ..... ... | 203,110 | 205,686 | 208,091 | 211,131 | 215,112 | 220,393 | 222,179 | 224,449 | 226,373 | 227,522 | 228,786 | 229,931 |
| Lancashire ... ... | 671,892 | 678,245 | 687,028 | 700,189 | 712,999 | 732,674 | 739,677 | 746,300 | 751,779 | 754,471 | 757,519 | 758,737 |
| Lincolnshire ... ... | 78,931 | 80,082 | 81,566 | 83,213 | 85,393 | 87,165 | 87,813 | 88,659 | 89,334 | 89,741 | 90,094 | 90,455 |
| Leicestershire ... ... | 72,422 | 73,268 | 74,100 | 75,421 | 76,668 | 78,318 | 79,304 | 80,227 | 80,998 | 81,183 | 81,527 | 81,761 |
| Middlesex ... ... | 104,098 | 105,078 | 104,242 | 105,340 | 106,885 | 110,005 | 111,077 | 112,274 | 113,341 | 114,099 | 114,726 | 115,075 |
| Monmouthshire ... ... | 38,461 | 39,020 | 39,721 | 40,570 | 41,742 | 43,446 | 44,550 | 45,844 | 46,302 | 46,651 | 46,941 | 47,306 |
| Norfolk ... ... ... | 60,341 | 61,302 | 62,108 | 63,408 | 64,914 | 66,607 | 67,415 | 68,066 | 68,729 | 69,057 | 69,366 | 69,630 |
| Northampton ... ... | 57,747 | 58,492 | 59,189 | 60,055 | 61,478 | 62,688 | 63,234 | 63,779 | 64,010 | 64,315 | 64,574 | 64,719 |
| Northumberland ... | 87,895 | 89,962 | 92,711 | 95,052 | 97,160 | 99,351 | 100,380 | 101,463 | 102,356 | 103,076 | 103,497 | 104,151 |
| Nottinghamshire ... | 103,506 | 105,273 | 106,832 | 108,867 | 110,627 | 114,252 | 115,548 | 117,169 | 118,851 | 119,120 | 119,577 | 119,897 |
| Oxfordshire ... ... | 34,837 | 35,108 | 34,987 | 35,192 | 35,660 | 36,230 | 36,454 | 36,621 | 36,822 | 36,808 | 36,873 | 37,055 |
| Rutland ... ... ... | 1,479 | 1,489 | 1,519 | 1,538 | 1,544 | 1,568 | 1,565 | 1,576 | 1,594 | 1,588 | 1,590 | 1,594 |
| Shropshire ... ... | 29,124 | 29,419 | 29,821 | 30,552 | 31,057 | 31,549 | 31,809 | 31,972 | 32,205 | 32,318 | 32,436 | 32,527 |
| Somerset ... ... ... | 53,942 | 54,634 | 55,746 | 56,958 | 57,977 | 59,444 | 60,057 | 60,728 | 61,159 | 61,460 | 61,616 | 61,836 |
| Staffordshire ... ... | 128,271 | 130,387 | 132,993 | 136,590 | 139,493 | 50,375 | 144,772 | 146,695 | 147,952 | 148,703 | 149,543 | 150,034 |
| Suffolk ... ... ... | 45,996 | 46,537 | 47,221 | 48,189 | 49,226 | 143,119 | 50,910 | 51,295 | 51,679 | 51,980 | 52,289 | 52,476 |
| Surrey ... ... ... | 184,941 | 186,376 | 188,083 | 190,358 | 192,831 | 197,016 | 198,560 | 200,520 | 201,933 | 202,943 | 204,105 | 204,720 |
| Sussex ... ... ... | 112,653 | 113,657 | 115,232 | 117,062 | 119,055 | 121,422 | 122,658 | 123,717 | 124,646 | 125,396 | 126,386 | 128,070 |
| Warwickshire ... ... | 229,469 | 232,438 | 234,585 | 238,498 | 242,189 | 248,369 | 250,848 | 253,364 | 255,666 | 257,042 | 258,545 | 259,340 |
| Westmorland ... ... | 5,469 | 5,513 | 5,556 | 5,637 | 5,737 | 5,868 | 5,922 | 5,957 | 5,989 | 6,013 | 5,998 | 6,044 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wiltshire ... ... ... | 42,602 | 43,011 | 43,706 | 44,469 | 45,053 | 46,897 | 46,258 | 46,641 | 46,951 | 47,116 | 47,304 | 47,518 |
| Worcestershire ... ... | 55,442 | 56,081 | 56,777 | 57,626 | 58,906 | 60,309 | 61,111 | 61,886 | 62,545 | 62,963 | 63,358 | 63,650 |
| Yorkshire ... ... | 569,620 | 577,251 | 585,609 | 598,719 | 612,237 | 628,619 | 639,716 | 646,993 | 651,758 | 654,786 | 658,088 | 660,439 |
| **WALES.** | | | | | | | | | | | | |
| Anglesey ... ... | 1,562 | 1,583 | 1,611 | 1,662 | 1,695 | 1,746 | 1,787 | 1,805 | 1,825 | 1,839 | 1,847 | 1,859 |
| Breconshire ... | 1,706 | 1,700 | 1,706 | 1,728 | 1,755 | 1,780 | 1,792 | 1,816 | 1,826 | 1,826 | 1,826 | 1,831 |
| Carmarthenshire ... | 13,794 | 13,943 | 14,236 | 14,591 | 15,210 | 16,270 | 16,924 | 17,660 | 18,006 | 18,358 | 18,484 | 18,589 |
| Caernarvonshire ... ... | 18,641 | 18,968 | 19,182 | 19,640 | 19,963 | 20,456 | 20,667 | 23,907 | 21,074 | 21,186 | 21,291 | 21,359 |
| Cardiganshire ... ... | 3,173 | 3,199 | 3,234 | 3,315 | 3,386 | 3,538 | 3,594 | 3,624 | 3,658 | 3,672 | 3,698 | 3,702 |
| Denbighshire ... ... | 11,711 | 11,809 | 11,899 | 12,128 | 12,446 | 12,728 | 12,888 | 12,019 | 13,171 | 13,229 | 13,266 | 13,325 |
| Flintshire ... ... ... | 8,606 | 8,543 | 8,546 | 8,686 | 8,896 | 9,188 | 9,279 | 9,384 | 9,479 | 9,533 | 9,576 | 9,599 |
| Glamorganshire ... ... | 112,318 | 113,682 | 114,643 | 117,585 | 120,118 | 125,137 | 128,306 | 133,676 | 135,651 | 136,514 | 137,276 | 138,158 |
| Merionethshire ... ... | 2,428 | 2,446 | 2,462 | 2,533 | 2,574 | 2,638 | 2,649 | 2,676 | 2,705 | 2,710 | 2,720 | 2,721 |
| Montgomeryshire ... | 4,162 | 4,179 | 4,255 | 4,331 | 4,443 | 4,570 | 4,632 | 4,660 | 4,680 | 4,693 | 4,707 | 4,718 |
| Pembrokeshire ... ... | 6,196 | 6,290 | 6,395 | 6,549 | 6,753 | 7,000 | 7,122 | 7,270 | 7,382 | 7,425 | 7,463 | 7,525 |
| Radnorshire ... ... | 1,726 | 1,742 | 1,761 | 1,788 | 1,836 | 1,889 | 1,923 | 1,948 | 1,952 | 1,957 | 1,965 | 1,978 |
| **SCOTLAND.** | | | | | | | | | | | | |
| Aberdeen ... ... ... | 28,234 | 28,673 | 29,166 | 29,882 | 30,505 | 31,128 | 31,469 | 31,722 | 32,004 | 32,263 | 32,393 | 32,556 |
| Argyllshire ... ... | 4,039 | 4,119 | 4,218 | 4,362 | 4,500 | 4,748 | 4,813 | 4,900 | 4,941 | 4,985 | 5,019 | 5,061 |
| Ayrshire ... ... ... | 23,124 | 23,022 | 24,372 | 25,068 | 25,835 | 26,836 | 27,304 | 27,721 | 28,103 | 28,463 | 28,581 | 28,717 |
| Banffshire ... ... | 2,514 | 2,591 | 2,652 | 2,763 | 2,825 | 2,939 | 2,995 | 3,042 | 3,078 | 3,088 | 3,104 | 3,122 |
| Berwickshire ... ... | 769 | 795 | 830 | 866 | 889 | 921 | 930 | 941 | 954 | 939 | 938 | 941 |
| Bute ... ... ... | 1,263 | 1,274 | 1,301 | 1,360 | 1,385 | 1,442 | 1,449 | 1,441 | 1,461 | 1,488 | 1,487 | 1,510 |
| Caithness ... ... | 1,049 | 1,064 | 1,084 | 1,150 | 1,182 | 1,251 | 1,273 | 1,276 | 1,293 | 1,312 | 1,318 | 1,325 |
| Clackmannan ... ... | 2,184 | 2,238 | 2,333 | 2,383 | 2,470 | 2,544 | 2,577 | 2,597 | 2,637 | 2,647 | 2,657 | 2,652 |
| Dumbartonshire ... ... | 4,603 | 4,688 | 4,823 | 5,006 | 5,223 | 5,420 | 5,534 | 5,654 | 5,740 | 5,814 | 5,885 | 5,927 |
| Dumfriesshire ... ... | 5,825 | 5,996 | 6,228 | 6,493 | 6,700 | 6,956 | 7,080 | 7,172 | 7,266 | 7,386 | 7,474 | 7,530 |
| East Lothian ... ... | 3,809 | 3,933 | 4,113 | 4,294 | 4,448 | 4,650 | 4,726 | 4,790 | 4,831 | 4,886 | 4,928 | 4,946 |
| Edinburgh ... ... | 60,987 | 61,993 | 63,279 | 65,191 | 67,294 | 69,817 | 70,901 | 71,615 | 72,366 | 74,028 | 74,226 | 74,475 |
| Fifeshire ... ... ... | 24,176 | 24,879 | 25,777 | 26,913 | 27,987 | 29,082 | 29,756 | 30,193 | 30,589 | 31,145 | 31,384 | 31,718 |
| Forfarshire ... ... | 24,136 | 24,706 | 25,511 | 26,428 | 27,354 | 28,744 | 29,216 | 29,563 | 29,933 | 30,252 | 30,647 | 30,742 |
| Glasgow ... ... ... | 111,030 | 114,355 | 114,395 | 117,577 | 121,261 | 125,705 | 126,993 | 129,238 | 130,595 | 133,628 | 134,507 | 134,849 |
| Inverness-shire ... ... | 3,578 | 3,668 | 3,807 | 3,980 | 4,122 | 4,312 | 4,402 | 4,480 | 4,547 | 4,637 | 4,680 | 4,707 |
| Kirkcudbright ... ... | 1,750 | 1,805 | 1,869 | 1,955 | 2,012 | 2,081 | 2,122 | 2,139 | 2,171 | 2,204 | 2,229 | 2,245 |
| Lanarkshire ... ... | 21,246 | 21,583 | 22,344 | 23,015 | 23,690 | 24,769 | 25,373 | 25,865 | 26,378 | 26,887 | 27,087 | 27,285 |
| Linlithgowshire ... | 3,450 | 3,579 | 3,726 | 3,848 | 3,971 | 4,082 | 4,124 | 4,053 | 4,097 | 4,177 | 4,197 | 4,221 |
| Morayshire ... ... | 2,876 | 2,952 | 3,069 | 3,193 | 3,319 | 3,488 | 3,538 | 3,631 | 3,658 | 3,685 | 3,710 | 3,725 |
| Orkney ... ... ... | 930 | 960 | 983 | 1,036 | 1,052 | 1,092 | 1,122 | 1,150 | 1,144 | 1,146 | 1,163 | 1,164 |
| Peebles ... ... ... | 1,005 | 1,029 | 1,050 | 1,119 | 1,119 | 1,146 | 1,154 | 1,165 | 1,170 | 1,178 | 1,185 | 1,193 |
| Perthshire... ... ... | 9,744 | 9,952 | 10,318 | 10,732 | 11,083 | 11,617 | 11,827 | 12,005 | 12,180 | 12,333 | 12,432 | 12,500 |
| Renfrewshire ... ... | 20,991 | 21,344 | 22,010 | 22,769 | 23,431 | 24,241 | 24,720 | 25,055 | 25,413 | 25,827 | 25,982 | 26,083 |
| Ross and Cromarty ... | 1,521 | 1,555 | 1,598 | 1,688 | 1,755 | 1,840 | 1,866 | 1,893 | 1,909 | 1,945 | 1,962 | 1,974 |
| Roxburghshire ... ... | 3,604 | 3,778 | 4,001 | 4,240 | 4,404 | 4,541 | 4,582 | 4,646 | 4,720 | 4,765 | 4,809 | 4,837 |
| Selkirkshire ... ... | 3,657 | 3,793 | 3,953 | 4,128 | 4,300 | 4,410 | 4,476 | 4,536 | 4,578 | 4,643 | 4,665 | 4,701 |
| Shetland ... ... | 766 | 780 | 806 | 835 | 860 | 894 | 926 | 961 | 975 | 978 | 986 | 998 |
| Stirlingshire ... ... | 18,321 | 18,622 | 19,630 | 20,331 | 20,831 | 21,789 | 22,213 | 22,507 | 23,041 | 23,327 | 23,420 | 23,580 |
| Sutherlandshire ... ... | 534 | 547 | 560 | 578 | 603 | 630 | 641 | 658 | 668 | 676 | 675 | 697 |
| Wigtownshire ... ... | 2,382 | 2,454 | 2,511 | 2,589 | 2,629 | 2,656 | 2,669 | 2,692 | 2,727 | 2,753 | 2,766 | 2,789 |
| **NORTHERN IRELAND.** | | | | | | | | | | | | |
| Antrim ... ... ... | 3,254 | 3,302 | 3,359 | 3,433 | 3,525 | 3,630 | 3,702 | 3,770 | 3,801 | 3,829 | 3,851 | 3,862 |
| Armagh ... ... ... | 2,703 | 2,759 | 2,814 | 2,857 | 2,937 | 3,071 | 3,147 | 3,199 | 3,236 | 3,273 | 3,305 | 3,333 |
| Belfast ... ... ... | 35,667 | 36,145 | 36,438 | 37,197 | 38,272 | 39,297 | 40,192 | 40,719 | 41,005 | 41,121 | 41,246 | 41,410 |
| Down ... ... ... | 2,836 | 2,862 | 2,888 | 3,003 | 3,054 | 3,125 | 3,186 | 3,215 | 3,267 | 3,289 | 3,297 | 3,329 |
| Fermanagh ... ... | 600 | 616 | 644 | 686 | 711 | 760 | 773 | 789 | 803 | 805 | 821 | 823 |
| Londonderry ... ... | 3,324 | 3,384 | 3,429 | 3,532 | 3,587 | 3,759 | 3,877 | 3,953 | 4,021 | 4,073 | 4,101 | 4,137 |
| Tyrone ... ... ... | 2,425 | 2,463 | 2,491 | 2,557 | 2,645 | 2,753 | 2,811 | 2,863 | 2,899 | 2,926 | 2,940 | 2,941 |

# IMPORT DUTIES ACT

This Act is officially defined as "an act to provide for the imposition of a general *ad valorem* duty of customs and of additional duties on any goods chargeable with the duty aforesaid, for the imposition of duties on goods produced or manufactured in a foreign country which discriminates in the matter of importation as against goods produced or manufactured in the United Kingdom, in certain other parts of His Majesty's Dominions, in protectorates or in mandated territories, and for purposes connected with the matters aforesaid."

Main provisions of the Act are as follows:

## PART I.

The Act imposes as from March 1, 1932, a customs duty of 10 *per cent.* of the value of the goods (general *ad valorem* duty) on all goods imported into the United Kingdom with the following exceptions:

(*a*) goods for the time being chargeable under any other Act, except the Irish Free State (Special Duties) Act, 1932, but not including (subject to the provisions of this Act) composite goods chargeable under that Act because some of their components are chargeable:

(*b*) goods specified for exemption under this Act.

Under the Act an Import Duties Advisory Committee is set up to advise the Treasury who, after receiving recommendations from the Committee, have the power to add to the schedule of exemptions.

The Treasury may also, after receiving a recommendation from the Advisory Committee, by order direct that additional duties shall be charged on the importation of goods into the United Kingdom by reference to value or weight or any other measure of quantity, for any period or without limit of period, at different rates for different periods or parts of periods.

In the case of countries which are Dominions within the meaning of the Statute of Westminster, 1931, and India and Southern Rhodesia, or territories which are being administered by those countries, products which have been consigned from any part of the British Empire except the Irish Free State and grown or manufactured in any of the above countries, are not subject to the duty before November 15, 1932, or any later date which may be fixed by Parliament.

At any time after that date the Treasury may, on the recommendation of the Secretary of State, direct that the general *ad valorem* duty or any additional duty or both of such duties shall not be chargeable or shall be chargeable only at some specified rate less than the full rate.

Section 5 of the Act provides that neither the general *ad valorem* duty nor any additional duty shall be chargeable in respect of goods consigned from any part of the British Empire except the Irish Free State and grown, produced or manufactured in

(*a*) any part of His Majesty's Dominions outside the United Kingdom, other than a country to which the preceding paragraph dealing with preference for Dominions applies, or

(*b*) any territory which is under His Majesty's protection.

For the purpose of ascertaining whether goods are free from general *ad valorem* or additional duty, goods are not considered to be manufactured in the British Empire unless a certain portion of their value as prescribed by regulations is derived from materials grown or produced or from work done within the British Empire.

Goods manufactured in a bonded factory in the United Kingdom from chargeable material produced in the British Empire are free from duty to the extent to which they have been manufactured by such material.

The Commissioners of Customs and Excise have the right to require the importer to furnish proof that the goods were grown, produced, or manufactured in a part of the British Empire.

The Treasury may, on the recommendation of the Board of Trade, direct that goods of foreign origin shall not be subject to duty or only to some specified rate less than full rate.

In such cases the Board of Trade may require the importer to furnish proof of the country of origin.

Where composite goods would be chargeable under this Act or under some other Act, the general *ad valorem* duty is chargeable only up to the amount by which it exceeds the duty chargeable under that other Act, unless it is otherwise expressly provided.

Section 9 of the Act empowers the Board of Trade to demand from any manufacturer a return for information purposes with reference to goods chargeable under the Act, giving information on the following:

(*a*) Quantity and value of output.

(*b*) Quantity and cost of materials used.

(*c*) Quantity and cost of fuels and electricity consumed.

(*d*) Number of persons employed.

No information obtained in this way will, without the consent of the owner of the business, be disclosed except to members of the Committee or to a Government Department requiring the information.

Goods consigned direct to a registered shipbuilding yard for repairing or refitting

ships in that yard may, by complying with the conditions, be imported free.

## PART II.

If it is found that a foreign country is discriminating between goods produced in the United Kingdom (or other territory under His Majesty's protection or in respect of which a mandate is being exercised by the British Government) and those produced by another foreign country, the Treasury may direct that additional duty shall be charged on goods imported into the United Kingdom from that foreign country.

These additional duties may be charged by reference to value or to weight or any other measure of quantity and shall not exceed 100 per cent. of the value of the goods.

The Commissioners of Customs and Excise may demand proof of the country of origin of the goods in question.

## PART III.

Where it is proved that goods are imported solely with a view to re-exportation after undergoing a process in the United Kingdom which will not change the form and character of the goods, or after transit through the United Kingdom or by way of trans-shipment, the Commissioners may, under certain conditions, allow such goods to be imported free of any duty chargeable under this Act.

Section 14 of the Act states that section 6 of the Customs and Inland Revenue Act, 1879, shall not apply to goods chargeable with duty under this Act, but where chargeable goods are re-imported into the United Kingdom and it is shown that any duty chargeable was duly paid or that no drawback of any such duty was allowed on exportation, or that any drawback allowed has been repaid by the Exchequer, then the goods are exempt from duty if they have not undergone any process abroad.

If they have undergone a process abroad without changing their form or character the goods shall be chargeable as if the amount of the increase in value of the goods due to the process represented their whole value.

The value of any imported goods is the price which an importer would give for them in the open market delivered to him at the port of importation, freight, insurance, commission and all other costs incidental to the purchase, except duties, having been paid, and duty is to be paid on that value as fixed by the Commissioners.

Any disputes arising as to the value of goods have to be referred to an arbitrator appointed by the Lord Chancellor.

If at any time it is found that any duty chargeable under this Act by reference to value could be levied with greater advantage and convenience by reference to weight or other measure of quantity, the Treasury may direct that the duty shall be charged by the latter method.

The Import Duties Advisory Committee submitted to the Treasury in April, 1923, and from time to time since that date their recommendations for additional duties, exemptions from duty and drawbacks payable on specified classes of goods, which recommendations are embodied in the Additional Import Duties (No. 1) Order, 1932, and subsequent Orders.

The following are some articles of general interest to the Radio Industry, chargeable with additional duties under the Import Duties Act, 1932 :—

| | Additional duty. Per cent. | Additional plus ad val. duty. Per cent. |
|---|---|---|
| Electrical goods, including :— Insulated wires and cables. Telegraph, telephone and wireless apparatus. Electric carbons. Batteries and accumulators. Electric meters. Parts of, and accessories to the above ... | 10 | 20 |
| Machinery (other than the electrical machinery specified below) or parts thereof ... ... ... | 10 | 20 |
| Electric motor and generator casings and unwound rotors and stators | 5 | 15 |
| Manufactures (other than sheets, piping, tubing and rods and machinery belting) wholly or partly of rubber, balata or gutta percha, including vulcanite and ebonite ... | 10 | 20 |
| Articles manufactured wholly or partly of aluminium, copper, lead, nickel, tin, zinc and alloys, including these metals (excluding sheets, and strip, rods, plates, ingots, bars, slabs and discs, angles, shapes and sections, wire and tubes ; machinery, tools, scientific and medical instruments) ... ... ... | 10 | 20 |
| Iron and steel springs, screws (other than wood screws), nails (other than wire nails), tacks, studs, spikes, rivets, washers, bolts and nuts ... ... | 10 | 20 |
| Goods manufactured wholly or partly of asbestos ... ... ... | 5 | 15 |
| Locks, padlocks, keys, bolts, latches, hasps and hinges of metal... ... | 10 | 20 |
| Tools other than agricultural tools ... ... | 10 | 20 |
| Articles manufactured wholly or partly of wood except plywood and veneers ... ... ... | 10 | 20 |
| Dressed leather ... ... | 5 | 15 |
| Paints and colours, including varnishes, lacquers, enamels, and dyestuffs | 10 | 20 |
| Spiegeleisen and ferromanganese (other than refined) containing less than 3 per cent. carbon.. | 23⅓ | 33⅓ |

# HANDLING EXPORT BUSINESS

If it is intended to develop seriously an export trade it will always be found a good plan to establish a separate export department at home. This department should be under the control of an export manager, who would make it his business to be thoroughly conversant not only with the firm's products but also with the theory of foreign marketing and transport problems, and if possible he should be a linguist. He should be adaptable and diplomatic and the type of man who can deal with foreign buyers when they visit his company.

When making quotations for export it should be remembered that long periods may elapse after the date of quoting before an order can materialise. It is also customary to arrange such terms of payment as will reduce to a minimum the risk of bad debts and will avoid losses due to fluctuations in exchange.

### Cash Against Documents.

In cases where no previous knowledge of the customer is available, it is a common practice to handle the order on the basis of "cash against documents." In this way the exporter safeguards himself by arranging for the Bill of Lading and other documents which represent the title to the goods to be forwarded to a bank at the port of destination with instructions to collect the amount due before handing the documents over to the consignee. He also gives instructions as to the disposal of the goods in case of default by the consignee.

### Procedure for Shipment.

When an order is ready for shipment the following is, generally speaking, the procedure which is adopted. The goods are despatched by road or rail to the port for shipment through a firm of forwarding agents, who arrange for insurance and take out the Bills of Lading. If the terms of sale are F.O.B. (Free on Board)—that is, the customer pays all transport expenses after the goods have been delivered to the ship—it is necessary to add insurance and freight charges to the invoice. A copy of this is sent to the customer with a letter advising shipment. The exporter draws a draft for the amount due and this, with the Bill of Lading (in triplicate), the insurance policy, and a copy of the invoice, is sent to his bankers for collection, with instructions that it shall not be presented for acceptance until the goods have arrived. In the transaction the following documents will be necessary :—

*Consignment Note.*—This should be in two parts, one of which is retained by the supplier as a receipt for the goods. It is a request to the railway company (or other local transport agent) to deliver the packages to the shipping agent. It should contain the name and address of the consignee (shipping agent), a short description of the packages, their weight and special markings.

*Instructions to Shipping Agents.*—This takes the form of an advice note and should contain date, name of ship, destination, consignee (customer), special markings, description and dimensions of packages, their contents and net weight, value for customs declaration, value for which insurance is to be effected, and class of insurance, by whom freight is to be paid, and how forwarded to shipping agents.

*Bill of Lading.*—This is taken out by the shipping agent. It is a shipowner's receipt for goods which he has contracted to convey. It is also a title to the goods and by endorsing it the goods can be transferred to another owner. On the Bill of Lading are set out details of the consignment, the name of ship, destination, and full particulars of the conditions under which the consignment is carried. This document is sent in duplicate, the two copies being sent by different mails in case one may be lost.

*Insurance Policy.*—This is taken out by the shipping agents.

Marine insurance falls roughly under two main classes known as "with particular average" and "free of particular average." Under the former arrangement the goods are protected against individual loss or damage as distinct from the remainder of the ship's cargo. With the latter arrangement it is only possible to make a claim if the whole of the ship's cargo is lost. The former method of insurance is more expensive than the latter, and it will depend largely on the nature of the goods to be consigned as to which method is adopted. If the goods are fragile and liable to breakage during transport it is worth while to insure under the more expensive scheme. Definite instructions on this point must be given to the shipping agents.

*Freight Note.*—This document is sent by the shipping agent to the supplier and contains charges for the actual freight, cost of Bills of Lading, insurance and commission charges, so that if necessary these can be embodied in the Invoice to the customer.

Primage (5 per cent., 10 per cent., or 15 per cent.) on the net freight will be charged on the freight note in most cases, part or the whole to be returned under certain conditions six or twelve months later. It is a matter of arrangement who has this when collected—the exporter, shipping agent or purchaser.

*Invoice.*—This, the supplier's invoice to the customer, should contain the date, customer's order number, number of cases, special markings on cases, name of ship, accurate description of contents and details of charges, and gross and net weights.

Wherever possible invoices should be made out in the currency of the country to which the goods are to be sent. The customer prefers also to have weights and measurments in the local units if possible. Gross and net weights should be shown on the invoice.

The number of copies to be prepared depends on the terms of payment, on any particular wishes of the customer, and on the requirements of the customs authorities in the country for which the goods are intended. In some instances the invoices have to be certified by the consul of that country; it might also be necessary to state what would be the value of the goods if sold for home consumption. The exporter may also be called upon to state the country of origin of the goods.

*Documentary Draft.*—This is drawn up by the exporters for the amount due and is sent to their bankers with instructions with regard to collection.

*Advice of Shipment.*—An advice of shipment together with the invoice is sent to the purchaser and this should contain the name of ship, date of despatch, and accurate description of the goods forwarded.

*Specification.*—This document is for the use of the Customs' authorities and must contain the name of port, name of ship, destination, date of final clearance of ship, markings on packages, number and description of packages, contents, and value. This specification is prepared by the shipping agent and handed in at the Custom House at the port of shipment.

## Tariffs.

The tariff list should be carefully studied, as it may be possible to avoid duty on a complete article by merely changing the method of manufacture of one of its details and utilising for that detail material which is not liable to duty in that country.

In some of the British Dominions and Colonies there is a tariff giving preference to British goods. In that case the invoice will need to bear upon it a certificate worded in accordance with the regulations of the importing country, stating that they are of British origin.

## Packing.

Too much emphasis cannot be placed on the need for extreme care in packing consignments for long journeys including sea transport. When deciding on the method of packing it should be remembered that the packages will receive rough treatment.

There is also the danger of loss by pilfering, and means should be adopted for making difficult the opening of cases during transit. It is, of course, possible to insure against loss by pilfering.

Wood as an outer protection is almost universally used for large consignments or for those that need special protection from mechanical damage. The use of exterior battens increases the overall measurements of the case and may, therefore, increase the freight charges; consequently some other method, such as metal bands, should be adopted for obtaining strength.

The cases should be lined with some kind of watertight lining, such as tarred or oiled paper, which is especially manufactured for the purpose. In many instances it is considered advisable to pack goods in cases lined with zinc or tin and hermetically sealed. Zinc lining is more costly than tin lining, but it is sometimes preferred, as it can be more readily used when the case is broken up. It is advisable to avoid the use of packing material which may be subject to duty when arriving at its destination.

In many instances the cost of freight is calculated on the cubical measurements of the packing case; the importance of compact packing will, therefore, be evident. Every available space should be filled up to prevent the goods from shifting during transit.

## Marking of Packages.

The markings which are likely to be required on the packages are the special symbol of the customer, name of port, serial number of the case, gross and net weight, and measurements of the case. All markings should be heavily stencilled or painted on the cases.

## Inspection.

The customer may probably arrange for the goods to be examined before despatch, but it is a good plan for the exporter himself to see that the shipments are carefully inspected before they are packed. It is also advisable to insist that, in the event of a claim being made, it should be made within a given period after delivery. A claim should be substantiated by an independent witness apart from the representative of the purchaser.

# GREAT BRITAIN'S INTERNATIONAL RADIO TRADE

## September, 1933, to August, 1934

**The figures given in the summaries on this page are the values in sterling of radio and allied goods imported into and re-exported from Great Britain and Northern Ireland during the year from September, 1933, to August, 1934. Complete classified statistics are published monthly in "The Broadcaster."**

## IMPORTS

| Country of Consignment. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | April. | May. | June. | July. | Aug. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Austria ... ... ... ... ... | 8,490 | 13,552 | 13,419 | 1,436 | 11,927 | 8,019 | 5,327 | 5,491 | 7,707 | 2,893 | 2,457 | 3,425 |
| Belgium ... ... ... ... ... | 4,871 | 4,928 | 6,801 | 3,200 | 1,124 | 566 | 2,347 | 901 | 5,940 | 332 | 16 | 31 |
| Canada ... ... ... ... ... | 9,515 | 10,053 | 16,990 | 1,911 | 344 | 771 | 20 | 3,144 | 8,816 | 1,924 | 2,872 | 4,275 |
| France ... ... ... ... ... | 1,688 | 2,126 | 3,377 | 9,449 | 2,731 | 1,278 | 980 | 3,391 | 510 | 331 | 543 | 216 |
| Germany... ... ... ... ... | 7,505 | 10,309 | 7,251 | 3,838 | 4,322 | 1,693 | 2,651 | 2,367 | 5,342 | 4,567 | 6,143 | 7,724 |
| Hungary ... ... ... ... | 838 | 585 | 1,075 | 625 | 1,154 | 993 | 693 | 505 | 636 | 996 | 395 | 480 |
| Netherlands ... ... ... ... | 38,019 | 38,935 | 42,611 | 28,082 | 27,071 | 20,378 | 26,940 | 29,034 | 32,086 | 43,061 | 49,159 | 58,575 |
| Switzerland ... ... ... ... | 1,129 | 1,297 | 1,492 | 1,342 | 1,721 | 1,312 | 1,340 | 1,376 | 1,248 | 1,922 | 2,456 | 2,715 |
| United States of America ... ... | 49,428 | 37,822 | 33,195 | 15,935 | 15,913 | 19,939 | 27,622 | 38,612 | 71,191 | 22,940 | 26,107 | 76,384 |
| Other Countries ... ... | 726 | 1,864 | 524 | 464 | 742 | 216 | 2,623 | 170 | 525 | 1,014 | 1,038 | 881 |
| TOTAL ... ... ... | 122,209 | 121,471 | 126,735 | 66,282 | 67,049 | 55,165 | 70,543 | 84,991 | 134,001 | 79,980 | 65,079 | 154,706 |

## RE-EXPORTS

| Country of Destination. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | March. | April. | May. | June. | July. | Aug. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Australia... ... ... ... ... | — | — | 120 | — | — | 11 | — | 21 | — | 43 | 5 | 5 |
| France ... ... ... ... ... | 150 | 118 | 210 | 14 | 21 | 10 | 8 | 36 | 13 | 44 | 27 | 49 |
| Channel Islands ... ... ... | — | 202 | 242 | 91 | 119 | 73 | 22 | 49 | 38 | 65 | 31 | 102 |
| Germany... ... ... ... ... | 854 | 74 | 124 | 217 | 2,260 | 72 | 12 | 123 | 103 | 55 | 815 | 21 |
| Irish Free State ... ... ... | 633 | 420 | 734 | 313 | 157 | 222 | 108 | 191 | 100 | 85 | 76 | 163 |
| Netherlands ... ... ... ... | — | 317 | 120 | 253 | 343 | 220 | 113 | 23 | 169 | 53 | 640 | 5,458 |
| United States of America ... ... | 572 | — | — | — | — | — | — | — | — | — | — | — |
| Other Countries ... ... | 579 | 1,331 | 237 | 455 | 2,028 | 301 | 255 | 1,736 | 1,646 | 477 | 379 | 371 |
| TOTAL ... ... ... | 2,788 | 2,462 | 1,787 | 1,343 | 4,928 | 909 | 518 | 2,179 | 2,069 | 822 | 1,973 | 6,169 |

# EXPORTS

The figures given in the summary on this page are the values in sterling of radio and allied goods exported from Great Britain and Northern Ireland during the year from September, 1933, to August, 1934. Complete classified statistics are published monthly in "The Broadcaster."

| Country of Destination. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | March. | April. | May. | June. | July. | Aug. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Afghanistan ... ... ... ... | — | — | 3,140 | — | — | — | — | — | — | — | — | — |
| Argentine Republic ... ... ... | 142 | 2,041 | 1,067 | 3,134 | 1,123 | 2,902 | 4,025 | 1,000 | 3,749 | 3,649 | 4,850 | 2,806 |
| Australia... ... ... ... ... | 1,340 | 7,231 | 2,870 | 4,253 | 4,813 | 3,192 | 12,448 | 6,921 | 3,757 | 4,652 | 4,623 | 7,490 |
| Belgium ... ... ... ... | 8,539 | 9,751 | 13,961 | 12,587 | 7,877 | 7,227 | 5,297 | 4,195 | 4,645 | 2,235 | 5,060 | 6,427 |
| Brazil ... ... ... ... ... | 1,953 | 588 | 950 | 1,209 | 12,886 | 89 | 2,654 | 5 | 362 | 971 | 33 | 4,391 |
| British India ... ... ... ... | 3,316 | 5,212 | 5,747 | 5,386 | 6,240 | 5,596 | 4,850 | 3,759 | 5,417 | 4,270 | 2,732 | 4,237 |
| Canada ... ... ... ... ... | 360 | 892 | 1,167 | 1,525 | 379 | 1,929 | 317 | 3,933 | 1,665 | 718 | 1,565 | 1,093 |
| Channel Islands ... ... ... | 3,462 | 6,629 | 6,271 | 6,099 | 3,090 | 2,839 | 2,503 | 2,031 | 2,064 | 1,958 | 2,908 | 4,179 |
| China ... ... ... ... ... | 660 | 19,219 | 943 | 974 | 1,197 | 387 | 609 | 604 | 2,120 | 505 | 344 | 224 |
| Colombia ... ... ... ... | 11 | 1,425 | 71 | 387 | 69 | 26 | — | — | — | — | — | — |
| Czechoslovakia ... ... ... ... | 1,390 | 2,616 | 3,670 | 2,397 | 1,963 | 459 | 1,224 | 1,246 | 957 | 230 | 244 | 801 |
| Denmark ... ... ... ... | 3,484 | 3,858 | 4,011 | 3,641 | 2,421 | 1,564 | 3,596 | 5,140 | 1,623 | 896 | 2,843 | 1,122 |
| Egypt ... ... ... ... ... | 1,203 | 909 | 20,091 | 5,989 | 4,609 | 2,137 | 1,581 | 1,840 | 572 | 890 | 1,241 | 1,735 |
| France ... ... ... ... ... | 2,627 | 5,150 | 5,380 | 6,944 | 5,155 | 3,094 | 2,537 | 4,373 | 2,641 | 2,416 | 2,655 | 2,167 |
| Germany... ... ... ... ... | 187 | 225 | 73 | 2,243 | 1,441 | 307 | 468 | 211 | — | — | — | — |
| Hong-Kong ... ... ... ... | 540 | 1,875 | 1,478 | 954 | 321 | 6,840 | 1,217 | 1,401 | 1,682 | 1,730 | 196 | 263 |
| Iceland ... ... ... ... ... | 414 | 1,109 | 1,510 | 6,020 | 925 | 729 | 840 | 1,090 | 808 | 275 | 468 | 849 |
| Iraq ... ... ... ... ... | 95 | 113 | 42 | 201 | 120 | 1,260 | 209 | 513 | 267 | 218 | 2,923 | 582 |
| Irish Free State ... ... ... | 11,178 | 18,766 | 18,984 | 24,889 | 11,795 | 5,954 | 6,886 | 6,673 | 5,006 | 3,580 | 3,515 | 9,189 |
| Italy ... ... ... ... ... | 2,567 | 982 | 971 | 1,051 | 2,077 | 756 | 949 | — | — | — | — | — |
| Japan ... ... ... ... ... | 544 | 311 | 825 | 819 | 561 | 683 | 111 | 21 | 515 | 1,322 | 320 | 257 |
| Kenya ... ... ... ... ... | 482 | 234 | 271 | 376 | 197 | 105 | 1,566 | 144 | 1,848 | 124 | 173 | 95 |
| Malta and Gozo ... ... ... | 258 | 325 | 433 | 665 | 445 | 580 | 470 | 316 | 343 | 268 | 238 | 356 |
| Netherlands ... ... ... ... | 9,659 | 8,870 | 11,229 | 19,124 | 19,663 | 13,134 | 17,224 | 27,249 | 15,767 | 7,913 | 11,087 | 17,943 |
| New Zealand ... ... ... ... | 3,774 | 2,548 | 3,625 | 2,243 | 1,395 | 4,960 | 5,101 | 4,526 | 3,896 | 7,571 | 5,449 | 5,643 |
| Norway ... ... ... ... ... | 715 | 13,255 | 4,806 | 5,174 | 10,651 | 3,392 | 2,503 | 1,048 | 363 | 838 | 1,429 | 1,089 |
| Poland ... ... ... ... ... | 1,092 | 2,122 | 2,897 | 2,736 | 1,073 | 324 | 878 | 312 | 704 | 485 | 3,014 | 845 |
| Portugal ... ... ... ... | 398 | 1,823 | 8,463 | 3,659 | 7,239 | 1,544 | 1,502 | 13,508 | 1,689 | 801 | 290 | 159 |
| Roumania ... ... ... ... | 21,952 | 600 | 32,022 | 11,918 | 351 | 24,833 | 23,712 | 744 | 2,347 | 23,267 | 115 | 22,120 |
| Spain ... ... ... ... ... | 3,763 | 1,491 | 1,486 | 3,301 | 2,507 | 4,053 | 3,506 | 2,671 | 3,063 | 4,519 | 5,331 | 4,783 |
| Sweden ... ... ... ... ... | 5,354 | 3,914 | 7,569 | 4,613 | 2,189 | 1,542 | 2,537 | 2,308 | 2,849 | 2,384 | 6,676 | 4,820 |
| Switzerland ... ... ... ... | 1,945 | 1,286 | 3,406 | 3,163 | 3,033 | 1,149 | 633 | 487 | 253 | 261 | 503 | 1,556 |
| Straits Settlements ... ... ... | 399 | 710 | 345 | 719 | 919 | 949 | 547 | 806 | 737 | 902 | 703 | 665 |
| Turkey ... ... ... ... ... | 170 | 788 | 327 | 185 | 111 | 117 | 505 | 657 | 67 | 259 | 264 | 387 |
| Union of South Africa ... ... ... | 4,314 | 4,066 | 7,116 | 6,750 | 3,973 | 4,316 | 5,922 | 8,886 | 6,822 | 9,027 | 7,904 | 5,078 |
| Other Countries ... ... ... | 6,833 | 6,412 | 6,896 | 10,417 | 5,887 | 10,658 | 6,722 | 8,944 | 6,441 | 11,237 | 12,686 | 8,297 |
| TOTAL ... ... ... | 105,120 | 137,345 | 184,113 | 165,745 | 128,695 | 119,626 | 125,649 | 117,572 | 86,029 | 100,371 | 92,382 | 121,648 |

# 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.

There is every indication that the Radio Set and Components Marking Order will be in force on July 1, 1935.

The draft Order-in-Council was laid before Parliament on Tuesday, November 20, 1934, when the new Session was opened.

A draft order has to lay before the House of Commons for twenty clear sitting days, when, on no objection being raised, it automatically comes into force.

The order will require 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 will be speakers and speaker units, mains units, chokes, condensers, drives for variable condensers, pick-ups, volume controls, electric gramophone motors, turntable units comprising an electric motor and a turntable, 'phones, resistors, valve-holders and adaptors, transformers, tuning coils, R.C.C. units, choke capacity coupling units, and chassis or frames carrying or adapted to carry a collection of components.

# FACTORY AND WORKSHOPS ACTS

## 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

## FACTORY ACTS

with certain other exceptions, begin between 6 a.m. and 8 a.m., and end between 6 p.m. and 8 p.m., with meal intervals of not less than one hour and a half, of which at least one hour must be before 3 p.m. No woman or young person shall be employed continuously for more than five hours without an interval of at least half an hour for a meal.

All women and young persons must have their meals at the same times of day; they must not be employed or allowed to remain in any room in which work is in progress during these times.

The recognised Bank Holidays must be observed—or a full day, or its equivalent, allowed as a holiday in lieu.

If an employer of the Jewish faith keeps his factory or workshop closed on Saturday until sunset, he may employ women and young persons from after sunset on Saturday until 9 o'clock in the evening. If he closes down all day on Saturday, he may extend the permitted hours of work by one hour each day during the rest of the week, except on Sunday.

### Miscellaneous Provisions.

The remaining sections of the Act may be briefly summarised as follows:—

*Sections* 36–48 set out special exceptions which may be made to the general rules previously laid down regarding hours and holidays.

*Sections* 49–60 regulate overtime and night-work, and deal with intermittent and special employment.

In non-textile factories and workshops the "hours of employment" for women on any day except Saturday may be extended for two hours overtime, provided that at least two hours are allowed during the day for meals, of which half an hour must be after 5 p.m., and also provided that a woman must not be so employed on overtime for more than three days in any one week, or for more than thirty days in twelve months.

*Sections* 61–67 forbid the employment of children under 12, and of women within four weeks of childbirth. Employers must have medical certificates of fitness in the case of young persons and children residing more than three miles from the factory.

*Sections* 68–72 relate to education, and make the employer share with the parent the obligation of seeing that each employed child shall attend a recognised school.

A child employed during the morning or afternoons must attend a recognised efficient school on each work-day for at least one attendance; or, when employed on the alternate day system, must on each other day make at least two attendances at the school, these attendances being between the hours of 8 a.m. and 6 p.m. ("Child" is defined to be a person under the age of 14 years and who has not—at the age of 13—obtained a certificate of proficiency or attendance at school.)

*Sections* 73–86 are concerned with certain industries specified as "Dangerous and Unhealthy."

*Sections* 87–106 set out certain modifications and extensions which are allowable in respect of the provisions made in the preceding sections.

*Sections* 107–115 are concerned chiefly with the conditions of employees who work at their own homes, particularly as regards the use of unwholesome premises or where there is infectious disease.

*Sections* 116–117 are designed to ensure that piece-workers in certain trades are fairly paid for the work they do.

In every factory, for the purpose of enabling each piece-time worker to calculate the amount of wages due to him, there must be a clear list of the rate of wages applicable to the work done, and also particulars of the work to which the rate is applicable. These must be given to the worker when the work is handed to him, or posted up in a conspicuous place in the workroom.

*Sections* 118–134 contain provisions regarding the general administration of the Act; the appointment, power, and duties of Factory Inspectors and Surgeons; and regulations as to special notices, registers, and returns, and how and when they are to be made.

*Sections* 135–148 relate to the various penalties incurred by any breach of the Act, and the legal procedure for enforcing them.

The last part of the Act (*Sections* 149–163) are of a supplementary nature, and do not call for further description.

Since the passing of the 1901 Act various supplementary measures have been passed.

### "Notice of Accidents Act, 1906."

This tightens up the provisions of the 1901 Act relating to accidents, and lays down that certain kinds of "dangerous occurrences" must be notified even though no bodily injury is caused.

### Dangerous Occurrences Notification Order, 1928.

This is a further development of the preceding Act making notification to the Inspector compulsory in the following cases, whether personal disablement or injury is involved or not—

(*a*) bursting of a revolving vessel or wheel driven by mechanical power;

(*b*) breaking of a rope or chain or other appliance used for raising or lowering persons or goods by mechanical power;

(*c*) any explosion or fire due to (i) ignition of dust, vapour, or gas; (ii) ignition of celluloid or substances composed wholly or partly of celluloid; (iii) electrical short-circuit or failure of electrical apparatus, if the occurrence causes damage to the structure of any building in which persons are employed or to any machinery or plant therein, and results in the complete suspension of ordinary work, or stoppage of plant for not less than five hours;

(*d*) explosion or fire due to causes other than those set out under (*c*) above, and causing total suspension of ordinary work for not less than 24 hours.

### Police, Factories, etc. (Miscellaneous Provisions) Act, 1916.

This act empowers the Secretary of State to make "Welfare Orders" compelling special precautions to be taken for the health and comfort of workers in certain industries.

### Employment of Women, Young Persons, and Children Act, 1920.

This was passed to give effect to recommendations made by the International Labour Organisation of the League of Nations. It forbids the employment of children under fourteen years of age in any industrial undertaking, except domestic factories and workshops. It also restricts the employment of young persons of both sexes between the years of 14 and 18.

In this connection it may be pointed out that the Education Act of 1921 forbids the employment of children between 12 and 14 in any manner which prevents their attendance at school.

### Regulations for Accumulator Manufacture and Repair.

Among the numerous Statutory Rules and Orders issued under the Factory and Workshops Acts, No. 28 of 1925, which repeals a previous Order of 1923, No. 1004, is of particular interest since it applies to the repair, as well as the manufacture, of any accumulator containing lead or any compound thereof. The principal provisions are:—

No person under 18 years of age shall be employed in any lead process, *i.e.*, in melting lead or any material containing lead, or in casting, pasting, lead-burning, or any operation involving trimming, abrading or cutting of pasted plates containing lead oxide.

No woman or young person under 18 shall be employed in any room in which the manipulation of raw oxide of lead, or pasting, is carried on.

In every room in which a lead process is carried on there must be a minimum of 500 cubic feet of air per person, any height over 12 feet not being taken into account.

Every person employed in a lead process shall be medically examined within seven days of his first employment, and monthly thereafter.

Other sections of the Order regulate the working conditions under which various processes are to be carried out, prescribe the protective clothing to be worn by the workers, and specify the sanitary and washing accommodation to be provided in each workshop or factory.

### Regulations for the Use of Electrical Energy (Order No. 1312 of 1908).

The principal provisions are as follows:—

All apparatus and conductors shall be sufficient in size and power for the work they are called upon to do, and so constructed, installed, protected, worked and maintained as to prevent danger so far as is reasonably practicable.

All conductors shall either be covered with insulating material, and further efficiently protected where necessary to prevent danger, or they shall be so placed and safeguarded as to prevent danger so far as is reasonably practicable.

Every switch, switch fuse, circuit-breaker, and isolating link shall be: (*a*) so constructed, placed, or protected as to prevent danger; (*b*) so constructed and adjusted as accurately to make and to maintain good contact; (*c*) provided with an efficient handle or other means of working, insulated from the system, and so arranged that the hand cannot inadvertently touch live metal; (*d*) so constructed or arranged that it cannot accidentally fall or move into contact when left out of contact.

Every switch intended to be used for breaking a circuit and every circuit-breaker shall be so constructed that it cannot with proper care be left in partial contact, or so that an arc cannot accidentally be maintained.

Every fuse and every automatic circuit-breaker used instead thereof shall be so constructed and arranged as effectively to interrupt the current before it so exceeds the working rate as to involve danger.

Every electrical joint and connection shall be of proper construction as regards conductivity, insulation, mechanical strength and protection.

Efficient means, suitably located, shall be provided for cutting off all pressure from every part of a system, as may be necessary to prevent danger.

Every motor, convertor and transformer shall be protected by efficient means suitably placed and so connected that all pressure may thereby be cut off from the motor, convertor or transformer as the case may be, and from all apparatus in connection therewith; provided, however, that where one point of the system is connected to earth, there shall be no obligation to disconnect on that side of the system which is connected to earth.

## FACTORY ACTS

Every flexible wire for portable apparatus, for alternating currents or for pressures above 150 volts direct current, shall be connected to the system either by efficient permanent joints or connections, or by a properly constructed connector.

In all cases where the person handling portable apparatus or pendant lamps with switches, for alternating current or pressures above 150 volts direct current, would be liable to get a shock through a conducting floor or conducting work or otherwise, if the metal work of the portable apparatus became charged, the metal work must be efficiently earthed.

### The Truck Act, 1896.

The Truck Acts prohibit, in general, the payment of workers' wages in any form other than cash.

The 1896 Act, which amends former Acts, lays down that an employer shall not make any contract with a workman for any deduction from the stipulated rate of wages, or for fine, unless

(*a*) the terms of the contract are conspicuously displayed in the workshop, or are set out in writing and signed by the worker, and

(*b*) the contract sets out specifically the acts or omissions in respect of which fines may be levied, and

(*c*) the fine imposed by the contract is in respect of some act which causes or is likely to cause loss to the employer, and

(*d*) the amount of the fine is fair and reasonable having regard to all the circumstances of the case.

These provisions apply equally to shop assistants as to other workers.

Deductions or fines in respect of damage done by workmen to goods or materials supplied are also subject to the foregoing provisions. In addition :—

(*a*) Not only must the fine be "fair and reasonable," but it must not, in any circumstances, exceed the actual amount or loss suffered by the employer.

(*b*) The contract need not set out all particulars of deductions, since it is impossible to foresee these completely, though it must set out definitely that deductions are to be made in respect of damage done to materials by the workman.

Any sum taken by or paid to the employer by way of fine, contrary to this Act, can be recovered by the employee provided he applies to the Court within six months of the date of deduction or fine ; but if he has signed a contract agreeing to such fines or deductions, he can only recover whatever amount has been paid in excess of that which the Court may hold to be fair.

## REGISTRATION OF BUSINESS NAMES ACT, 1925

This Act is designed to ensure that the true name and nationality of any person trading under a "Business Name" shall be officially registered.

All firms or individuals, whether of British or alien nationality, having a place of business in the United Kingdom must register under the Act, (a) if in the case of a firm it trades under a name which does not consist of the true surnames of all the partners ; or (b) if any member has at any time changed his name (except, in the case of a woman, on marriage) ; or (c) if, in the case of an individual, he does not trade under his true surname.

The Act does not in general apply to a business which is incorporated as a limited company ; but certain of its provisions are now applicable under the Companies Act of 1929 to any company incorporated subsequently to the 22nd November, 1916.

A firm, individual, or corporation carrying on business in this country as the nominee, trustee, or on behalf of another person or firm, or acting as general agent for any foreign firm is bound to register under the Act.

In the case of death or retirement of one of the partners, the successor or survivor can carry on the business under its original name, without registering afresh, provided he adds his own name to the original trading name, together with the words "successor to" or "late."

Firms established abroad, but having places of business in this country, are included in the Act.

Section 18 of the Act lays down that every individual and firm required by the Act to register shall show, in legible characters, (a) the present surname and Christian names or initials, (b) and former Christian name or surname, and (c) the nationality, if not British (and also the nationality of origin if this is not the same as the present nationality) *on all trade catalogues, circulars, show cards, and business stationery.* In the case of firms, these particulars must be given for all the partners.

Registration must be made, within fourteen days of the commencement of business, at Princes House, Kingsway, London, W.C.2, when the business is situated in England or Wales, or at Exchequer Chambers, Parliament Square, Edinburgh, for businesses carried on in Scotland. The cost of registration is 5s.

Neglect to comply with the provisions of the Act renders each individual concerned liable on Summary Conviction to a fine not exceeding £5 for each offence.

# SHOP REGULATION ACTS

In his own interest the owner or manager of any shop, large or small, should study the main provisions of the Shops Acts. He is responsible for the proper observance of specified obligations towards his employees, and cannot evade the consequences of any infraction of the law under the plea of ignorance.

The Act of 1912 consolidated the Shops Regulation Acts 1892–1911. Since then there have been the Acts of 1928 and 1934.

### Conditions of Employment.

(*a*) On at least one weekday in each week a shop assistant shall not be employed after half-past one-o'clock in the afternoon.

This does not apply to the week preceding a Bank Holiday if the shop assistant is not employed on the Bank Holiday, and if on one weekday in the following week, in addition to the Bank Holiday, the employment of the shop assistant ceases not later than half-past one o'clock in the afternoon.

(*b*) The occupier of a shop shall set out in a notice displayed in the shop the day of the week on which his shop assistants are not employed after half-past one o'clock, and may fix different days for different shop assistants.

### Meal Times.

Intervals for meals shall be allowed to each shop assistant and shall be arranged so as to secure that no person shall be employed for more than six hours without an interval of at least twenty minutes being allowed, provided that :—

(1) where the hours of employment include the hours from 11.30 a.m. to 2.30 p.m., an interval of not less than three quarters of an hour shall be allowed between those hours for dinner, which shall be increased to one hour in cases where that meal is not taken in the shop, or in a building of which the shop forms a part or to which the shop is attached :

(2) where the hours of employment include the hours from 4 p.m. to 7 p.m., an interval of not less than half an hour shall be allowed between those hours for tea.

This provision does not apply to a shop if the only persons employed as shop assistants are members of the family of the occupier of the shop, maintained by him and dwelling in his house.

The penalty for any breach of the foregoing regulations is, for the first offence, a fine not exceeding £1 ; for a second offence £5 ; and for a third or subsequent offence £10 ; but an exception is made in the case where an assistant stays on after 1.30 for the purpose of serving customers who were in the shop at that time.

### Employment of Young Persons.

The provisions with regard to the employment of persons under the age of 18 years have been considerably changed by the new (1934) Shops Act. This operates from December 30, 1934. Thenceforward :

(*a*) No " young person " (*i.e.*, one under the age of 18 years) shall be employed in or about a shop for a longer period than 52 hours in any one week until December 27, 1936, or for more than 48 hours in any one week after that date.

(*b*) On occasions of seasonal or exceptional pressure, however, young persons between 16 and 18 may be employed in excess of these normal maxima subject to certain provisions, which are, briefly, that when in any year there have been six weeks of overtime no young person involved shall be again so employed during the remainder of the year, and that when any young person has been employed overtime

1. for 50 hours in any year after 1936 or for 24 hours in any year up to 1936, or
2. for 12 hours in any week after 1936 or for eight hours in any week up till the end of 1936,

he must not be again so employed during that period.

The Home Secretary has power to issue regulations dealing with the extent to which such employment may be divided into spells.

(*c*) Any young person who is employed in a shop must be allowed an interval of at least 11 hours in every 24 between complete periods of employment, and these 11 hours must include the hours of 10 p.m. until 6 a.m.

Offences render shopkeepers liable to fines not exceeding £10 for every person in respect of whom the contravention occurs.

(*d*) In every shop in which a young person is employed a notice shall be kept exhibited by the occupier of the shop in a conspicuous place stating the number of hours in the week during which a young person may lawfully be employed in or about the shop.

If the occupier of a shop fails to comply with the provisions regarding " notices " he is liable to a fine not exceeding forty shillings.

## SHOP REGULATION ACTS

### Sanitary Arrangements in Shops

Section 10 of the new (1934) Shops Act lays down that in every part of the shop in which assistants are employed there must be :

(*a*) proper ventilation,

(*b*) means to maintain a reasonable temperature,

(*c*) sanitary conveniences (unless certificate of exemption is obtained),

(*d*) proper means of lighting,

(*e*) sufficient washing facilities (unless certificate of exemption is obtained),

(*f*) facilities for taking meals where meals are taken.

Local authorities can require an owner to take steps to comply with this provision, and if there is non-compliance the shopkeeper may be liable on summary conviction to a fine not exceeding £20 for the first offence, or a fine of £50 or £5 per day since the first conviction, whichever is the greater, for a second conviction.

### Seats for Female Assistants.

In all rooms of a shop where female shop-assistants are employed in the serving of customers, the occupier of the shop shall provide seats behind the counter, or in such other position as may be suitable for the purpose, and such seats shall be in the proportion of not less than one seat to every three female shop-assistants employed in each room.

Failure to comply with this provision entails a fine not exceeding three pounds for the first offence, and for a second or subsequent offence a fine not less than one pound and not exceeding five pounds.

This has been amended by the Shops Act (1934) to the extent that it is now the duty of a shopkeeper to permit female shop assistants to make use of their seats whenever this does not interfere with their work, and it is obligatory to give them notice that they are intended to use them in this way.

### Early Closing.

Every shop shall, save as otherwise provided, be closed for the serving of customers not later than one o'clock in the afternoon on one weekday in every week.

The local authority may, by order, fix the day on which a shop is to be so closed for "the weekly half-holiday," and any such order may either fix the same day for all shops, or may fix :—

(*a*) different days for different classes of shops ; or

(*b*) different days for different parts of the district ; or

(*c*) different days for different periods of the year.

Failing such an order, the weekly half-holiday shall be such day as the occupier may specify in a notice affixed in the shop, but it shall not be lawful for the occupier of the shop to change the day oftener than once in any period of three months.

Where the local authorities have reason to believe that a majority of the shopkeepers of any particular class in any area are in favour of being exempted from the provisions of this section either wholly or by fixing as the closing hour instead of one o'clock some other hour not later than two o'clock, the local authorities shall make an order exempting the shops of that class within the area from the provisions of this section of the Act, either wholly or to such extent as specified.

Failure to comply with any of the provisions of this section, entails a fine not exceeding :—

(*a*) in the case of a first offence, one pound ;

(*b*) in the case of a second offence, five pounds ; and

(*c*) in the case of a third or subsequent offence, ten pounds.

### Special Exceptions.

In places frequented as "holiday resorts" during certain seasons of the year, the local authority may by order suspend, for such period or periods as may be specified in the order (not exceeding in the aggregate four months in any year), the obligation imposed by this Act to close shops on the weekly half-holiday.

Where the occupier of any shop in any place in which any such order of suspension is in force satisfies the local authority that it is the practice to allow all his shop assistants a holiday on full pay of not less than two weeks in every year, and keeps affixed in his shop a notice to that effect, the requirement that on one day in each week a shop assistant shall not be employed after half-past one o'clock shall not apply to the shop during such period or periods as aforesaid.

### The Shops (Hours of Closing) Act, 1928.

This enacts that every shop (with certain exceptions which do not include wireless retailers) shall be closed not later than nine o'clock in the evening on one day in the week (known as the late day) and not later than eight o'clock in the evening of all other weekdays.

### 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.

# PATENTS, DESIGNS AND TRADE MARKS

## By "The Broadcaster" Patent Expert

The last Patents and Designs Act, which came into force on November 1st, 1932, introduced certain important changes in existing practice. For the information of those familiar with the former procedure, it may be convenient to give a short summary of the more outstanding alterations.

In order to give more time to an inventor to develop his plans, the time limit for filing a Complete after a Provisional Specification has been increased from nine to twelve months (or to thirteen months by paying an extension fee). A corresponding extension has been made in the statutory periods for Acceptance and Sealing.

An applicant who has filed a Complete Specification may convert it into a Provisional, in order to be able to include later developments; or he may post-date his Specification, on paying a fee, for a period not exceeding six months.

The official search into the novelty of the invention may now include Foreign as well as British patent Specifications, together with technical and scientific periodicals, text-books, and other relevant publications.

To cover the extended search, the fee paid on filing a Complete Specification has been increased from £3 to £4. Otherwise the official Stamp fees—with a few unimportant exceptions—remain as before.

A patent may now be granted direct to an assignee, in cases where the inventor has agreed to assign. The Comptroller is also given powers to adjudicate as to the grant of licences when joint owners disagree.

The grounds on which a patent may be revoked have been specified and enlarged. They include—an objection that the invention is not useful; that it is not fairly described in the specification; that the scope of the patent is not fairly ascertained; that the inventor has not described the "best" method of carrying out the invention known to him when he filed his application; that the invention has been "secretly" worked on a commercial scale before patent protection was applied for; and various other objections.

The provisions intended to protect the public against unjustifiable threats of infringement have been strengthened. Relief against such threats may now be obtained whether the threatener has an interest in the patent in question or not. Also it is now no defence against an "action for threatening" to institute proceedings for infringement. This used to be a convenient way out for the threatener—if brought to book—as the infringement suit could always be dropped if the threats were merely "bluff."

The Patent Office is now given power to refuse patents for inventions of an obviously frivolous or fantastic nature.

A new Tribunal has been set up to hear Appeals on the part of inventors from decisions of the Comptroller. Such appeals were formerly heard by the Law Officer, who has now been replaced by a Judge of the High Court (Mr. Justice Luxmoore).

The procedure as regards Designs is but little affected. Perhaps the most important change is one allowing the proprietor of a Registered Design to secure protection for a minor improvement on his design in much the same way as an inventor is allowed to take out a "patent of addition."

### What May be Patented.

In the first place the invention must be for a "manner of manufacture." That is to say, it must have some commercial application and be beneficial to trade.

The discovery of a new scientific principle, such as Einstein's theory of relativity, is not patentable unless it is embodied in some practical application. The same objection applies to any abstract notion or bare philosophic idea.

Inventions for which a patent can be obtained usually fall into one or other of the following classes:—

(1) New articles of commerce made by mechanical or chemical operations.

(2) New machinery and apparatus.

(3) New processes of manufacture in which a series of operations are performed in sequence.

### Essentials of a Patent.

Obviously the invention must be new and original. The degree of novelty may be slight, but it must be present. In other words, the inventive step must be something more than an improvement such as would naturally be carried out by an intelligent artisan or skilled workman engaged in the trade to which the invention relates.

The invention must also be useful. There is no advantage either to the State or the inventor in granting a patent for something which is obviously futile.

To secure a patent, the inventor must file a written specification setting out clearly and fairly (a) the nature of his invention, and (b) the way in which it is to be carried into effect. An inventor is sometimes tempted to give as little information as possible. This is dangerous because it may have the effect of rendering the patent

## PATENTS, DESIGNS, ETC.

invalid. The criterion is that the description must be sufficient to enable a skilled workman to carry out the invention and to secure the correct results from the information given in the Patent specification. Anything less than this, or any deliberate misstatement of facts, will be sufficient to invalidate the patent should it be brought to Court.

**Procedure on Application.**

Generally speaking, it is advisable to employ professional assistance.

To assist Inventors who may desire to proceed in person, a useful official pamphlet entitled "Instructions to Applicants for Patents" may be obtained free on application to the Comptroller-General of Patents, 25, Southampton Buildings, London, W.C.2. This sets out in detail the formalities to be observed in preparing the written specification and accompanying drawings.

**Provisional Application.**

The application for a patent may be made either in two stages or in one. In the former case the first step is to file a Provisional specification, and then at any time within twelve months to follow this up by filing a Complete specification.

In the Provisional specification the inventor is only called upon to give a brief description of the nature of his invention. He then has a further year (or 18 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.

*What Cannot be Registered.*

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."

*How to Register.*

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."

This definition brings out the true distinction between a design and a patent, a point which is frequently confused. Contrivances or devices which essentially involve processes or methods of manufacture, or some mechanical principle, can only be protected by means of Letters Patent and not by registration under the Designs Act.

*Registration.*

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.

*Rights Given by Registration.*

Registration of a design gives the proprietor the exclusive right to use the design. By Act of Parliament, any *manufacturer* who infringes or imitates a registered design, whether or not he does so knowingly, may be proceeded against in the Courts.

*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 AND REPLACED APPARATUS

When an authorised electricity undertaking wishes to change the system of the supply, it has to obtain the consent of the Electricity Commissioners or in certain cases of the local authority (as for instance the L.C.C. in the London area). The consent is usually given subject to the undertaking suiting to the new supply any of the consumer's apparatus (which includes wireless equipment) affected by the change.

If the undertaking refuses to make good the change-over of the wireless equipment, or disputes the cost of it, the listener can take the matter to arbitration in accordance with the conditions of the consent. It is within the power of the arbitrator to award that the cost of the arbitration shall be borne by the party against whom the award is given. Under the form of consent now issued by the Electricity Commissioners the undertaking is relieved of the responsibility for dealing with consumer's apparatus installed after notice (six months) of the change over has been given.

All this applies to authorised electric supply undertakings only—that is to say, those which have undertaken to supply electric current under the provisions of the Electricity Supply Acts, 1882 to 1926. There are a few comparatively unimportant undertakings which have been set up independently of those Acts, and over whom the Electricity Commissioners have no control.

# 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 1s. (not more than 15 bedrooms). For each additional 15 bedrooms (or part), £1 1s.

Radiograms or radio sets, plus gramophones : £1 11s. 6d. (not more than 15 bedrooms). For each additional 15 bedrooms (or part), £1 11s. 6d.

Rebates will be granted if the premises are only open for part of the year.

### 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.

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# 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.

# 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 of a manufacturer whose actual payment to the Pool is £1,800 per annum remains, therefore, at the standard rate per valve of 2s. 6d., a manufacturer whose total payment to the Pool on this standard scale would amount to £9,000 would receive such a rebate as would reduce his per valve payment to approximately 1s. 5d. and the actual net sum from £9,000 to £5,000.

No schedule of patents is incorporated in the licence, but the following is a list of the principal patents, including those of the Hazeltine Corporation, which are held at the moment by the Pool.

Patent No. 275 of 1915 covering the push-pull amplifier (recently extended by order of the High Court until January, 1935) is still on the list, as well as No. 15448/15 relating to the use of a centre-tapped filament for raw A.C. valves, which was similarly given a fresh lease of life up to November, 1935.

One or two of the scheduled patents are due to expire within the next year, including one of the earliest superhet patents, No. 135177, but the rest have still a long term to run.

The well-known "Craft" patent, covering the basic principle of the radiogram, the Rice-Kellog patents for moving-coil speakers, and the 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

to regulate the bias on the first detector valve only; next, if necessary, to control the output of the intermediate frequency valve; and then, in succession, the frequency-changing valve and the H.F. amplifier. The A.V.C. rectifier may be a diode valve arranged in parallel with the second detector.

No. 381847 (Marconi's Wireless Telegraph Co.), March 21, 1931.—The A.V.C. voltage is derived either from a double-diode-triode valve, or from an ordinary triode valve in which the cathode and grid are used to rectify the signal voltages, while the cathode and anode act as a second pair of electrodes to rectify the carrier-wave. The rectified carrier voltage is fed back to the grid of the preceding valve for A.V.C., whilst the audio-frequencies are applied to a resistance in the grid-cathode circuit, and, after passing through the valve in this form, are fed forward to another stage of L.F. amplification. The arrangement can be used to give "quiet" or "delayed" A.V.C. by preventing the development of any D.C. carrier voltage until the signal reaches a definite level of strength.

No. 393318 (Marconi's Wireless Telegraph Co. and R. M. Armstrong), December 2, 1931.—Part of the rectified carrier-wave is used to vary the voltage applied to the screening-grid of a S.G. valve in such a way as to increase its effective amplification-factor as signal strength falls off and vice versa. Part of the resistance across which the A.V.C. voltage is developed may consist of the anode-cathode path of an auxiliary valve.

**OTHER PATENTS.**

Ganged Tuning Control.—No. 221868 (Western Electric Co. and G. H. Nash), June 19, 1923.—Covers the use in a receiving set of a number of variable tuning condensers which are mounted coaxially, but not on the same shaft, and so locked together that the rotation of one from a single control knob simultaneously effects the rotation of the others.

Anti-Reaction Circuit.—No. 260036 (H. J. Round), July 20, 1925.—In order to eliminate reaction due to interelectrode capacity, the usual anode "balancing" inductances consist of various coils, some wound in the ordinary way, whilst others are astatically wound, i.e., so that there is no external magnetic field.

Screening.—No. 285020 (British Thomson-Houston), February 8, 1927.—Covers the use of "partition" screening in the case of screen-grid amplifiers. The input and output circuits are preferably arranged on opposite sides of the same partition, the bulb of the valve extending part way through.

Automatic Grid-bias.—No. 348540 (S. J. Anderson), February 12, 1930.—"Free" grid bias is obtained by using the voltage drop across one of the usual anode impedances. For instance, the D.C. voltage developed across the primary of an ordinary L.F. coupling-transformer is used to bias the grids both of the detector and the following L.F. stage.

Remote Tuning Control.—No. 355706 (Marconi's Wireless Telegraph Co. and A. T. Witts).—The tuning condensers of a receiving set are controlled from a distance through a potentiometer knob, which varies the resistance in a circuit, comprising a solenoid, and so alters the position of an armature moving in and out of the solenoid. The armature is coupled to the moving plates of the condenser through a spring-controlled plunger, which prevents any movement of the condenser plates when the solenoid is de-energised.

Straight-line Amplifier.—No. 358932 (Marconi's Wireless Telegraph Co.; H. J. Round; and P. K. Turner), June 12, 1930.—The grid and cathode of a valve of high mutual conductance are tapped across a small portion of the inductance of a tuned circuit, which is also lightly coupled to the plate circuit, the degree of reaction being such as to reduce the damping practically to zero. The response of such a circuit to impressed signals is substantially linear.

Frequency-correcting Circuits.—No. 370300 (N. M. Rust), December 24, 1930.—Covers the use of inductance, resistance, and capacity networks for correcting variations in current frequency or phase, and compensating for attenuation.

Band-pass Circuits.—No. 393983 (N. P. Hinton).—A variably-tuned band-pass input or coupling-circuit which has two resonant frequencies at each setting (double-humped curve), and a constant difference between these two frequencies at all points within the tuning range. The two circuits forming the band-pass are cross-connected, so that there is always a tuned "series" circuit, together with a second tuned "figure-of-eight" circuit. The arrangement is suitable for ganged control, and more particularly for coupling the signal and local oscillator circuits in a superhet receiver.

The Hazeltine Corporation's list includes one patent originally issued to Mr. Scott Taggart for an early neutrodyne development, and certain others issued to Messrs. Loftin and White for couplings designed to ensure a constant amplification over the entire tuning range of a set.

Broadly speaking, the inventions fall into three main groups, the first relating to constant amplification, the second to methods of ganging for single-knob tuning control, and the third to neutrodyning. The remainder are chiefly concerned with constructional details.

As they were originally intended for the American rather than the British market the circuits are not, as a rule, designed to cover both medium and long-wave ranges. There is, however, evidence of a far-sighted appreciation of the problems of ganged tuning and automatic volume control.

The first-mentioned group is probably the most important at the present time. It covers various methods of ensuring constant coupling, and therefore constant amplification at different frequencies, together with other advantages, such as increased stability and simplified control.

The patents concerned are:—

256644, issued to S. Y. White.
256967, issued to S. Y. White.
259613, issued to Hazeltine Corporation.
263804, issued to E. H. Loftin.
273639, issued to Hazeltine Corporation.
297723, issued to Hazeltine Corporation.
315399, issued to Hazeltine Corporation.

The constant-coupling circuit usually identified with the names of Loftin and White consists of a magnetic coupling combined in additive phase with a capacity coupling. That is to say, the two separate couplings are so proportioned as to give a constant total transfer of energy throughout the whole tuning range.

The first patent 256644, describes this coupling as applied between the aerial and the input to a valve amplifier. The other two patents, 256967 and 263804, cover the same principle as applied to intervalve couplings. In addition to maintaining a constant energy transfer, the coupling counteracts any tendency to instability caused by the inter-electrode capacity of the valve.

With this type of coupling, the plate circuit is not purely inductive, but contains a capacity element, and also the resistance of the tuned circuit at resonance.

In general, resistance or inductance in the plate circuit creates a positive feed-back, while a capacitative plate circuit produces the opposite effect, the change from an inductive to a capacitative load reversing the phase of the oscillatory voltages. With an inductive load, the resultant feed-back to the grid is in phase, while with a capacitative load it is out of phase with the input.

By combining the two effects, the feed-back can be adjusted either to zero or to any desired amount necessary to obtain increased amplification, while, at the same time, maintaining stability. In actual practice one of the magnetic couplings is usually adjusted by the manufacturer before sale, so that the receiver cannot be made to oscillate at any point on the tuning scale.

Patents 273639 and 315399 cover an alternative system of constant coupling, more suited to mass production. By analysing the response curves of an ordinary amplifier it is shown that

## A.4 LICENCE

the required effect can be secured by means of a mixed inductive, and capacity coupling in combination with a choke-fed valve, the whole output circuit, including the choke, being tuned to a wave-length slightly longer than the longest to be received.

The tuned circuit, as a whole, has a capacitative reactance, and the transformer primary an inductance reactance to the valve output, causing the currents in the two windings to be in opposite phase. The amplification is, in fact, maintained constant throughout the tuning range entirely by the design of the primary circuit. The moving vanes of the condenser in the secondary circuit can therefore be earthed, to facilitate "ganging" and to eliminate hand capacity effects.

Patent No. 259613 covers the use of differently designed transformers in a multi-stage amplifier. The first-stage transformer is, say, most efficient at one wave-length, while the transformer in the next stage is made more efficient at another wave-length, the result being that the overall efficiency is kept substantially constant for all wave-lengths.

Patent No. 297723 discloses a constant amplification receiver, in which the valves are neutrodyned by split primary transformers, the primary, neutralising and the secondary inductances all being variable, while the coupling to the secondary is controlled by means of movable screens. All the variable components are ganged to specially designed tuning-condensers in such a way as to maintain constant amplification at all points on the tuning scale.

To avoid the difficulty of ganging the aerial circuit, the input to the first valve is made aperiodici.

The next group relates to methods of ganging for tuning control, and comprises the following patents :

250162, issued to S. Y. White.
250969, issued to Hazeltine Corporation.
252691, issued to Hazeltine Corporation.
312354, issued to Hazeltine Corporation.
314070, issued to Hazeltine Corporation.

Patent No. 250162 describes a self-contained speaker set with some interesting ganging features. Trimming condensers are used to secure resonance at the lowest wave-length to be received, whilst at the highest wave-length special plates are provided on the tuning condensers to allow the rate of change of capacity to be varied in order to secure uniformity. The ordinary aerial is replaced by a metal plate inserted at the bottom of the speaker compartment, the screens and batteries serving as a counterpoise earth. If an external aerial is used, any variation in capacity is compensated by a series condenser.

Circuits of the reflex type where the same valve is used to amplify at both high and low frequency are concerned in patents 250969 and 252691. By using an untuned aerial two advantages are gained. First, re-radiation is prevented, and, secondly, the difficulty of ganging is overcome.

In No. 312354 the aerial tuning-coil is made sufficiently large to tune to a wavelength slightly longer than the longest wave to be received, and is only loosely coupled to the secondary. The aerial is thus kept inductively reactive over the whole tuning-range, and does not reflect capacity into the coupled secondary circuit. This secures the following advantages: (1) The aerial constants are less critical than with the usual aperiodic aerial; (2) the aerial tuning favours the longer waves, which ordinarily are the least amplified; and (3) the only component affected by "ganging" is the aerial tuning-coil and not the tuning condenser, which means less cost.

PROBLEMS OF GANGING.

The problem of ganging when using a frame aerial and without employing large trimming or padding condensers, which restrict the tuning range, is touched on by patent 314070. The required object is achieved by making the inductance of the frame equal that of the tuning coils, the larger distributed capacity of the loop being reduced to that of the other tuned circuits by connecting a part only of the frame across the input to the first valve.

The third group of patents covers various methods of neutrodyning, or balancing-out the effect of inter-electrode capacity inside the valve.

Since the introduction of the screened-grid amplifier the value of the neutrodyne has fallen off as far as the modern receiving set is concerned, but the principle still has important applications in other directions.

The neutrodyne patents are contained in the following list :—

217971, issued to J. Scott-Taggart.
222894, issued to Jackson-Mellersh (Independent Radio Manufacturing, Inc.).
222895, issued to Jackson-Mellersh (Independent Radio Manufacturing, Inc.).
223181, issued to Jackson-Mellersh (Independent Radio Manufacturing, Inc.).
240114, issued to Hazeltine Corporation.
248389, issued to Hazeltine Corporation.
248311, issued to Hazeltine Corporation.
256649, issued to Hazeltine Corporation.
264304, issued to A. E. White (Thermodyne Research Lab., Inc.).

The earliest of the series is 217971, which was originally issued to Mr. John Scott-Taggart. It covers the use of a supplementary condenser inserted in parallel with the grid-anode capacity of the valve, as well as a neutralising condenser.

The others are of American origin and include No. 222895, which is the first to describe "split primary" neutralising with maximum coupling between the primary and neutralising windings. It also refers particularly to the use of screening and the employment of sheathed leads as a refinement in stabilising.

It depends upon the use of a "balanced" bridge, the arms of which are made up of the anode-grid capacity C1, the neutrodyne condenser NC, and the inductances L1 and L2. The input is applied across the diagonal AB, whilst the output is taken from the opposite diagonal CD, so that fluctuations in one cannot affect the other so long as the bridge is balanced.

Patent 222894 applies the neutrodyne idea to an input coupling between an aerial and secondary circuit. In No. 223181 the turns ratio of the neutralising and the primary windings is made equal to the ratio of the grid-anode capacity to the neutralising capacity, and Nos. 240114 and 248389 relate to neutrodyning by capacitative elements only, with the object of maintaining a more exact balance at all frequencies.

The last three patents in this series disclose features of more modern interest. For instance, 248311 describes the decoupling of the H.T., L.T. and G.B. supplies in a neutralised receiver. Resistance-capacity decoupling combinations are used, and the necessity for the separate screening of each stage is recognised.

No. 256649 covers a method of arranging the components and wiring of a receiver in such a way that the mutual capacitative couplings automatically give a neutrodyne effect.

The plate circuit of a valve is arranged in 264304, to give a capacitative step-up by applying the anode voltage across one of a pair of series condensers used to tune the output inductance. The arrangement also reduces the oscillating voltage between the anode and filament, and so diminishes feedback to the grid.

The remaining patents mostly relate to various detail improvements in components and circuit design.

Patent 229625 covers a neutrodyne condenser formed of a wire and insulating sleeving, with a sliding tubular electrode for adjustment.

No. 231820 aims to reduce the magnetic coupling between adjacent coils by setting them with their axes parallel and inclined at an angle of 55 degrees to the line joining the centres of the coils.

No. 238256 is for a method of mounting a

coil on a tuning condenser by means of short brackets, and 252315 is for a valve-mounting in which the connecting leads form the sole support for the valve. The leads consist of spring strips flexible in both the horizontal and vertical planes.

The improvement of selectivity is the aim of 253146. The idea is to make the primary winding of the coupling-transformers smaller than the calculated optimum value, so that the impedance of each tuned circuit, as presented to the valve, is less than the anode impedance.

There remain two patents which fall outside the groups already mentioned.

Patent 293462 covers various improvements in automatic volume control, including the use of a meter to give a visual indication of resonance. The use of a two-electrode valve as a detector and for obtaining a biasing voltage for the high-frequency valves, is described, as well as the use of the ordinary type of detector valve for the same purpose. Both systems are designed to prevent fluctuations in the mains supply voltages from affecting the output. Volume control may also be applied by varying in the filament current in a mains-driven set using series-connected valve filaments.

The elimination of hum is the object of the next patent. No. 304309 covers the use of a Wheatstone bridge filter for suppressing disturbances in the supply circuits of a valve amplifier. A "balanced bridge" is formed of the anode-cathode path of the valve, a choke or resistance and two condensers. The output is taken from the diagonal A. B joining the plate of the valve to the mid-point of the two condensers, while the H.T. supply is inserted across the opposite diagonal.

As long as the bridge is balanced, voltage fluctuations in the H.T. supply cannot affect the speaker, which is across the opposite diagonal of the bridge. Similarly, any mains hum, or any current from other valves passing through the common H.T. supply, cannot affect the output. The arrangement therefore eliminates any form of low-frequency distortion, such as "motor-boating," or "hum," due to incomplete smoothing.

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# PHILIPS—MULLARD LICENCE

The terms of the Philips-Mullard agreement offered to manufacturers of radio sets was announced in May, 1933.

The text of the agreement follows broadly the general lines of the old A.3 and R.G.2 licences issued by the British Pool.

The initial period of the agreement is two years from June 1, 1933. If not previously terminated by six months' notice before June 1, 1935, it is to continue on a yearly basis.

Fifty-seven selected patents are scheduled and the amount of the royalty payable is fixed at 1/6 per valve holder with a proviso that in the case of multi-valves the rate is 1/6 for the first function of the valve and 1/- for every additional function.

The royalty is subject to a sliding scale of rebate. This rebate varies from a minimum of ½ per cent. on a payment of £1,500 to a maximum of 62 per cent. on a payment of £30,000.

The patents listed vary from the earliest which dates back to July, 1926, and is due to expire on July, 1942, to a patent which normally would remain in force until June, 1947.

The well-known pentode patent is of course included.

Actually 50 of the patents are scheduled on the part of Philips Lamps and seven by the Mullard Radio Valve Co.

A clause of special interest in the licence states 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.

331450, 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.

331907, 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.

# THE INDUSTRY AT LAW

## Summary of the Year's Actions

### *Patents; Copyright; Price Cutting.*

**Reaction Patent: Appeal Withdrawn.**—The Appeal entered by the Marconi Co., against the judgment given by Mr. Justice Maugham in favour of Philips Lamps has been withdrawn. It will be remembered that the Marconi Co., sued last year for infringement of their early master-patent covering the use of reaction. The patent in question had, in fact, expired but the acts complained of took place during its lifetime. The High Court held that although the patent was valid at the time, Philips Lamps had not infringed it.

**Price-cutting: Hivac Injunction.**—In the Chancery Division, Mr. Justice Clauson heard a motion by the High Vacuum Valve Co., Ltd., for an interlocutory injunction restraining Douglas Shackman, trading as Pentonville Radio, Pentonville Road, King's Cross, from infringing plaintiffs' patent by selling their valves below the market price in breach of the terms of a limited licence.

**Pye Injunction.**—Mr. Justice Eve, in the Chancery Division, granted an injunction to Pye Radio, Ltd., against Super Radio (Manchester), Ltd., of Withy Grove, Manchester, restraining them from infringing certain letters patent by selling receivers below the current retail prices fixed by the plaintiffs.

**Pentode Valve: Mullard Injunction.**—Before Mr. Justice Crossman, in the Chancery Division, Mr. Lloyd Jacobs for the Mullard Radio Valve Co., Ltd., said they had applied for an injunction to restrain the Rothermel Corporation, Ltd., from infringing their pentode patent No. 287,958. The defendants had agreed to submit to a perpetual injunction in the terms of the notice of motion, and to pay an agreed sum by way of costs.

Mr. Briscoe, for the defendants, said that was correct. They were prepared to treat the motion as the trial of the action. His Lordship accordingly granted a perpetual injunction in the terms of the notice of motion.

**Copyright in "Public" Broadcasts: Appeal Dismissed.**—The Court of Appeal consisting of the Master of the Rolls, Lord Hanworth, and Lords Justices Lawrence and Romer, dismissed with costs an appeal arising over the test action brought to decide whether reproduction of music by sets and speakers in hotels and public-houses for the entertainment of customers or guests was an infringement of copyright.

The appellants were Hammond's Bradford Brewery Co., Ltd., as proprietors of the George Hotel, Brighouse; and the respondents the Performing Right Society.

In the original action before the High Court, Mr. Justice Maugham held that there was an infringement of copyright, and gave judgment in favour of the Performing Right Society with costs. Against this decision the Brewery Company now appealed.

Giving judgment, the Master of the Rolls said the appeal raised an important point, which had been fully, and to his mind, adequately dealt with and decided by Mr. Justice Maugham.

The action was brought by the P.R.S., who had the sole right of performing in public certain musical works. It appeared that the Brewery Company had made it possible for certain persons at the hotel, who were outside the domestic circle, to hear the representation of these works, which were being broadcast from a Hammersmith kinema.

The Brewery Company, by certain acts, made the performance at Hammersmith audible to a larger number of persons than would have automatically received it as part of the domestic circle of the George Hotel. In his view that was a separate performance, or an authorisation of a performance, which is prohibited by the terms of the Copyright Act.

Lords Justices Lawrence and Romer concurred.

**Copyright in P.A. Gramophone Records.**—This action was brought by the Gramophone Co., Ltd., against Stephen Carwardine and Co., Ltd., restaurant proprietors, of Bristol, for injunctions restraining infringement of their copyright in a record entitled "Overture—The Black Domino," by publicly performing the same and permitting a place of entertainment to be used for the performance for their private profit.

Sir Stafford Cripps, K.C., and Mr. Basil Drewe appeared for the plaintiffs, and Mr. Fergus Morton, K.C., and Mr. F. E. Sugden for the defendants.

Sir Stafford Cripps said that the point raised was a very important one for the industry, and as it was a test case arrangements had been made to meet the defendants' costs.

The defendants bought a copy of the record from the plaintiffs' agents, F. W. Allen (Bristol), Ltd., Lower Arcade, Bristol. It bore a label with the words "This copyright patented record cannot be sold below the price fixed by the patentee, nor publicly performed."

The defendants played the record in their tea and coffee rooms, Baldwin Street, Bristol, without the consent of the plaintiffs and this was the infringement complained of.

Mr. Morton said he admitted that this was a public performance.

Continuing, Sir Stafford Cripps said there had never been any direct decision on the point. It was a new class of copyright altogether. It was not a copyright in a musical work but in a particular representation of a musical work.

He submitted that in the making of the original plate of "The Black Domino" copyright was created in all records derived from that plate. The owners of the plate were to be deemed to be authors of the work and had the sole right to perform the work in public. The sale of the record carried with it only the right to private or ordinary domestic performances.

Opening the defence, Mr. Morton said he called no evidence. The proposition he hoped to establish was that the only person who could restrain a public performance either by the use of gramophones or other means of a musical composition or an adaptation of it was the owner of the copyright in the musical composition as distinct from the owner of the copyright in a contrivance or record on which that musical composition or adaptation of it was recorded.

You could not "perform" a gramophone record, but only the piece of music recorded on the record, which was a very different thing.

Giving judgment, Mr. Justice Maugham said the Gramophone Co., Ltd., were seeking to restrain an alleged infringement of their copyright in the record by the performance of it otherwise than in private.

He was told that the case was of great importance to those interested in the gramophone industry.

A French composer, Auber, 100 years ago wrote "The Black Domino." It was admitted for the purposes of this case that the overture in the language of the Copyright Act, 1911, was a musical work which was in the public domain and that there was no copyright in it. The plaintiffs made the original plate reproducing the overture to this work on October 28, 1931, and records had accordingly been put on the market bearing labels cautioning the public that they could only be used for private performances.

None of the facts was in dispute except the right of the plaintiffs to restrain the public performance of the record.

The musical work being in public domain it was clear that anyone might perform it in public or publish it in the usual way.

The question was whether the plaintiffs were entitled to restrain not the performance of the piece of music simpliciter, but the performance of the music as played by the London Symphony Orchestra and recorded by the plaintiffs.

This depended upon the effect of Section 19 of the Copyright Act. He was told that this section, which presented many difficulties, was the result of a compromise arrived at between various interested parties while the Bill, which subsequently became the Act, was passing through Parliament. In those circumstances difficulties were to be anticipated in construing the section.

In his opinion, as argued by the plaintiffs, two copyrights could co-exist.

The question then was, had the persons who had lawfully made records such a copyright as would entitle them to the exclusive right to the performance in public of those particular records so that they were entitled to restrain the use of those records for public performances? He did not think the answer was free from difficulty having regard to the defective drafting of Section 19.

The words of the section were: "Copyright shall subsist in records, perforated rolls and other contrivances in like manner as if such contrivances were musical works."

He thought the phrase was not apt to describe the mere right to prevent the reproduction in a physical form of the record and the right to sell the record.

The owner of the copyright in musical work had the sole right to reproduce it in public, and he thought it was a reasonable construction that the owner of a special copyright under Section 19, in a record of which he is the owner, had the sole right to use that record for a public performance, providing that the overriding right of the original owner did not intervene.

On that view each record holder had the right to use and to protect his record.

The action succeeded and the plaintiffs were entitled to the injunction claimed.

Sir Stafford Cripps, K.C., said there was no need for any order as to damages or costs.

**Injunction for Mullard Valves.**—In the Chancery Division, Mr. Justice Clauson gave judgment for the Mullard Radio Valve Co., Ltd., of Nightingale Lane, London, S.W., in an action against Mr. Sydney Reynolds, of Wandsworth Road, London, S.E., in respect of infringement of the plaintiffs' patents in radio valves, and for delivery by Mr. Reynolds of the valves concerned.

**Ekco Wins Price-cutting Action.**—In the Chancery Division, Mr. Justice Bennett granted an interim injunction to E. K. Cole, Ltd., of Southend-on-Sea, restraining Super Radio (Manchester), Ltd., from selling, or offering for sale, wireless sets made by the plaintiff company at below the authorised prices, in breach of the terms of a limited licence.

Mr. K. E. Shelley, who appeared for the plaintiff company, said that there was no appearance for the defendant company.

The evidence was that, although the defendant company were well aware of the limited licence, and had written to the plaintiff company stating that they did not market or sell their products at less than the authorised prices, they did, in fact, sell a wireless set made by the plaintiff company and listed at £13 13s. for £12 7s. 9d.

The sale was made to one of the plaintiff company's representatives and the set was delivered unpacked in its original carton.

Subsequently Mr. Justice Crossman gave judgment in default of delivery of defence in the above action and made the customary order in favour of the plaintiffs. This included an inquiry as to damages.

**"Radiogram" Patent Revoked.**—The "Craft" radio-gramophone patent, No. 195,589, held by the Western Electric Co., Ltd., has been revoked by order of the High Court. This patent came into considerable prominence some time ago, and was regarded as an important one.

**Pentode Valve; Mullard v. Philco.**—In the Chancery Division, Mr. Justice Farwell heard an action by the Mullard Radio Valve Co., Ltd., against the Philco Radio and Television Company of Great Britain, Ltd., George Robinson and Son, Lt ., of West Ferry Road, Millwall, and London Piano and Radio, Ltd., of Argyll Street, London, W.

The claim was for an injunction restraining infringement of the plaintiff company's letters patent No. 287,958, which is generally known as the "Pentode patent."

Mr. Rudolph Moritz, K.C., Sir Stafford Cripps, K.C., and Mr. Lionel Heald, appeared for the plaintiff company, and Mr. J. Whitehead, K.C., Mr. Trevor Watson, K.C., and Mr. Geoffrey Tookey, appeared for all the defendants.

Mr. Moritz, opening the case for the plaintiff company, said they did a very large valve making trade. The first-named defendant company carried on a similar trade, and the two other defendants were dealers.

The plaintiff company were registered legal owners of the patent in question. The title to the patent and certain facts as to sale and manufacture were admitted, but the defences were, that there was no infringement, and that the patent was invalid for want of novelty, based upon seven specifications and six scientific papers, that there was no subject-matter, that there had been a prior grant, and that the patent was not useful.

The Pentode valve, Mr. Moritz said, had great merit in working and was an instantaneous success. It was sold by the million, and was not only valuable but, indeed, indispensable in many ways.

The important claim which was alleged to have been infringed was: "A discharge tube having at least three auxiliary electrodes between the cathode and the anode, characterised in that the auxiliary electrode nearest the anode is directly connected to the cathode so as to be maintained continuously with the cathode potential."

Mr. L. W. Meyer and Professor E. V. Appleton, gave evidence in favour of the plaintiffs.

Mr. Whitehead, opening the case for the defence submitted that the patent in suit covered no inventive step.

The case was remarkable in that the specification seemed to be leaving it to the court to select which of the many discharge tubes was the one included within the first claim. All the evidence tended to show that an act of invention had been performed; had been directed to show the use of a suppressor grid as a means of suppressing secondary electrons. The valve had to be connected up in the right way to give the proper potential to the various parts of the apparatus.

The first claim was the only one where any attempt was made to claim an invention of that character, and it was not alleged that the defendants had infringed that.

Giving judgment his Lordship said infringement was alleged by the manufacture and sale of four valves. The manufacture and sale were admitted, and the title to the patent was admitted.

In their challenge to the validity of the patent, the defendants pleaded all the usual grounds, but the plea of want of utility was abandoned.

The problem which the patent was alleged to

## THE INDUSTRY AT LAW

have solved was the elimination of the abstraction from the anode of the secondary electrons. The problem was a real one, and in his judgment there was nothing in any of the prior documents or in the common general knowledge of the time to render the first claim invalid for want of novelty or subject-matter.

But the vital question in this case was the validity of the second claim in the patent specification, infringement of which was alleged. This was an independent claim, not to any circuit arrangement or to any special arrangement of the electrodes in the valve, but for any valve containing more than four electrodes and with the electrode nearest the anode directly connected with the cathode so as to maintain continuously the cathode potential.

"That appears to me," said his lordship, "to be a very wide claim. No limit is suggested to the number of electrodes which the valve may contain so long as they exceed four."

This claim, he held, was invalid for want of subject-matter. It could not be suggested that a valve having five or more electrodes was novel prior to the date of the patent, as examples of such valves were cited in the documents. In the light of the evidence given for the plaintiffs, this was a device which did not require the exercise of any inventive faculty.

The claim was not for any particular arrangement embodying some original ideas, but was for a valve constructed in a particular way.

Since the only other claim alleged to have been infringed was the fifth claim, which must be involved with the second claim, he held that as the latter, which was alleged to have been infringed, was the vital claim, the action failed and must be dismissed.

### *Hire Purchase*

**A Conflict of Evidence.**—Mr. Registrar Friend, at Clerkenwell County Court, directed that the documents in an action should be retained following the denial by a Walthamstow woman that the signature to an H.P. agreement for a set was in her hand-writing.

The Retailers Trust, Ltd., sued Percy R. Thomas, of Walthamstow, for £2 4s. 6d., balance of hire of a Marconiphone set, which was sold through a dealer and had been returned.

When the question concerning the agreement was raised, Mr. Thomas said his name appeared on the document but the signature was not his.

Frederick Birch, the salesman, gave evidence that he saw Mr. Thomas on the night before Mrs. Thomas signed his name. Mrs. Thomas said it would be all right for her to sign, as she would pay. He was making the agreement with Mr. Thomas, but allowed the woman to sign as he understood it was with the husband's full consent.

Mrs. Thomas, the wife, stated she did not sign the document or the delivery post-card. She signed a slip of paper which was not now produced. She denied that she made the statement that it was all right for her to sign as she would pay for it.

She was submitted to a writing test in court, and wrote on two pieces of paper, which were retained by the Registrar with other documents.

The Registrar gave judgment to the defendant. On the question of the signature, he said that one or other of the witnesses was not speaking the truth. On the whole, he preferred the evidence of the woman. He made no order as to costs.

**Radio Dealers and Finance Company.**—A case heard at the Liverpool County Court, raises a point of importance to radio dealers who handle H.-P. business.

Associated Distributors, Ltd., of Nottingham, claimed £8 15s. 6d. from Stanley Baker, of West Derby.

Two representatives of the Shaw Radio Company, of 1, Brunswick Street, Liverpool, called on Baker and demonstrated a receiver, which they sold to him for £10 4s., to be paid at the rate of 15s. 6d. per month, with a deposit of 18s. 6d.

They took the set away and brought it back again a week later, together with a printed form, which he signed. He actually paid 10s. 6d. deposit and three instalments of 5s. When the set went wrong, Baker took it back to the Shaw Radio Company. Although he had since made repeated applications, he had never seen the set again. He had had nothing to do with Associated Distributors.

It was stated that Associated Distributors were a financing company and had nothing to do with the attitude of Shaw Radio Co., in retaining the set.

Judge Dowdall said the bargain was between Baker and Associated Distributors. From the printed form it appeared that Baker was not dealing with Shaw Radio Co., whose name was in large letters at the bottom of the agreement, but with Associated Distributors, whose name was in small letters at the top.

By signing the form Baker made himself liable to Associated Distributors, thereby putting himself to great disadvantage.

The Judge added that in respect of the financing of radio, people thought they were dealing with the dealer. He held that Baker knew nothing about Associated Distributors at all, and was satisfied Baker did not understand he was dealing with Associated Distributors. Judgment for the defendant was given.

The plaintiffs were given leave to appeal.

**A Part-Exchange Problem.**—Pye Radio, Ltd., claimed at Cambridge County Court for a balance alleged to be due under an H.-P. agreement. The case presented some interesting features, and Judge Farrant was at one time inclined to adjourn it for fuller evidence of the exact nature of the understanding between the plaintiffs and their agents, a Maidenhead firm.

It was stated that £5 8s. 9d. had been paid on a receiver, and the plaintiffs sued for £5, which the defendant, Mrs. Lee, claimed had been credited to her in respect of an old set accepted by the retailers.

Major Lee, son of the defendant, told the judge that his mother declined to have a new set unless the old one was taken in part payment. The retailers still held the old set and had since cancelled the credit note.

Mr. Stevenson, for Pye Radio, Ltd., maintained that as soon as the defendant got into touch with the plaintiffs the question of agency ended. The defendant would have a very good claim against the retailers. Pye never had the set and were never offered it. The agreement was to pay in money, not sets.

A representative of the manufacturers said he knew that the agents had no authority to give credit notes or make H.-P. arrangements.

The Judge decided that the plaintiffs must be non-suited.

# MANUFACTURERS' DIRECTORY

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

## A

Abbey Engineering Works, Watton, Norfolk. Watton 2.

Academy Gramophone Co., Academy House, 96, Clerkenwell Road, E.C.1. Clerkenwell, 3501-5.

Accles and Pollock, Ltd., Oldbury, Birmingham. Broadwell 1500. Accles, Oldbury. Fairfax House. Fulwood Place, High Holborn, W.C.1. 26, Cannon Street, Manchester.

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

Accumulators Elite, Hebble Mills, 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.

Acton Battery Co., Ltd., Dorland House, Regent Street, London, W.1. Whitehall 9889. Proudee Piccy London. 57, Bridgman Road, London, W.4. 229, Acton Lane, London, W.4.

Adams Bros. and Burnley, Ltd., Harrow Sheet Metal Works, Harrow, Middlesex. Harrow 3685. Rhodenite, Harrow.

Adey Portable Radio, 99, Mortimer Street, Regent Street, London, W.1. Langham 3258.

Adolph, F., 139, High Holborn, W.C.1.

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.

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.

Alkinm Storage Batteries, Ltd., Waterside Works, Halifax, Halifax 3020.

Allen and Co., Ltd., E., Imperial Steel Works, Sheffield 9. Attercliffe 41055. Allen, Sheffield. Artillery House, Westminster, London, S.W.1. Victoria 4528.

All-Power Transformers, Ltd., 8a, Gladstone Road, Wimbledon, S.W.19. Liberty 3303.

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

Allwood, Blackband and Co., Alexander Works, Alcester.

Alpha Coil and Component Co., Hawksley Avenue, Hillsborough, Sheffield. Sheffield 43335.

Altham Radio Co., 25, Mosley Street, Manchester 2. Central 6427. Staportco, Manchester.

Alton Battery Co., Ltd., Alton, Hants, Alton 67. Battery Alton. Donington House, Norfolk Street, W.C.2. Temple Bar 9265. Batterical, Estrand, London.

Amalgamated Manufacturers, 431, Coventry Road, Birmingham. Victoria 1662.

Ambassador Radio-Gramophones, Ambassador Works, Bramston Street, Brighouse, Yorks, Brighouse 283.

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. Victoria 2002.

Appletons (Leeds) Ltd., Hanover Place, Leeds. Leeds 21694-5-6. 96, New Bridge Street, Newcastle-on-Tyne. Newcastle 27651. Gramophones, Newcastle.

Ardea Vulcanizer Syn., Ltd., 318, King Street, Hammersmith, W.6. Riverside 0365.

Artic Fuse and Electrical Mfg. Co., Ltd., Birtley, Co. Durham. Birtley 61. Artic, Birtley.

Arvin Electric Co., Ltd., 313, Goswell Road, E.C.1. Clerkenwell 1452 and 2749.

Ashford, Dunn and Co., Ltd., Ryde Avenue, Hull. Central 7577. Mantel, Hull.

Ashley Wireless Telephone Co. (1925), Ltd., Finch Place, Falkland Street, London Road, Liverpool. North 238. Rotary, Liverpool, 3.

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.

Austin and Hayes, Woodside Works, Summersley Road, Highgate, N.6. Tudor 1009. Austayes, Crouchway, London.

Automatic Coil Winder and Electrical Equipment Co., Ltd., Winder House, Douglas Street, S.W.1. Victoria 3404-7, Autowinda, Churton, London.

Automobile Accessories (Bristol), Ltd., Clifton Terrace, Sion Road, Bedminster, Bristol 3. Bristol 64067.

A.E.F. Manufacturing Co., Ohmic Works, Queensway, Ponders End, Middlesex. Enfield 3249. Juicepotz, Enfield.

## B

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. 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., 91, Belle Grove, Welling, Kent. Bexley Heath 1320.

Barber and Colman, Ltd., Marsland Road, Brooklands, Manchester. Sale 2277. Barcol Sale.

Barnard Accumulator Co., 195-197, Perry Vale, London, S.E.23. Sydenham 5106.

Barrow, Hepburn and Gale, Ltd., Grange Mills, Grange Road, Bermondsey, S.E.1. Bermondsey, 3112-6. Rossoc, Berm, London.

Bastock, E., 135, Showell Green Lane, Sparkhill, Birmingham.

Batteries, Ltd., Redditch. Astwood Bank 4, Batteries, Redditch.

## MANUFACTURERS' SECTION

Baty, E. J., 157, Dunstable Road, Luton. Luton 229. Baty, Luton.

Baxendale and Co., Ltd., Miller Street, Manchester. Blackfriars 8282. Hanover Street and School Lane, Liverpool. Royal 5555. Baxendales. Grassmarket, Edinburgh. Edinburgh 27047. Baxendales. Capel Street, Dublin. Dublin 21607.

Baxter, Stavridi and Crales, Ltd., 9, Commercial Road, Edmonton, N.18. Tottenham 3576.

Bayliss, William, Ltd., Sheepcote Street, Birmingham. Midland 1409. Drawbench, Birmingham.

Beacon Radio Manufacturing Co., Ltd., 75, Pellon Lane, Halifax. Halifax 4890.

Beaufoy Grimble and Co., Ltd., Rita Road, Vauxhall Park, S.W.8. Reliance 3086.

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.

Bedford Electrical and Radio Co., Ltd., 22, Campbell Road, Bedford. Bedford 2343.

Beethoven Radio, Ltd., Beethoven Works, Gt. College Street, Camden Town, N.W.1. Euston 2181.

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, Tottlane, London.

Bennett Heyde and Co., J., 18, New Cannon Street, Manchester. City 1364. Benhey, Manchester.

Berclif, Ltd., 38, Rabone Lane, Smethwick, Smethwick 0751.

Beresford and Co., A. 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.

Bi-Metals, St. Mary's Works, Eldon Road, Wood Green, London, N.22. Bowes Park 3979.

Bird and Sons, Ltd., Sydney S., Cyldon Works, High Road, London, N.20. Hillside 2244.

Birkbys, Ltd., Liversedge, Yorks. Cleckheaton 103. Elo, Liversedge.

Birmingham Aluminium Casting (1903) Co., Ltd., Birmid Works, Smethwick, Birmingham. Smethwick 1213. Birmal, Smethwick. Abford House, Wilton Road, S.W.1. Victoria 1620.

Birmingham Sound Reproducers, Ltd. Claremont Works, Claremont Street, Old Hill, Staffs. Cradley Heath 6370. Electronic, Old Hill.

Bligh, S. W., 1 and 2, North Lane, and 11, St. Dunstan's Street, Canterbury. Canterbury 289. Bligh, Canterbury.

Block Batteries, Ltd., By Pass, Barking, London, E. Grangewood 3346.

Blue Comet, Ltd., Comet Works, Gartside Street, Manchester. Blackfriars 7773.

Bond and Sons, Ltd., V.C., Parkfield Works, Church Road, Leyton, E.10. Leytonstone 1066. Veeceebee Walstreet 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.

Boynton and Co., Ltd., 65-8, Stafford Street, Birmingham. Central 1525. Portables, Birmingham ; 139, Corporation Street, 3 & 5, Hill Street, and 23-33, Ashley Passage, Birmingham.

Braby and Co., Ltd., F., 352, Euston Road, London, N.W.1. Museum 3032. Braby Eusroad, London.

Bradnam and Co., 15, Heywood Street, Moss Side, Manchester.

Bramley, J. W., Radio House, Corporation Street, Halifax. Halifax 3394.

Brandon and Sons, Ltd., J., 82, Scawfell Street, Hackney Road, E.2. Bishopsgate 5008.

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.

Britannia Lathe and Oil Engine Co., Ltd. (Head Office), 125, High Holborn, London, W.C.1. Holborn 2525, Britlathes, Westcent. (works), Britannia Works, Colchester. Colchester 3847. Britannia, Colchester.

Britannia Rubber and Kamptulicon Co., Ltd., 7, Newgate Street, E.C.1. City 6951, Britannia, Cent., London.

Britannia Wireless Cones and Chassis, 12, Hyde Road, London, N.1. Clerkenwell 0547.

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, 2, Lawley Street, Birmingham ; 274, Deansgate, Manchester ; 66, Kirkstall Road, Leeds.

British Battery Co., Clarendon Road, Watford, Herts. Watford 3617.

British Belmont Radio, Ltd., Balfour House, 119-125, Finsbury Pavement, E.C.2. National 6828. Belrad Phone, London.

British Blue Spot Co., Ltd., Blue Spot House, 94-96, Rosoman Street, Rosebery Avenue, London, E.C.1. Clerkenwell 3570. Bluespot, Isling, London.

British Capehart Corpn. Ltd., Winchester Works, Sumner Road, Peckham, S.E.15. Rodney 2211.

British Celanese, Ltd., Celanese House, Hanover Square, W.1. Mayfair 8000. Celanese, Wesdo, London.

British East Light, Ltd., 18, St. Clare Street, Minories, London, E.1. Royal 4207. Fleastli.

British Ebonite Co., Ltd., Hanwell, London, W.7. Ealing 1 560. 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 Electric Resistance Co., Ltd., Ohmic Works, Queensway, Ponders End, Middlesex. Enfield 2252-3. Vitrohm, London.

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 Hard Rubber Co., Ltd., Ponders End, Middlesex. Enfield 1414-5.

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 Lumophon Co., Stal House, Judd Street, King's Cross, London, W.C.1. Euston 1183. Lumobrit, Kincross, London.

British Needle Co., Ltd., Argosy Works, Redditch. Redditch 119. Argosy, Redditch, 9, Falcon Avenue, Aldersgate Street, London E.C.1. 52, Spencer Street, Birmingham.

British N.S.F. Co., Ltd., Building No. 3, Waddon Factory Estate, Waddon, Surrey. Fairfield 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., 65, Grosvenor Road, London, W.7. Ealing 3251.
British Radio Gramophone Co., Ltd., Pilot House, Church Street, Stoke Newington, London, N.16. Clissold 6287.
British Radio Mfg. Co. (Liverpool), Ltd., 9, South Castle Street, Liverpool, 1. Central 2311.
British Radio Valve Manufacturers' Association, 59, Russell Square W.C.1. Museum 1206. Bradval, Westcent, London.
British Radiophone, Ltd., Aldwych House, Aldwych, W.C.2. Holborn 6744.
British Radiostat Corporation, Ltd., 24, Throgmorton Street, London, E.C.2. London Wall 3659.
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 Sampson Products, British Sampson Works, Acton Lane, London, N.W.10. Willesden 7084.
British Talkatone, Ltd., 89-91, Wardour Street, London, W.1. Gerrard 6747.
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.
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. Twinzono, Smith, London.
Bromley-Langton Electric Wire and Insulator Co., Ltd., 34-5, Newman Street, Oxford Street, W.1. Museum 2256-7. Elewires, Ruth, London.
Brookes Measuring Tools, 51-3, Church Street, Greenwich, London, S.E.10. Greenwich 1828.
Brown, Ltd., F., Langley Works, Long Acre, W.C.2. Temple Bar 7222.
Brown, Brew and Co., Ltd., Whitehorse Place, Market Street, Wellingborough, Northants. Wellingborough 98.
Brown Radio Co., W. F., Ossillo Works, Brierley Hill, Staffs. Brierley Hill 7062.
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.
Buck and Hickman, Ltd., 2 to 8, Whitechapel Road, E.1. Bishopsgate 6543. Roebuck, Edo, London. 29-30, Whittall Street, Birmingham; 37-39, Robertson Street, Glasgow; 277, Deansgate, Manchester.
Bulgin and Co., Ltd., A. F., Abbey Road, Barking, Essex. Grangewood 3266-7. 9-11, Cursitor Street, Chancery Lane, E.C.4. Holborn 2072.
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.
Bulmer, Fred, 4, Carlton Terrace, Scarborough. Scarborough 723. Bulmer 723, Scarborough.
Burall Bros., Patent Label Factory, Wisbech. Wisbech 113. Burall, Wisbech.
Burgoyne Wireless (1930), Ltd., Great West Road, Brentford, Middlesex. Ealing 2091.
Burnand and Son, W. E., Duo Works, 66-106, Shoreham Street, Sheffield 1. Central 20766 and 24850. Burnand, Sheffield.
Burndept, Ltd., Light Gun Factory, Erith, Kent. Erith 681.
Burne-Jones and Co., Ltd., 296, Borough High Street, S.E.1. Hop 0495. Burjomag Sedist, London; Burjomag, London.
Burton, Ltd., C. F. and H., Progress Works, Bernard Street, Walsall, Staffs. Walsall 3960.
Burwood's Wireless, Cork, I.F.S. Cork 1581.
Busby and Co., Ltd., 40-47, Price Street, Birmingham. Aston Cross 5696. Busco, Birmingham.
Bush Radio, Ltd. (Sole Concessionaires, G.B. Equipments, Ltd.), Woodger Road, Shepherd's Bush, London, W.12. Shepherd's Bush 2050. Soundifilm, Shepherds, London.
Butcher and Sons (Ross), Ltd., W., The Wireless Depot, Ross, Herefordshire. Ross 140.
B.C.N. Co., Waddon Factory Estate, Stafford Road, Waddon, Croydon. Fairfield 6068. Becien Croydon.
B. and H. Valve Co., Station Road, Finsbury Park, N.4.

## C

Callender's Cable and Construction Co., Ltd., Hamilton House, Victoria Embankment, London, E.C.4. Central 5241. Callender, Fleet, London.
Calvete, Ltd., I., 59, North Street, Clapham, S.W.4. Macaulay 3202. Elecalvete, Clapcom, London.
Cambridge Instrument Co., Ltd., 45, Grosvenor Place, London, S.W.1. Sloane 9146. Unipivot, Knights, London.
Caradio Services, Ltd., 28, Stockwell Road, S.W.9. Brixton 3888.
Carrington Mfg. Co., Ltd., Camco Works, Sanderstead Road, South Croydon. Croydon 1925. Camco, Croydon.
Castagnoli, Gordon, A.M.I.R.E., Culver Street, Colchester. Colchester 814.
Castle Fuse and Engineering Co., Ltd., Castle Works, 33, Chester Street, Liverpool 8. Royal 1610. Corundum, Liverpool.
Caxton Wood Turnery Co., Market Harborough. Market Harborough 59. Haddon, Market Harborough.
Celestion Ltd., London Road, Kingston-on-Thames. Kingston 5656. Celestion, Kingston-on-Thames. 106, Victoria Street, London, S.W.1. Victoria 3955-6.
Celluloid Printers, Ltd., 204, South Park Road, Wimbledon, S.W.19. Liberty 1905. Celluprint, Wimble, London.
Central Equipment, Ltd., 188, London Road, Liverpool. Royal 6152.
Chalkley, C. G. (Incorporating Chalgrove Radio), 6, Grove Street, Wellingborough, Northamptonshire. Chalgrove, Radio, Wellingborough.
Chapman, Ltd., A. W., Ranelagh Gardens, Hurlingham, S.W.6. Putney 2372-3. Nevajah, Phone, London.
Charlesworth Mouldings, Ltd., Northcote Road, Stechford, Birmingham. Stechford 2148.
Charlton Higgs (Radio), Ltd., 12, Spencer Street, S.W.1.
Chloride Electrical Storage Co., Ltd., Exide Works, Clifton Junction, near Manchester. Swinton 2011. Chloridic, Pendlebury. 137, Victoria Street, S.W.1. Victoria 6308; Lexden Road, Acton, W.3.; 205-231, Shaftesbury Avenue, W.C.2; 57-58, Dale End, Birmingham; 16-18, Broadmead, Bristol; 40-44, Tureen Street, Glasgow; 8, Pearse Street, Dublin, C.5; 1, Franklin Street, Belfast.
Cholerton, F., Bridge Street, St. Helens. St. Helens 3636.
Chorlmet Radio Elec. Ltd., Arras Mill, Fitzgeorge Street, Collyhurst, Manchester. Collyhurst 1802.

## MANUFACTURERS' SECTION

Christie and Sons, Ltd., Jas., 246, West Street, Sheffield. Sheffield 22732. Christie, Sheffield.
City Accumulator Co., 18-20, Normans Buildings, Central Street, London, E.C.1. Clerkenwell 6206. 4, Surrey Street, Strand, London, W.C.2. Temple Bar 8620.
Clarendon Radio Ltd., Cobbold Road, N.W.10. Willesden 5331.
Clarion Radio Valve Co., 7, Duke Street, London, W.C.2. Temple Bar 1693. Phoenix Works, Tyburn Road, Erdington, Birmingham, Erdington 1291.
Clarke and Co. (Manchester), Ltd., H., Atlas Works, George Street, Patricroft, Manchester. Eccles 2001. Pirtoid, Phone, Manchester. Bush House, Aldwych, London, W.C.2. Temple Bar 3862 and 7130. Pirtoid, Phone, London.
Clarke's (Redditch), Ltd., Sinew Works, Redditch. Redditch 100. Sinew, Redditch.
Clayton (Rubber Sales), Ltd., Progress Works, Clayton, Manchester. East 0788. Crepechouc, Manchester.
Cleveleys Engineering Co., Back Victoria Parade, Cleveleys, Blackpool.
Clifford Pressland (Sales) Ltd., 13, Creek Road, East Molesey, Molesey 1231.
Climax Radio Electric, Ltd., Haverstock Works. Parkhill Road, Hampstead, N.W.3. Primrose 1171.
Coates, Ltd., J. G. Kings Mill, Bridge Street, Burnley, Lancs. Burnley 2295. Coates, Ltd., Burnley.
Cole, Ltd., E. K., Ekco Works, Southend-on-Sea. Southend 49491. Ekco, Southend-on-Sea.
Collaro, Ltd., Culmore Works, Culmore Road, Peckham, S.E.15. New Cross 2050. Korllaro, London.
Collet Mfg. Co., S. H., 341, Goswell Road, London, E.C.1. Clerk. 7984.
Collie and Co., J. H., 10, Canning Place, Liverpool. Central 5039.
Collings and Co., N. R., 101, Hitchin Street, Biggleswade, Beds. Biggleswade 63.
Collinson's Precision Screw Co., Ltd., Provost Works, Macdonald Road, E.17. Walthamstow 0532. Elecolvern. 150, King's Cross Road, London, W.C.1. Clerkenwell 5362.
Columbia Graphophone Co., Ltd., Columbia House, 98-108, Clerkenwell Road, E.C.1. Clerkenwell 7620-4. Talkingdom, Smith, London. Fibrillose, London.
Colvern, Ltd., Mawney's Road, Romford. Romford 2020. 150, King's Cross Road, London, W.C.1. Terminus 3077.
Concerton Radio and Electrical Co., Ltd., 256-7, Bank Chambers, 329, High Holborn, London, W.C.1. Holborn 8667.
Concordia Electric Wire Co., Ltd., Trent Mills, New Sawley, Nr. Nottingham. Long Eaton 249. Polianite, Long Eaton. 81, Milton Street, Sydney Avenue, E.C.2. Metropolitan 9780.
Connollys (Blackley), Ltd., Blackley, Manchester. Cheetham Hill, 1801-2-3. Connollys, Blackley. Oswaldtine House, Norfolk Street, W.C.2.
Consolidated Radio Co., Ltd., Warple Way, Acton, London, W.3. Shepherds Bush 2257.
Conways Electric Ltd., Park Avenue, Alperton, N.W. Willesden 5331.
Cooke and Co., H. S., Resilient Works, Redditch, Worcs. Redditch 72. Redditch, Stancap.
Cookson and Co., 25, New Oxford Street, W.C.1. Holborn 8503.
Coppock, J. T., 61-67, Old Street, E.C.1. Clerkenwell 0430. Jatocop, London.
Corey, Parsons and Co., Ltd., Winchester Works, Sumner Road, Peckham, S.E.15. Rodney 2211.
Correx Amplifiers, 21, Marmora Road, East Dulwich, London, S.E.22. Sydenham 3782.
Cosmocord Ltd., Cambridge Arterial Road, Enfield, Middlesex. Enfield 4022.
Cossor, Ltd., A.C. Cossor House, Highbury Grove, N.5. Canonbury 1234. Amplifiers, Phone, London. Amplifiers, London. 14-16, Carrs Lane, Birmingham 4. Midland 1627. 14, Bath Street, Bristol 1. Bristol 20271-2. 21, Waterloo Street, Glasgow, C.2. Central 4446-7. 17, Wellington Street, Leeds 1. Leeds 21581. 42, Paradise Street, Liverpool 1. Central 1877. 6-10, Cannon Street, Manchester 3. Blackfriars 9777-8. 3, St. Nicholas Buildings, Newcastle 1. Newcastle 23154. 3, Porter Street, Moor Head, Sheffield 1. Sheffield 23103-4. 47B, Fleet Street, Parliament Row, Dublin. Dublin 22471. 47, Queen Street, Belfast. Belfast 7979. 4, Park Lane, Cardiff. Cardiff 3377.
Crabtree, J. A., and Co., Ltd., Lincoln Works, Walsall, Staffs.
Cranley Radio, Ltd., 32, Craven Park Road, Harlesden, N.W.10. Willesden 3473.
Crawford and Co. (Tottenham), Ltd., Derby Road, West Green, N.15 Mountview 1835.
Cressall Mfg. Co., Eclipse Works, 31-2, Tower Street, Birmingham 19. Central 3463-4. Ohmic Birmingham.
Cromwell (S'hampton), Ltd., 32-33, Brintons Terrace, Southampton.
Cruickshank, Ltd., R., Camden Street, Birmingham. Central 7213. Cruickshank, Birmingham.
Crystalate Gramophone Record Mfg. Co., Ltd., Imperial House, 60-62, City Road, London, E.C.1. Clerkenwell 2633, 2116. Town Works, Tonbridge, Kent. Tonbridge 35. Golden Green, Tonbridge, Kent. Hadlow 33.
Curtis Mfg. Co., Ltd., 26-28, Paddenswick Road, Hammersmith, W.6. Riverside 4456.
Custerson, R., Old Factory, Bateshill, Redditch.
C.I.V.A.R.E., 137, Praed Street, London, W.2. Paddington 1903. Quesolar, Edge, London.

## D

Dagnall, Ltd., S., 420, Stratford Road, Sparkhill, Birmingham. Victoria 0015-6.
Dallas and Sons, Ltd., John E., 6-10, Betterton Street, W.C.2. Temple Bar 6351-4. Lensidern, Phone, London.
Dallow Manufacturing Co., Ltd., Forge Mill, Milford, Derbyshire. Duffield 236.
Daly, H. C., 44, Ranelagh Road, S.W.1. Victoria 5878.
Darwins, Ltd., Fitzwilliam Wks., Sheffield, Eros House, 29-31, Regent Street, London, S.W.1. Regent 5627.
Davis and Timmins, Ltd., Brook Road, Wood Green, N.22. Mountview 2466. Screwdatim Wood, Lon.
Dawkins Trading Co., 317, High Holborn, W.C.1. Holborn 8164. Nightingale Works, 347, Hornsey Road, London, N.
Daws, Clarke and Co., 23, The Avenue, Bedford Park, London, W.4. Chiswick 0368.
Decca Gramophone Co., Ltd. and Decca Record Co., Ltd., 1-3, Brixton Road, S.W.9. Reliance 3311.
De la Rue and Co., Ltd., Thos., Shernhall Street, Walthamstow, E.17. Walthamstow 2900. Telenduron, Walt., London.
Dent and Co., and Johnson, Ltd., Linwood Works, Linwood near Paisley. Johnstone 109. Dentcompa, Linwood.
Diehl, H., 40, Sun Street, London, E.C.2. Bishopsgate 7949. Diehlency, London.
Digby, F., 9, The Oval, Hackney Road, E.2. Bishopsgate 6458.
Diggle & Co., A., Jane Street, Rochdale. Rochdale 2869.
Disque Cabinet Co., Ltd., 11, Poultry, London, E.C.4. City 6631. Towundal, Cannon, London.
Distavox, Ltd., 119, Bunhill Row, London, E.C.1. National 8672.
Doherty and Sons, Edward, 700-710, Seven Sisters Road, N.15. Tottenham 3321.
Donophone Public Address Co., Ltd., 7, Ely Place, Holborn Circus, London, E.C.1. Holborn 4562.
Dr. Nesper, Ltd., 85, Crowland Road, S. Tottenham, N.15. Stamford Hill 2864.
Dual Motors, Ltd., 85-86, New Bond Street, W.1. Mayfair 1648-9. Dualmoto, Wesdo, London.
Dubilier Condensor Co. (1925), Ltd., Victoria Road, N. Acton W.3. Acorn 2241. Hivoltcon, Phone, London.

Dulcetto Polyphon, Ltd., 2-3, Newman Street, W.1. Museum 4201. "Dulcetpoly" London.
Dulci Electrical Co., Ltd., 7-8, Lizard Street, Old Street, London, E.C.1. Clerkenwell 5522.
Duray, 101, London Road Nth., Lowestoft. Lowestoft 165.
Dyson & Co. (Works), Ltd., J., 2, Coleman Street, E.C.2. Metropolitan 7988. Londepot, Ave., London. 5, Godwin Street, Bradford. Bradford 6037. Equipment, Bradford.

# E

Eagle Engineering Co., Ltd., Eagle Works, Warwick. Warwick 126-7. Eagle, Warwick.
Eagle Transfer, Ltd., Spring Road, Hall Green, Birmingham. Springfield 1117. Eagtranco, Birmingham.
Earl, Mfg. Co., Ltd., Avenue Wks., Hanover Pk., London, S.E.15. New Cross 0422. Earlect Peck, London.
East Ham Wireless Supplies, 427 and 429, Barking Road, East Ham, E.6. Grangewood 1038.
Eastick and Sons, J. J., 118, Bunhill Row, London, E.C.1. Metropolitan 0314. 9, Library Place, Jersey. 10/11, St. Helens Place, Swansea. Commercial House, Place Road, Portsmouth. St. Georges, Norwich.
Ebonestos Insulators, Ltd., Excelsior Works, Rollins Street, Canterbury Road, S.E.15. New Cross 1913. Ebonestos, Phone, London.
Ecco Battery Co., Ltd., Ecco Works, Bow Common Lane, E.3. East 4904-5. Eccobatri, Bochurch, London.
Edge Radio, Ltd., Salop Street, Bolton, Lancs., Bolton 1942.
Edison Storage Battery Distributors, Ltd., Victoria House, Southampton Row, W.C.1. Holborn 6673-4. Accedison, Westcent. London. Accedison, London.
Edison Swan Electric Co., Ltd., 155, Charing Cross Road, W.C.2. Gerrard 8660. Windmill Brae, Aberdeen (Sub store operating from Dundee). 12, King Street, Belfast. 23-25, Constitution Hill, Birmingham. Central 6411. 32, Duke Street, Brighton. Brighton 2518. 63, Victoria Street, Bristol. Bristol 20161. 89-90, Frederick Street, Cardiff. Cardiff 3157-8. 47, Dawson Street, Dublin, C.2. Dublin 43581-2. Ediswan House, Bank Street, Dundee. Dundee 3129. 127, George Street, Edinburgh. Edinburgh 27231. 167A, St. Vincent Street, Glasgow, C.2. Central 1609. Ediswan House, School Street, Hull. Central 36823. 15-15A, Wellington Street, Leeds. Leeds 29634-5. 27, High-cross Street, Leicester. Leicester 58124-5. Ediswan House, Paradise Street (Sub store operating from Manchester), Liverpool. Central 2002. Lloyds House, Albert Square, Manchester, Blackfriars 4423-6. Wards Buildings, High Bridge, Newcastle. Central 27473-5. Goldsmith Street, Nottingham. Nottingham 42511-2. 9, Whimple Street, Plymouth (Sub store operating from Bristol). Mappin Buildings, Norfolk Street, Sheffield. Sheffield 22144. 24, High Street, Southampton. Southampton 6121-2 (Sub store operating from Bristol). 4, Nelson Street, Swansea (Sub store operating from Cardiff). Telegraphic address in each case: Ediswan, followed by name of town.
Edmonds, Ltd., G., Soho Hill Works, Birmingham, 19. Northern 0129. Reciprocal, Birmingham. 49, Gamage Building, London, E.C.1. Holborn 0128.
Efandem Co., Ltd., Fallings Park Works, Wolverhampton. Wolverhampton 31012-3. Efandem, Wolverhampton. 11, Fitzroy Square, W.1. Museum 2265.
Eldeco Radio Ltd., 62, Conduit Street, London, W.1. Regent 5119. 16-17, New Burlington Place, London, W.1.
Electric Depot, Ltd., Pritchett Street, Aston, Birmingham, 6. Aston Cross 1673.
Electric Lamp Service Co., Ltd., Stal House, Judd Street, King's Cross, London, W.C.1. Euston 1183.
Electric and Ordnance Accessories Co., Ltd., Havelock and Shelton Potteries, Hanley, Stoke-on-Trent. Hanley 2863. Eoa, Hanley.
Electrical Measuring Instruments Co., 55, Cardington Street, Hampstead Road, London, N.W.1. Museum 1042.
Electrical Ohms, Ltd., 6, Bridge Street, Glasgow. South 328.
Electrical and Radio Products (1931), Ltd. Empire Works, Salfords, Redhill. Horley 404-405. Ammeter, Horley.
Electrico, 97, George Street, Croydon. Croydon 2527.
Electrocet Radio Co., Poplar Road, Solihull, Birmingham. Solihull 0750. Electrocets, Solihull.
Electrocolour Products, Ltd., 20, Copthall Avenue, London, E.C.2. Metropolitan 3180.
Electromicro Mfg. Co., 34, Queen Street, Hammersmith, W.6. Chiswick 6235.
Electro-Dynamic Construction Co., Ltd., Devonshire Grove, S.E.15. New Cross 4972-5. Eledamic, Phone, London.
Electro-Technical Products Ltd., 77, Fortress Road, N.W.5. Gulliver 2166. Techproc Kentish London.
Ellin (Footprint Works), Ltd., Thos. R. Hollis Croft, Sheffield. Sheffield 22171. Footprint, Sheffield.
Elliott, E., 315, Summer Lane, Birmingham. Aston Cross 1156. Galalith, Birmingham.
Elliott Radio Mfg. Co., Ltd., 87, Senhouse Street, Maryport, Cumberland. Maryport 104. Elliott Radio, Maryport.
Elliotts, 33, Curzon Street, Maryport, Cumberland.
Ellison Insulations, Ltd., Wellhead Lane, Perry Barr, Birmingham 20. Birchfields 4554. Tufnol, Phone, Birmingham.
Elvy, C. L., 1, Dyott Street, Shaftesbury Avenue, London, W.C.1. Temple Bar 3791.
Emaree, Ltd., 29, High Street, Clapham, S.W.4. Macaulay 1925.
Emmott (Pawsons), Ltd., George, Wadsworth Mill, Oxenhope, near Keighley, Yorks. Haworth 14. Emmott, Oxenhope.
Enfield Cable Works, Ltd., Lincoln House, 296-302, High Holborn, W.C.1. Holborn 0591. Enfelcama, Phone, London.
Enfield Zinc Products, Ltd., 30, Newgate Street, E.C.1. City 6079. Penedoog London.
English Steel Corporation, Ltd., Vickers Works, Sheffield.
Eon Vacuum Wireless Co., 7, Pool Valley, Old Steine, Brighton. Brighton 5246.
Epoch Radio Mfg. Co., Ltd., Exmouth House, Exmouth Street, London, E.C.1. Clerk 6666.
Ercolani and Sons, E., 27, Claremont Road, London, E.17. Walthamstow 1252.
Ericsson Telephones, Ltd., 67-73, Kingsway, W.C.2. Holborn 3271. Works: Beeston, Notts.
Erie Resistor, Ltd., Waterloo Road, North Circular Road, London, N.W.2. Gladstone 2258.
Erinoid, Ltd., Lightpill Mill, Stroud, Glos., and 11-12, Finsbury Square, E.C.2. Stroud 239. Erinoid, Stroud.
Ernest Turner Electrical Instruments, Ltd., Chiltern Works, High Wycombe, Bucks. High Wycombe 301. Gorgeous, High Wycombe.
Essex Accumulator Co., Ltd., 499, Grove Green Road, London, E.11. Leytonstone 1749.
Eta Tool Co., Metcalf Street, Leicester. Leicester 5386. Eta Tool Co., 5386 Leicester.
Evac Ltd., Basil Street, Rusholme, Manchester. Rusholme 4637.
Ever Ready Co. (Gt. Britain), Ltd., Hercules Place, Holloway, N.7. Archway 3030. Eveready, Holway, London.
Everett, Edgcumbe and Co., Ltd., Colindale Works, Hendon, N.W.9. Colindale 6045. Evergendos, Hyde, London.
Evershed and Vignoles, Ltd., Acton Lane Works. Chiswick, W.4. Chiswick 1370. Dorothea, Chisk, London.
Evington Electrical Mfg. Co., 5, Beckingham Road, Leicester. Leicester 59221. Evington Electric, Leicester.
E.M.G. Hand Made Gramophones, Ltd., 11 Grape Street, London, W.C.2. Temple Bar 7166.

## MANUFACTURERS' SECTION

# F

Fairfield Mfg. Co., 20, Laurel Road, Liverpool. Anfield 1848.
Fallowfield, Ltd., Jonathan, 61-62, Newman Street, W.1. Museum 8318. Fallowfield, Rath, London.
Faraday All-wave Wireless, 4, Holborn Place, W.C.1. Holborn 7709.
Fel-Electric Radio, Garden Street, Sheffield. Sheffield 20795.
Feldman, M. (Radio XXX Supplies), 58, Meanwood Road, Leeds. Leeds 23768.
Ferranti, Ltd., Hollinwood, Lancs. Failsworth 2000. Ferranti, Hollinwood. Bush House, London, W.C.2. Temple Bar 9325-6. Ferranti, Bush, London.
Film Industries, Ltd., 60, Paddington Street, W.1. Welbeck 2293-4. Troosound, Baker, London.
Finmar, Ltd., 44, Ranelagh Road, S.W.1.
Fletcher and Co., Ltd., H. J., 168-170, Shaftesbury Avenue, W.C.2. Temple Bar 8720. Dulciphone London.
Fluxite, Ltd., Dragon Works. Bermondsey Street, S.E.1. Hop 2632.
Forbat, E., 28-29, Southampton Street, W.C.2. Temple Bar 8608. Hyvoltstar, Rand, London.
Formo Products, Ltd., Masons Hill, Bromley, Kent. Ravensbourne 3379.
Fox Industrial, Ltd., 29, Dingley Place, City Road, E.C.1. Clerkenwell 6039.
Francis, Ltd., E. M., 36, Heathcote Grove, Chingford, E.4. Silverthorn 1355.
Francois, E. J., 89, Clerkenwell Road, E.C.1. Holb. 6055. Nosamfran, Smith, London. Nosamfran, London.
Franklin Electric Co., Ltd., 150, Charing Cross Road, London, W.C.2. Temple Bar 5833. Elecfranko, Westcent, London. Elecfranko, London.
Fraser and Glass, Assembly Works, Woodside Lane, Finchley, N.12.
Freed, S. R. F., 66, Hatton Garden, E.C.1. Chancery 8433. Arthoshel Smith, London.
Fry's (London), Ltd., 24-25, King Street, London, E.1. Royal 6152-3. Fryonia, Ald, London.
Fuller Accumulator Co., (1926), Ltd., Woodland Works, Grove Road, Chadwell Heath. Seven Kings 1200. Fuller, Chadwell Heath. 48, Gt. Charles Street, Birmingham. 53A, Back George Street, Princess Street, Manchester. 50A, Woodhouse Lane, Leeds. 13, Cumberland Street, Bristol. 10-11, St. Helens Road, Swansea.
F.W.F. and Son., White Lund, Morecambe. Morecambe 803.

# G

Gale, A. E., 16, Archer Street, W.1. Gerrard 7851.
Gambrell Bros. and Co., Ltd., Merton Road, Southfields, London, S.W.18. Putney 3641-2.
Garrard Engineering and Manufacturing Co., Ltd., Newcastle Street, Swindon. Swindon 534-5. Garrard, Swindon.
Gee (Birmingham), Ltd., 249-250, Icknield Street, Birmingham. Northern 1232.
Geipel, Wm., Ltd., 156, Bermondsey Street, London, S.E.1. Hop 0594. Perivale Lane, Wembley, Middlesex. Perivale 2814. 132, Spital Lane, Chesterfield. 48, Guildhall Buildings, Navigation Street, Birmingham. Rosecliff, Victoria Park, Liverpool 15. Exchange Buildings, Whitehead Street, South Shields. 30, Gordon Street, Glasgow. 172, Craigleith Road, Edinburgh, 136, Sommerville Road, St. Andrews Park, Bristol 6. 3, Balbec Avenue, Headingley, Leeds.
General Electric Co., Ltd., Magnet House, Kingsway, W.C.2. Temple Bar 8000. Electricity, Westcent, London. Polyphase, London.
General Inductance Co., 28-34, Fortess Road, N.W.5. Gulliver 1338.
General Mouldings Co., Ltd., Nelson Street Works, Mornington Crescent, N.W. Museum 8666. Genmolding Norwest, London.
Gent and Co., Ltd., Faraday Works, Leicester. Leicester 24151. Gents, Leicester. 47, Victoria Street, London, S.W.1. Victoria 2655. Tangent House, Leazes Park Road, Newcastle-on Tyne 2. Newcastle 20135.
Giffens (London) Ltd., 373, Edgware Road, London, W.2. Paddington 6038. Whizgif, Padd, London.
Gilbert and Co., Ltd., C., Arundel Street, Sheffield. Sheffield 21244. Gilrad, Sheffield. Pall Mall, Hanley. South Street, Hull. St. Mary's Place, Newcastle-on-Tyne. 174, Cleethorpe Road, Grimsby. 9, Venn Street, Huddersfield. 10, Gillygate, York. 179-181, Huntingdon Street, Nottingham.
Goldman Products, 7, Cambridge Avenue, Kilburn, N.W.6.
Goodman Gear and Electrical Co., 82, Bath Street. City Road, London, E.C.1. Clerkenwell 2422.
Goodmans (Clerkenwell), Ltd., Broad Yard Works, Turnmill Street, Clerkenwell, London, E.C 1. Clerkenwell 3838.
Gordon, Fredk. J., and Co., Ltd., 114-116, Euston Road, N.W.1. Euston 1688. Normalcy, Norwest, London.
Goulden, Ltd., H. J., 36, 39, 40, High Street, Canterbury. Canterbury 139. Goulden's, Canterbury.
Graham and Co., R. F., Norbiton Engineering Works, 45 and 47, Cambridge Road, Kingston.
Graham Farish, Ltd., 153, Masons Hill, Bromley, Kent. Ravensbourne 3377-8. Grafar, Bromley.
Gramophone Co., Ltd., 98-108, Clerkenwell Road, London, E.C.1. Clerkenwell 3426. Jabberment, Telex, London. Factories: Hayes, Middlesex. Southall 2468.
Grampian Reproducers, Ltd., Kew Gardens, Surrey. Richmond 3610.
Grayson and Co., Campo Lane, Sheffield. Sheffield 20703 and 70679. Grayson 20703, Sheffield. 146, Bishopsgate, E.C.2.
Greatrex and Co., R. G., Ballards Works, 123-125, High Street, Edgware. Edgware 2813.
Green and Faulconbridge, Ltd., 11, Queen's Road, Coventry. Coventry 3543.
Green and Co., George, Gee Gee Works, Chapel Road, S.E.27.
Greengate and Irwell Rubber Co., Ltd., Greengate, Salford, Manchester. Blackfriars 5652 Sincolor, Manchester.
Greenman, Ltd., S., 280-282, Old Street, E.C.1. Bishopsgate 4474.
Gresley Radio, Ltd., Ordsall Lane, Salford 5, Manchester. Blackfriars 6961.
Gre-Solvent Co., Leeds. Leeds 27441. Perco, Leeds.
Gripso Co., 28, Victoria Street, S.W.1. Victoria 2433. Unmuzzled, Vic.
Grosvenor Electric Batteries, Ltd., Bowman's Place, Holloway, N.7. Archway 2285(2 lines). Works, Watford.
Grosvenor Works (Holloway), Ltd., 113, Cottenham Road, Holloway, London, N.19. Archway 1039.
Guillaume and Sons, Ltd., Riverside Needle Works, Alcester. Alcester 81. Guillaume, Alcester.
Guiterman and Co., Ltd., S., 35, Aldermanbury, E.C.2. Metropolitan 8074. Guiterman, Phone, London.

# H

Hacker and Sons, H., Perfecta Works, Ray Lea Road, Maidenhead, Berks. Maidenhead 1211.
Halcyon Radio Ltd., Valetta Road, Acton, W.3. Shepherds Bush, 4501.
Halford Radio, Ltd., 39, Sackville Street, London, W.1. Regent 7136-7. Julhalford, London. 137, Regent Street, W.1.
Halson Radio Co., Ltd., 36A, Bruton Place, W.1. Mayfair 3425. Rockbound, Wesdo, London.
Hambling and Co., A. W., 26, Charing Cross Road, London, W.C.2. Temple Bar 4704.

Harken Electrical Co., Ltd., 18A, South End, Croydon. Fairfield 4772. Harken, Croydon.
Harlie, Ltd., Balham Road, Lower Edmonton, N.9. Tottenham 4372.
Harmony Electrix Ltd., 226, Cowley Road, Oxford.
Harris, G. and R., Anderton's Square, Whittall Street, Birmingham. Central 3215.
Harrison, A. T., and Co., Kintore Works, Grange Road, Bermondsey, S.E.1. Bermondsey 1155.
Harrison and Norris, Radio House, 75, Parade, Leamington Spa. Leamington Spa 279. 51, Bedford Street, Leamington Spa.
Hart Bros. Electrical Mfg. Co., Ltd., Queensway, Ponders End, Middlesex. Enfield 1880-1. Harbros, Enfield.
Hart, Collins, Ltd., 38A, Bessborough Street, Westminster, S.W.1. Gilboyding, Churton, London.
Hartley Turner Radio, Ltd., Thornbury Road, Isleworth, Middlesex. Hounslow 1854.
Haslam and Newton, Ltd. (formerly Newton Bros. (Derby), Ltd.), Alfreton Road, Derby. Derby 777. Dynamo Derby. Dynamo, Derby, England.
Havenhand, Lewis and Co., Kingsley Works, Young Street, Sheffield. Sheffield 23788.
Haynes Radio, Queensway, Enfield, Middlesex. Enfield 2726.
Healey, Ltd., P., 239-241, Gt. King Street, Birmingham. North 1835. Perceal.
Healey Mouldings, Ltd., 109, Gt. Hampton Row, Birmingham. Northern 2641. Perceal.
Heayberd and Co., F. C., 10, Finsbury Street, E.C.2. Metropolitan 7516-7. Heayberd, Finsquare, London.
Hellesens, Ltd., Hellesen Works, Morden Road, S. Wimbledon, London, S.W.19. Liberty 2404. Hellesens, Toot, London.
Henderson and Co., D. M., Ltd., 45, Hatton Garden, E.C.1. Holborn 6874. Wedgeful, Smith, London. Wedgeful, London.
Henry Ford Radio, Ltd., 56, Howland Street, W.1. Museum 5675.
Hewitt, A. J., Ltd., South Street, Greenwich, S.E.10. Greenwich 2242.
Hicking, H. B., 37, Station Approach Hayes, Kent. Hurstway 1267. Hicking, Hayes, Kent.
Higgs Motors, Ltd., Witton, Birmingham 6, Birchfields 4545. Higswiton, Birmingham. 6, Dudley House, Southampton Street, Strand, London, W.C.2. Temple Bar 4616, 47, Corporation Street, Manchester 4, Blackfriars 8800. 74, York Street, Glasgow, C.2. Central 5863. 7, Unity Street, College Green, Bristol 2. Bristol 24902. 37, Silver Wood Road, Peterborough. Peterborough 2445. The Crescent, Holy Moorside, Chesterfield. Holymoorside 17. Eildon, Moorside North, Newcastle-on-Tyne 4. Newcastle 34081. 18, Bedford Street, Belfast. Belfast 1645.
High Vacuum Valve Co., Ltd., 113-117, Farringdon Road, London, E.C.1. Clerkenwell 7587 and 8064. Hivac Smith, London. Hivac, London.
Hildick and Hildick, Walsall Tube Works, Pleck Road, Walsall. Walsall 2123. Hildick. 'Phone, Walsall.
Hilger, Ltd., Adam, 98, Kings Road, London, N.W.1. Gulliver 5426. Sphericity, Phone, London. Sphericity, London.
Hill and Co., Ltd., F. C., 17, Bilston Street, Wolverhampton. Wolverhampton 22259.
Holmes Bros. (London), Ltd., Holbro Works, Billet Road, Walthamstow, E.17. Larkswood 1086. Dogfish, Phone, London. Dogfish, London.
Hounslow and Co., C., 96A, Coleridge Street, Hove. Hove 4878. Hovoware, Phone, Hove.
Howard, Butler, Ltd., Crown Works, Lincoln Road, Walsall. Walsall 4085. Instrument, Walsall.
Hudson Record Co., 171, Wardour Street, W.1. Gerrard 1815. Musicall, Rath, London.
Hyatt and Co., Ltd., J., Ento Works, De Beauvoir Road, London, N.1. Clissold 7635-6.
H.S.P. Wireless Co., Langford Works, Weston-super-Mare. Weston-super-Mare 620. H.S.P. Wireless, Weston-super-Mare.

## I

Igranic Electric Co., Ltd., 149, Queen Victoria Street, E.C.4. Central 7123. Igranic, London. 73-74, Exchange Bldgs. B'ham. 1, Small Street, Bristol. 50, Wellington Street, Glasgow. Standard Buildings, Leeds. 30, Cross Street, Manchester. 90, Pilgrim Street, Newcastle.
Imp Radio Co., 58, Bousefield Road, New Cross, London, S.E.14. New Cross 3949. Imperial Works, Edith Road, S.E.15.
Impex Electrical, Ltd., 47, Victoria Street, Westminster, London, S.W.1. Victoria 3914. Darlolect, Sowest, London.
Incorporated Radio Society of Great Britain, 53, Victoria Street, S.W.1. Victoria 4412.
Insulators, Ltd., Leopold Road, Edmonton, London, N.18. Tottenham 4256.
Ioco Rubber and Waterproofing Co., Ltd. Netherton Works, Anniesland, Glasgow, W.3. Scotstoun 2201.
Ionic Alkaline Batteries, Ltd., 26, High Street, Stratford, London, E.15. Maryland 3291.
Itonia, Ltd., 58, City Road, E.C.1. Clerkenwell 2031. Overturish, Finsquare, London. 44, Wellington Street, Leeds. Leeds 30081-2. Overturish, Leeds. 17, Commercial Road, Portsmouth. Portsmouth 2411-2. Overturish, Portsmouth. 20, Rose Lane, Canterbury. Canterbury 1040. Overturish, Canterbury. 56, Rose Street, Edinburgh. Edinburgh 24064. Overturish, Edinburgh. 15, Ellison Place, Newcastle-on-Tyne. Newcastle 23381.
Ivory Electric, Ltd., 18, Noel Street, London, W1. Gerrard 2378.
I.M.S. Radio Co., 29, Lattimore Road, St. Albans Herts. St. Albans 1350.

## J

Jackson Bros. (London), Ltd., 72, St. Thomas Street, S.E.1. Hop 1837. Walfilco, Boro', London. 47, Pershore Street, Birmingham. Central 7794. Lymington Garage, Lymington Road, Torquay. Torquay 7592. 12, Victoria Street, Bristol. Bristol 2230. 113, St. Vincent Street, Glasgow. Central 6447. 47, Fleet Street, Dublin. Dublin 21760.
Jeacocks, 14, Gloucester Street, Clerkenwell, E.C.1. Clerkenwell 1725.
Jobling and Co., Ltd., J. A., Wear Glass Works, Sunderland. Sunderland 2882-3. Greener, Sunderland.
Johnson, Mathey and Co., Ltd., 78, Hatton Garden, E.C.1. Holborn 6989. 71, Victoria Street, Birmingham. Central 6726.
Johnson and Phillips, Ltd., Charlton, London, S.E.7. Greenwich 0400. Juno, London.
Johnson, W., Radio Corner, Esplanade, Lerwick, Shetland, N.B. Lerwick 130. Johnson, Radio Corner, Lerwick.
Jones and Sons, Ltd., William, Cecil Street Foundry, Birmingham. Aston Cross 5203-4. Malleable, Birmingham.
Joseph, H., 33, Percy Street, W.1. Museum 7634. Lockabinet, Rath, London.

## K

Kadette, Ltd., 21, Northumberland Avenue, London, W.C.2. Museum 2330. Duetteit, Estrand, London.
Kay Brothers, Ltd., St. Petersgate, Stockport. Stockport 2247. Kay, Stockport.
Kemp's Vulcanizing Co., Ltd., 50, 52 and 69, Hardman Street, Manchester. Blackfriars 4652. Kempoleum, Manchester.
Kent Bros.' Electric Wire Co. and E. H. Phillips, Ltd., Kew Works, Mortlake Road, Kew Gardens, Surrey. Prospect 1032-3. Encosil, Richmond, Surrey.
Kenwell Radio, Ltd., 15-29, Windsor Street, Essex Road, N.1. Clerkenwell 5746. Urocordmer, Nordo, London.
Kingsway Radio Ltd., 3-9, Dane Street, High Holborn, W.C.1. Holborn 9030.

## MANUFACTURERS' SECTION

Kniveton Cable Works, Ltd., Queensway, Ponders End, Middlesex. Enfield 3452.
Kolster-Brandes, Ltd., Cray Works, Sidcup, Kent. Sidcup 1188. Kolster, Phone, Sidcup. Matchtone, Sidcup. 163-165, Gt. Portland Street, London, W.1. Welbeck 3511.

# L

Laker Co., Ltd., J. and J., Kent House Road, Beckenham, Kent. Sydenham 3721. Lakerco, Beckenham. Jaylakerco, London.
Lampex Radio and Electric Co., Phantom Hse., 62, Brewery Road, Islington, London, N.7. North 1644.
Lamplugh Radio, Ltd., Silver Ghost Works, Northfield Road, Coventry. Coventry 2864. Silghost, Coventry.
Lancashire Dynamo and Crypto, Ltd., Trafford Park, Manchester. Trafford Park 2161–2166. Ironclad, Manchester. Acton Lane, London, N.W.10 Willesden 6363. And at Birmingham, Leeds, Nottingham, Sheffield.
Lathwood, J., 3, Maidstone Road, Bowes Park, N.11. Bowes Park 3246.
Lavino (London), Ltd., 48, Fenchurch Street, London, E.C.3. Royal 6623.
Lawrence, Percy Harold, 38, Market Street, and Aldergate, Tamworth. Tamworth 70. Lawrence, Tamworth.
Le Carbone Co., Ltd., Spencer House, South Place, E.C.3. National 4536. Lacombe, Ave, London. Battery Works, Portslade, Sussex.
Lechner and Co., Ltd., F. W. 61, Spencer Street, London, E.C.1. Clerkenwell 8638.
Lectro Linx, Ltd., 79A, Rochester Row, S.W.1. Victoria 3541–2, Victoria 3516. Trolinx, Sowest, London. Trolinx, London.
Lehmann, Archer and Lane, Ltd., 5, Farringdon Road, E.C.1. Holb 7456 (3 lines). Tapsandles, London.
Leibovici, J., 7, Banner Street, Bunhill Row, London, E.C.1. Clerkenwell 6601.
Lesingham, F. L., 13, Victoria Street, S.W.1. Victoria 2919. Lesingham, Sowest, London.
Lilley and Son, Ltd., S., 80, Alcester Street, Birmingham. Midland 2385. Biron, Birmingham. Mid. 2385. Uneedus, Birmingham.
Line and Co., F., Old Mill Works, Birmingham. Central 5336. Linco.
Linolite, Ltd., 96, Victoria Street, London, S.W.1. Victoria 4840. Lytanclip, Sowest, London.
Lisenin Wireless Co., 66, Newman Street, London, W.1. Museum 3706. Posgrip, Rath, London.
Lissen, Ltd., Worple Road, Isleworth, Middlesex. Hounslow 2361 (16 lines). Lissenium, Phone, London. Lissenium London.
Lithanode Co., Ltd., 190, Queen's Road, Battersea. Macaulay 4541–2. Lithanode, Claproad, London.
Liverpool Radio Supplies, 64, Myrtle Street, Liverpool Royal 1567.
Lock, Ltd., W. and T., Bath. Weston, Bath 7234. Lock, Bath. 33, Percy Street, London, W.1. Museum 7634. Lockabinet, Rath, London.
Lockwood Casework Mfg. Co., 63, Longley Road, Harrow, Middlesex.
Loewe Radio Co., Ltd., Fountayne Road, Tottenham, N.15. Stamford Hill 3911. Loewerad, Southtot, London. Loewerad, London.
London Electric Wire Co. and Smiths, Ltd. Church Road, Leyton, E.10. Leytonstone 3636. (10 lines). Lewcos, Phone, London.
London Electric Clock Co., The, 90, Victoria Street, S.W.1. Victoria 1508.
London Electrical Co. (Sherborne Lane), Ltd., 1, Sherborne Lane, King William Street, London, E.C.4. Mansion House 6201-2-3. Electa, Phone, London. 35, Arch, Gt. Suffolk Street, S.E.1.
London Metal Warehouses, Ltd., 27, Victoria Street, Westminster, London, S.W.1. Vic. 3631–2. Stebraware, Sowest, London. Works and warehouse, Hill Street, Pocock Street, London, S.W.1. Hop 6992.
London and Provincial Factors, Ltd., 146, Theobald's Road, London, W.C.1. Holborn 3251–3. Wanie-Blade, Holb, London. 16, Withy Grove, Manchester. Blackfriars 4054. Wanie-Blade, Manchester.
London Radio Co. (Leeds), Ltd. 26, Queen's Arcade, Leeds. Leeds 24928. 41, Headrow, Leeds. 50, Saville Street, Hull. Hull 31171. 32, Bridge Street, Northampton. 59, Whitefriar Gate, Hull. Hull 31171.
Londona, Ltd., 66, Hatton Garden, E.C.1.
Lorival Mfg. Co. (1921), Ltd., Norwood Works. Southall, Middlesex. Southall 1014 (2 lines). Lorinsulor, Phone, Southall.
Lotus Radio (1933) Ltd., 105, Judd Street, London, W.C.1. Euston 1183. Arras Mills, Fitzgeorge Street, Collyhurst, Manchester.
Lucas, Ltd., J., Gt. King Street, Birmingham 19. Northern 5201. Lucas, Birmingham. 319, Regent Street, London, W.1. Langham 4311. Guidepost, Wesdo, London.
Lugton and Co., Ltd., 203, Old Street, London, E.C.1. Clerkenwell 0257. Maxitone, Finsquare, London. 161, Howard Street, Glasgow. Central 5602.
Lundberg and Sons, Ltd., A. P., 477-489, Liverpool Road, London, N.7. North 1746 and 3415. Lundberg, London.
Lyons, Ltd., Claude, 76, Oldhall Street, Liverpool. Central 4641. Minmetkem, Liverpool. 40, Buckingham Gate, Westminster, London, S.W.1. Victoria 7595. Minmetkem, Sowest, London.
L.P.S. Electrical Co., Ltd., Ealing Road, Alperton, Wembley. Perivale 5621. Engineyor, Phone, London.

# M

Macintosh Cable Co., Ltd., Derby. Derby 2306. Macintosh, Derby.
McLeod and McLeod, Ltd., 329, High Holborn, W.C.1, Chancery 8696-7. Macleodius, Holb, London. Macleodius, London.

McMichael Radio, Ltd., Wrexham Road, Slough, Bucks. Slough 441-2-3. Radiether, Slough. 179 and 265, Strand, London, W.C.2. Temple Bar 6988 and Holborn 2466.
McMillan and Co., J., 17, Surrey Street, Strand, W.C.2. Temple Bar 8250. Elektriken, London. Walsall.
Magnavox (Great Britain), Ltd., Brantwood Works, Tariff Road, Tottenham, N.17. Tottenham 1500. Benjalect, Tottlane, London. Benjalect, London.
Magnetic and Electrical Alloys, Ltd., Lancelot Road, Wembley, Middlesex. Wembley 4933. Magnetic, Wembley.
Mains Power Radio, Ltd., Broadway Works, Eastern Road, Romford, Essex. Romford 338.
Mains Radio Gramophones, Ltd., Vaughan Street, Bradford. Bradford 6795. Emmargee, Bradford.
Mains Radio Mfg. Co., 103A, Parchmore Road, Thornton Heath, Surrey. Livingstone 1164.
Maisner and Co., Ltd., E. H., 11, Osborne Terrace, Clapham Road, S.W.8 Reliance 2717. Maisner, Claproad, London.
Majestic Electric Co., Ltd., Majestic Works, Tariff Road, Tottenham, N.17. Tottenham 4461. Majestelec, Southtot, London.
Manor Works (Aston), Ltd., 58, Albert Road, Aston, Birmingham. Northern 0630. Manor Northern 0630.
Manuwares Co., 79, Lots Road, Chelsea.
Marconiphone Co., Ltd., Radio House, 210-212, Tottenham Court Road, London, W.1. Museum 4144. Marconifon, Rath, London. Registered office and factories, Hayes, Middlesex. Marconifon, Hayes, Middlesex. Southall 2468—Service Depots: 10, West Campbell Street. Glasgow Central 1109. Marconifon, Glasgow.—13, St. Andrew Lane, Trinity Street, Dublin. Dublin 22095. Radvalve, Dublin.
Marconi's Wireless Telegraph Co., Ltd., Electra House, Victoria Embankment, London, W.C.2. Temple Bar 4321. Expanse, Estrand.
Margolin, J. and A., 112 to 116, Old Street, E.C.1. Clerkenwell 1638.
Marks and Son, S., Oval Works, 57, James Street, N.W.1. Gulliver 1178. Metcrafts, Norwest, London.
Master Radio and Electrical Co., Ltd., 102-105, Shoe Lane, London, E.C.4. Central 2279.
Maul and Murphy, Ltd., 21-22, Chapel Street, Milton Street, E.C.2. National 2372. Centuplico, Barb, London.
Mavox Radio, Ltd., 21, Store Street, London, W.C.1. Museum 9228-9.
Mellow Tone Co., Ltd., The, 153, Holland Road, Kensington, London, W.14. Park 5489.
Meritus (Barnet), Ltd., 36, Wood Street, High Barnet, Herts. Barnet 3667.
Merrington Bros., Ltd., India Pavilion, Exhibition Grounds, Wembley. Wembley 3116.
Mervyn Sound and Vision Co., Ltd., 4, Holborn Place, London, W.C.1. Holborn 7709. All-wave, Holborn.
Metal Agencies Co., Ltd., Queen Square, Bristol. Bristol 21061. Themac, Bristol.
Metropolitan Lighting Co., Ltd., 25, Atlantic Road, S.W.9. Brixton 1535.
Meyer and Co., E., 66, Newman Street, London, W.1. Museum 3706.
Mica Mfg. Co., Ltd., Volta Works, Bromley, Kent. Ravensbourne 2829. Micamanu, London.
Micanite and Insulators Co., Ltd., Empire Works, Blackhorse Lane, Walthamstow, London, E.17. Larkswood 1044. Mytilite, Phone, London. 1, Mayland Road, Edgbaston, Birmingham. 94, Market Street, Manchester. 197, Bath Street, Glasgow, C.2.
Michell, P. C., 18, Nassau Street, W.1. Museum 6200.
Michelson Bros., Mark Lane Station Buildings, London, E.C.3. Royal 9056.
Microfuses, Ltd., 4, Charterhouse Buildings, Goswell Road, London, E.C.1. Clerkenwell 4049. Microfuses, Clerkenwell 4049.
Midgley-Harmer, Ltd., Dukes Road, Western Avenue, London, W.3. Acorn 3295. Trutone, Act, London.
Midland Electric Wire Co., Ltd., Lutterworth. Lutterworth 8. Conductors.

## MANUFACTURERS' SECTION

Midland Radio and Television Co., Stourbridge Road, Halesowen, Nr. Birmingham. Halesowen 1330. Midland Radio, Halesowen.
Mile End Radio Co., 358A, Commercial Road, Mile End Place, Portsmouth. Portsmouth 3233. Renown, Portsmouth.
Millards, 49/50, Twyfold Street, Caledonian Road, London, N.1. Terminus 4789.
Millet, J., 39, Farringdon Road, E.C.1. Holborn 0293 and 4299. Alembic, Smith, London.
Milnes Radio Co., Ltd., Victoria Works, Church Street, Bingley, Yorks. Bingley 500. Milnes Radio, Bingley.
Miscellaneous Trading Co., Ltd., 13-17, New Oxford Street, London, W.C.1. Holborn 4894.
Mobile Amplifiers, Ltd., 1, Balham High Road, S.W.12. Balham 1660.
Money Hicks, Ltd., 102-110, Hackford Road, S.W.9. Reliance 3124.
Moores and Co., J., Kings Works, Ravald Street, Salford 3, Lancs. Blackfriars 7618, Manchester.
Morleys, 115, Borough High Street, S.E.1.
Mortley, Sprague and Co., Ltd., Nelson Road, Tunbridge Wells. Tunbridge Wells 159.
Morton, Ltd., E. R., 11, Newman Street, W.1. Museum 6616.
Morton and Co., Ltd., R., Mappin Buildings, Norfolk Street, Sheffield. Sheffield 23905.
Mountford Rubber Co., Ltd., 13, Weaman Street, Birmingham. Central 1657. Nipples, Birmingham.
Muirhead and Co., Ltd., Elmers End, Beckenham, Kent. Beckenham 0041. Muirheads, Elmers End.
Mullard Radio Valve Co., Ltd., Nightingale Works, Nightingale Lane, Balham, S.W.12. New Road, Mitcham Junction, Surrey. (See also Mullard Wireless Service Co., Ltd.) Battersea 3368. Emvalco, Phone, London.
Mullard Wireless Service Co., Ltd., Mullard House, Charing Cross Road, W.C.2. Gerrard 7733. Radiovalve, Westcent, London.
Muller and Co. (England), Ltd., Sphinx Works, Chase Road, Park Royal, London, N.W.10. Willesden 7282-3.
Multitone Electric Co., Ltd., 95-8, White Lion Street, London, N.1. Terminus 5474-5. Multonelec, Isling, London.
Murphy Radio, Ltd., Broadwater Road, Welwyn Garden City, Herts. Welwyn Garden 800.
Musikon, Ltd., 17, Lisle Street, Leicester Square, London, W.C.2. Gerrard 4476.
M.C.L. and Repetition, Ltd., Pool Lane, Langley, Birmingham. Broadwell 1115. Karlyteko, Langley, Worcs.
M.O. Valve Co., Ltd., Osram Works, Brook Green, Hammersmith, W.6. Riverside 3431. Thermionic, Phone, London.

## N

National Radio Service Co., 15-16, Alfred Place, Tottenham Court Road, London, W.C.1. Museum 7651.
Needham and Brother, Ltd., C. E., Change Alley and Milk Street, Sheffield. Sheffield 21011. Pumps, Sheffield.
Neill and Co. (Sheffield), Ltd., James' Composite Steel Works, Sheffield 11. Sheffield 24371. Composite Phone.
Neutron (1927), Ltd., 54, Lamb's Conduit Street, London, W.C.1. Holborn 6455.
New London Electron Works, Ltd., East Ham, E.6. Grangewood 1408-9 and 1363. Stannum, London.
Nichols, Ltd., J. T., 542, Kingsland Road, London, E.8. Clissold 5464.
Nobel Chemical Finishes, Ltd., Slough, Bucks. Slough 528 (12 lines). Belco, Telex, Slough.
No-Mast Patent Aerial Co., 110, Singleton Avenue, Birkenhead.
Norma Technical Products, Ltd., Balfour House, 119-125, Finsbury Pavement, London, E.C.2. National 8838. Normaco Ave, London.
North Eastern Instrument Co., Durham Road, Low Fell, Gateshead-on-Tyne. Low Fell 76654. Instrument Co., Lowfell.
Northampton Plating Co., St. Giles Street, Northampton. Northampton 1804.
Northern Batteries, Ltd., Mitchell Street, Birtley, co. Durham. Birtley 76. Norbat, Birtley.
Novo Radio-Electric, Ltd., Novo House, 34, Lovaine Place, Newcastle-on-Tyne. Newcastle-on-Tyne 21126. Novorel, Newcastle-on-Tyne.
Nuvolion Electrics, Ltd., Meredith Yard, Park Crescent, Clapham Park Road, London, S.W.4. Macaulay 4294.
N.P. Electrical Co., 514, Alum Rock Road, Birmingham 8. East 1753.

## O

O'Brien, Ltd., T., Slater Street Factory, Liverpool. Royal 1398.
Octron, Ltd., Phœnix Works, Tyburn Road, Erdington, Birmingham. Erdington 1291. Octron, Birmingham. 7, Duke Street, Adelphi, London, W.C.2. Temple Bar 1693.
Oldham and Son, Ltd., Denton, near Manchester. Denton 2431. Oldhams, Denton. 40, Wicklow Street, King's Cross, London, W.C.1. Terminus 4446. Shurestart, Kincross, London.
Olympia Radio, Ltd., 49A, Shudehill, Manchester. Blackfriars 9128. Olympaphone.
Orion Lamps, Ltd., 72, Oxford Street, London, W.1. Museum 5053.
Ormond Engineering Co., Ltd., Ormond House, Rosebery Avenue, Clerkenwell, E.C.1. Clerkenwell 9334-6—9344-6. Ormondengi, Isling.
Orr Radio, Ltd., 79A, Parkhurst Road, London, N.7. North 3883.
Osborn (Woodworkers), Ltd., C., The Regent Works, Arlington Street, Islington, London, N.1. Clerkenwell 5095. 21, Essex Road, Islington, N.1. Clerkenwell 5634.
Osdur Mfg. Co., 26, Adam Street, London, W.1. Welbeck 2528.

## P

Page Car Radio, Ltd., 55, Windsor House, Victoria Street, London, S.W.1. Victoria 9739.
Parkes, L. E., London Bridge Works, Wembley Hill Estate, Wembley, Mddx. Wembley 3620.
Parlophone Co., Ltd., 102, Clerkenwell Road, London, E.C.1. Clerkenwell 7620. Parlocord, Telex, London.
Paroussi, E., 10, Featherstone Buildings, High Holborn, W.C.1. Chancery 7010. Chancery Phone 7010.
Parsonage, W. F., 104, Harrison Street, Bloxwich, near Walsall. 69, Gt. Hampton Street, Birmingham. Northern 0815.
Partridge and Mee, Ltd., 74, New Oxford Street, W.C.1. Museum 5070. Parmeko Works, Aylestone, Leicester.
Partridge, Wilson and Co., Ltd., Davenset Works, Evington Valley Road, Leicester. Leicester 24612. Davenset, Leicester. 21, Douglas Street, Glasgow. Central 8853.
Paull's Wireless Stores, 43, Caroline Street, Cardiff. 196, Dock Street, Newport, Mon. Cardiff 3092 and Newport 3379.
Peace, Henry, Ltd., Lloyd Street Works, Wednesbury, Staffs. Wednesbury 0082. Peace, Ltd., Wednesbury.
Pegasus, Ltd., Low Mills, Nussey Mill Lane, Lower Wortley, Leeds. Armley 38901.
Person and Son, L., 63, Shaftesbury Street, London, N.1. Clerkenwell 7139.
Peto and Radford (Props., Pritchett and Gold and E. P. S. Co., Ltd.), 50, Grosvenor Gardens, S.W.1. Sloane 3908. Concentration, Sowest, London. 29, Bury Street, Salford, Manchester. Blackfriars 5116. Concentration, Manchester. 158, Clyde Street, Glasgow. Central 4886. Dagenite, Glasgow.
Peto-Scott Co., Ltd., 77, City Road, E.C.1. Clerkenwell 9406. 62, High Holborn, W.C.1. Holborn 3248.

Philco Radio and Television Corporation of Great Britain, Ltd., Aintree Road, Perivale, Middlesex. Perivale 3344.
Philips Industrial (Philips Lamps, Ltd.), 145, Charing Cross Road, London, W.C.2. Gerrard 7777. Phildustry, Westcent, London.
Philips Lamps, Ltd., 145, Charing Cross Road, W.C.2. Gerrard 7777. Phillamps, Westcent, London; New Road, Mitcham Junction, Surrey. Mitcham 2081. Stafford Road, Waddon, Surrey; Fairfield 4191. 30, Handyside Arcade, Percy Street, Newcastle; Newcastle 21236-7. 14-16, Bridge Street, Manchester; Blackfriars 2261. 28, St. Paul's Street, Leeds; Leeds 29001-2-3. 28, Warser Gate, Nottingham; Nottingham 40581. 16, Temple Street, Bristol; Bristol 20307. 55, Cornwall Street, Birmingham; Central 7201-2-3. 26, Bothwell Street, Glasgow; Central 4302. Victoria Buildings, Tithebarn Street, Liverpool; Central 4584. 3, Lower Abbey Street, Dublin; 44357.
Phœnix Telephone and Electric Works, Ltd., The Hyde, Edgware Road, London, N.W.9. Colindale 6243. Phonofenix, London. 66, Victoria Street, London, S.W.1. Victoria 1931. Cystermeta, Phone, London.
Pickett's Cabinets, Albion Road, Bexleyheath. Bexleyheath 194.
Pioneer Mfg. Co., Cromwell House, Fulwood Place, London, W.C.1. Chancery 7054. Pioneer, Jamarker, London.
Pix Valves, Ltd., Pix House, 118, Southwark Street, London, S.E.1. Hop 1001. Hop1001, London.
Plessey Co., Ltd., Vicarage Lane, Ilford. Ilford 3040. Plessey, Ilford.
Plew Television, Ltd., Stafford Road, Waddon, Croydon. Fairfield 5191.
Plowden and Thompson, Ltd., Dial Glass Works, Stourbridge. Stourbridge 57243. Dial, Stourbridge.
Pohlmann and Son, Princess Street, Halifax, Yorks. Halifax 2872. Pohlmann 2872 Halifax.
Pollock and Co., Ltd., W. J., 79-81, Mortimer Street, W.1. Museum 2874.
Pomona Rubber Co., Openshaw Bridge Works, Manchester. East 0316. Pomrub.
Pooley, G. J., 25, Kenilworth Avenue, London, E.17.
Portable Gramophone Co., Ltd., Albion Works, Albion Street, London, N.1. Terminus 6864. Portogramo, Kincross.
Portadyne Radio, Ltd. (Whittingham, Smith and Co., Ltd.), Gorst Road, North Acton, N.W.10. Willesden 7541-2.
Portland Radio Co., Ltd., 222, Great Portland Street, London, W.1. Museum 1023.
Postlethwaite Bros., Kinver Works, Kinver, Stourbridge. Kinver 68.
Powertone Products, 102, Cromer Street, London, W.C.1. Terminus 6184.
Precision Electric, Ltd., 21-23, St. Paul's Square, Birmingham 3. Central 4031.
Prideaux, Junr., Ralph, 101, Hatton Garden, E.C.1. Holborn 6244.
Primus Mfg. Co., Primus House, Willow Street, E.C.2. Bishopsgate 5681. Aatsolo, London.
Provincial Incandescent Fittings Co., Ltd. (Pifco, Ltd.), Pifco House, Shudehill, Manchester. City 4044 and 0831. Provencal, Manchester. 150, Charing Cross Road, London, W.C.1. Temple Bar 3720. Pifco, Westcent, London.
Public Address Corporation, Ltd., 167, City Road, London, E.C.1. Clerkenwell 4520.
Pullin and Co., Ltd., R. B., Phœnix Works, Seaford Road, W.13. Ealing 6231. Pullinco, London.
Pye Radio, Ltd. Radio Works, Cambridge. Cambridge 3434. Pyrad, Cambridge. Sales Organisation: Africa House, Kingsway, London, W.C.2. Holborn 5384. Pyradlim, Westcent, London.

## Q

Quartz Crystal Co., 63A and 71, Kingston Road, New Malden, Surrey. Malden 0671.

## R

Radiamp Co., Ltd., Orchard Works, Farningham Road, Tottenham, London, N.17. Tottenham 2157.
Radio Development Co., Aldwych House, Aldwych, London, W.C.2. Holborn 9111.
Radio Furniture and Fittings, Ltd., 102, Wembley Hill Road, Wembley, N.W.10. Wembley 1443.
Radio Gramophone Development Co., Ltd., 18-20, Frederick Street, Birmingham. Central 6272. Gramorad. 40, Doughty Street, London, W.C. Holborn 7360. 17, Bridge Street, Manchester. Blackfriars 1951.
Radio and Gramophone Trades Guardian Association, Ltd., The, 78, New Oxford Street, London, W.C.1. Museum 5904. Radguardio, Westcent, London.
Radio Instruments, Ltd., Purley Way, Croydon. Thornton Heath 3211. Instradio, Croydon.
Radio Mfrs. Association, The, Astor House, Aldwych, W.C.2. Holborn 3346-7. Oldarion, Estrand, London.
Radio Manufacturing Co., Epsom Road, Morden, Surrey. Mitcham 0860.
Radio Reconstruction Co., Ltd., 33-37, Alfred Place, W.C.1. Museum 7740.
Radio Resistor Co., 1, Golden Square, Piccadilly, London, W.1. Gerrard 7291.
Radio Service Co., 21A, Bridge Street, Itchen, Southampton. Woolston 88429.
Radioformer Ltd., York Works, York Avenue, Browning Street, London, S.E.17. Rodney 3573.
Radiomobile Ltd., 16-18, South Bruton Mews, New Bond Street, W.1. Mayfair 3893 and 4737 (3 lines). Radiomobile, Wesdo, London.
Radiomonic, Ltd., 23A, White Street, Moorgate, London, E.C.2. Met. 0992. Radinenta, London. Works, Enfield.
Radiovox Wireless Services, Ltd., 48, Gt. George Street, Leeds 1. Phone 23804. Radiovox 23804, Leeds.
Ramaco Radio Services, 21-23, St. Paul's Square, Birmingham 3. Central 4031.
Ramsey, F. W., 63, Shaftesbury Street, New North Road, N.1. Clerkenwell 7139.
Rawlplug Co., Ltd., Rawlplug House, Cromwell Road, London, S.W.7. Frobisher 8111 (10 lines). Rawlplug, Southkens, London.
Rawson (Sheffield and London), Ltd., H. C., 100, London Road, Sheffield. Sheffield 26006. Hardware, Sheffield. 37-9, Clyde Place, Glasgow, C.5. South 1289. 22, St. Mary's Parsonage, Manchester. Blackfriars 4229. 177, Westgate Road, Newcastle, 1. Newcastle 23868. 45, Spring Bank, Hull. Hull 35215. Maysonia House, Haymarket, Bristol. Bristol 23703.
Ray Engineering Co., Ltd., Waterdale Works, Southmead, Bristol. Westbury-on-Trym 66074. Ray, Southmead Bristol.
Record Radio, Ltd., 2-3, Eldon Street, London, E.C.2. Bishopsgate 1301. Radorecord, Ave, London.
Redfern's Rubber Works, Ltd., Hyde, Cheshire. Hyde 622. Rubbers, Hyde. 212, Gt. Portland Street, London, W.1. Museum 0381. Berrub, Wesdo. 7, Albion Street, Leeds. Leeds 22166.
Regent Fittings Co., 120, Old Street, London, E.C.1. Clerkenwell 2923.
Regent Investment Sales Ltd., Cobbold Road, N.W.10. Willesden 5331.
Regentone, Ltd., Worton Road, Isleworth, Middlesex. Hounslow 1171.
Regent Radio Supply Co., Worton Road, Isleworth, Middlesex. Hounslow 1171.
Reliance Electrical Wire Co., Ltd., Staffa Road, Leyton, E.10. Leytonstone 2214.
Reliance Manufacturing Co. (Southwark), Ltd., Westbury Works, Westbury Road, Walthamstow, London, E.17. Walthamstow 0235.
Remax Cables, 3-6, Alfred Place, London, W.1. Museum 6512. Remaxity, Westcent, London.
Reproducers and Amplifiers, Ltd. (R & A), Frederick Street, Wolverhampton. Wolverhampton 22241. Audio, Wolverhampton.
Rex Gramophone Co., Ltd., 32, Queen Victoria Street, London, E.C.4. City 3759.

## MANUFACTURERS' SECTION.

Rich and Bundy, Ltd., New Road, Ponders End. Middlesex. Enfield 0777.
Righton and Co., Ltd., Henry, 218, Pentonville Road, King's Cross, N.1. North 5213-4-5. Balfourite, London.
Riley and Son, Wm., 51, Farringdon Road, London, E.C.1. Holborn 8180.
Riley and Sons, Ltd., John. Hapton, Near Burnley. Padiham 290-1. Rileys, Hapton.
Ripaults, Ltd., King's Road, N.W.1. North 4374. Ripault, Norwest, London. Ripault, London.
Rist (1927) Ltd., A., Waveney Works, Lowestoft. Lowestoft 484. Rist, Lowestoft. 45, Grafton Street, Tottenham Court Road, London, W.1. Museum 8731.
Roberts, J., 1-3, Bridgwater Viaduct, Knot Mill, Manchester. Blackfriars 1837-8. 14, Wellington Road South, Stockport. Stockport 3761.
Robinson and Co., Ltd., Lionel, 3, Staple Inn, W.C.1. Holb. 6322. Ferrydom, Holb, London.
Roladisc Co., The, 134a, Kingsland Road, E.2. Bishopsgate 3062.
Romac Motor Accessories, Ltd., Romac Works, The Hyde, Edgware Road, N.W.9. Colindale 6055-9. Strength, Hyde, London.
Ronnie Engineering Co., Crewdson Road, London, S.W.9. Reliance 2809.
Rose, Morris and Co., Ltd., 57, City Road, E.C.1. Clerk. 5377.
Ross, Courtney and Co., Ltd., Ashbrook Road, Holloway, N.19. Archway 1166. Homonyms, Holway, London.
Rotax, Ltd., 319, Regent Street, London, W.1. Langham 4311. Guidepost, Wesdo, London. Willesden Junction, London, N.W.10. Willesden 2480. Rodynalite, Willesden.
Rothermel, Ltd., R. A., Rothermel House, Canterbury Road, Kilburn, N.W.6. Maida Vale 6066.
Rotor Electric, Ltd., 1, Robert Street, Hampstead Road, N.W.1. 'Phone and telegrams : Museum 2641.
Ruhl (1922), Ltd., O., 15-29, Windsor Street, Essex Road, London, N.1. Clerkenwell 5746. Unocordmer, Nordo, London.
Runbaken Magneto Co., Ltd., 280, Deansgate, Manchester. Blackfriars 5515. Runbaken, Deansgate, Manchester.
R.A.P., Ltd., Ferry Works, Thames Ditton, Surrey. Emerbrook 2453-4.
R.C. and Wilson Electric, Ltd., 51, Whitcomb Street, London, W.C.1. Whitehall 8876-7. Loudsigs, Lesquare, London.
R.M. Radio, Ltd., 11, Garrick Street, W.C.2. Temple Bar 3721. Arremmarad, Les Sq., London. Arremmarad, London.

## S

St. Helens Cable and Rubber Co., Ltd., Trading Estate, Slough, Bucks. Slough 333. St. Helens, Slough. Branch offices and stores : 70-71, Petty France, London, S.W.1. Franklin 6181-2 ; King Alfred's Place, Broad Street, Birmingham. Midland 2102 ; 30, Wood Street, Deansgate, Manchester. Blackfriars 8004 ; 45, Hope Street, Glasgow. Central 566 ; 50, Charles Street, Cardiff. Central 5500 ; 11, College Street North, Belfast. Belfast 663 ; 91, Thornton Road, Bradford. Bradford 2286 ; 37, Moorfields, Liverpool. Central 1138 ; 1A, St. James Street, Okehampton. Okehampton 93.
Salford Electrical Instruments, Ltd., Peel Works, Silk Street, Salford, 3. Blackfriars 8888 ; Sparkless, Salford. Magnet House, Kingsway, W.C.2.
Salisbury Transformer and Electrical Co., Devizes Road, Salisbury.
Sankey and Sons, Ltd., Joseph, 168, Regent Street, W.1. Regent 2748. Permeable, London.
Savage, W. B., 56, Clerkenwell Road, London, E.C.2. Clerkenwell 3068. Compaminex, London.
Saxon Radio Co., Henry Street Works, South Shore, Blackpool. Blackpool 1894.
Saxonia Electrical Wire Co., Ltd., Roan Works, Greenwich, S.E.10. Greenwich 0463 and 1672. Saxonist, London.
Scientific Supply Stores (Wireless), Ltd., 126, Newington Causeway, London, S.E.1. Hop 4177.
Scott, A. C., and Co., Ltd., 39, City Road, Manchester, 15. City 9235. Cromaloy.
Scott, Geo. L., and Co., Ltd., Waddon Factory Estate, Croydon, Surrey. Fairfield 5533. Steelhead, Croydon.
Scott Insulated Wire Co., Ltd., Queensland Road, N.7. North 3408-9. Silcotenam, London.
Scott and Co., S. W., 110, Lothian Road, S.W.9. Reliance 2504. 31-31a, Elliott Road, Brixton, S.W.9.
Scott, Sessions and Co., G., Muswell Hill, N.10. Tudor 4101 (two lines). Tropiset, London. (Cables only.)
Segal (Furniture), Ltd., R., 85, Crowlands Road, N.15. Stamford Hill 2864. Segphonic, Southtot, London.
Selecta Gramophones, Ltd., 81, Southwark Street, S.E.1. Hop 6671.
Service Equipment Co., Ltd, 99, Albion Street, Leeds. Leeds 20595-6.
Shalless and Evans, Ltd., Haverlock Street, Forest Hill, S.E.23. Sydenham 1121-2.
Sharplin, W. J., Ltd., Middle Lane Works, Hornsey, London, N.8. Mountview 0952. Nilpras, Crouchway, London.
Shearing, A. E., Albion Works, Lampeter Street, London, N.1. Clissold 4732.
Siemens Electric Lamps and Supplies, Ltd., 38-9, Upper Thames Street, London, E.C.4. Central 2332 (13 lines). Siemotor, Cent., London.
Siemens Schuckert (Gt. Britain), Ltd., 30-34, New Bridge Street, E.C.4. Central 8461-2-3. Elefes, Lud, London.
Sifam Electrical Instrument Co., Ltd., York Works, Browning Street, London, S.E.17. Rodney 3573. Sifamafis, Sedist, London.
Sinclair Speakers, Ltd., 13, Vale Royal, York Road, London, N.7. North 2235-6.
Six-Sixty Radio Co., Ltd., Six-Sixty House, 17-18, Rathbone Place, Oxford Street, W.1. Museum 6116. Dullemitta, Westcent, London.
Slektun Products, Ltd., 21, Douglas Street, Vauxhall Bridge Road, S.W.1. Victoria 3406.
Small Power Dynamo and Motor Co., Ltd., Old Lane, Openshaw, Manchester 11. Droylesden 1135. Small Power, Higher Openshaw.
Smith and Sons (Motor Accessories), Ltd., S., Cricklewood Works, London, N.W.2. Gladstone 3333. Speedofac. Phone, London.
Smith's English Clocks, Ltd., Cricklewood Works, N.W.2. Gladstone 3333. Rightime, Phone London.
Smurthwaite, Ltd., F. W., Harmony Works, Ross Parade, Wallington, Surrey. Wallington 1982.
Sonochorde Reproducers, Ltd., Canterbury Road, Kilburn, N.W.6. Maida Vale 6066.
Sorbo, Ltd., Sorbo Works, Woking. Woking 966. Sorbo, Woking.
Sound Sales, Ltd., Tremlett Grove, London, N.19. Archway 1661.
Sparkes and Co., J., 119, Cheapside, London, E.C.2. National 6847.
Spicers, Ltd., 19, New Bridge Street, E.C.4. Central 4211. Nykoping, Lud, London.
Spong and Co., Ltd., 27, Braemar Road, South Tottenham, London, N.15. Stamford Hill 1770. Spongolia, Southtot, London.
Squire, Frederick, Ltd., Queen's Works, Leswin Place, Stoke Newington, N.16. Clissold 0334.
Stadium, Ltd., 75-77, Paul Street, Gt. Eastern Street, E.C.2. Clerkenwell 9321-2-3-4. Etiencimex, London.
Standard Telephones and Cables, Ltd., Connaught House, Aldwych, London, W.C.2. Holborn 8765. Relay, Estrand, London. Relay, London. St. Chad's Place, 364, Gray's Inn Road, London, W.C.1. Terminus 6255.
Stanton, T., 9, Lime Grove, London, E.9.
Static Condenser Co., 11, Eden Street, London, N.W.1. Museum 5534.

Stead and Co., Ltd., J., Manor Works, Sheffield. Sheffield 20512. Steadfast, Sheffield.
Stebbings, J. R., 6, Warwick Street, Piccadilly Circus, W.1. Gerrard 6702.
Sterno Manufacturing Co., Ltd., 19, City Road, London, E.C.1. National 5886.
Stilwell and Sons, 153, Far Gosford Street, Coventry. Coventry 2263.
Stockall, Marples and Co., Ltd., 6-10, Clerkenwell Road, London E.C.1. Clerkenwell 2781-64, Bridge Street, Deansgate, Manchester.
Stocko (Metal Works), Ltd., 26–28, Bartholomew Square, Old St., E.C.1. Clerkenwell 5479.
Stonehouse Radio Supplies, 54, Union Street, Stonehouse, Plymouth, Devon. Plymouth 2496.
Storrar and Balls, Reliance Works, Old Paradise Street, S.E.11. Reliance 2108.
Stratton and Co., Ltd., Eddystone Works, Bromsgrove Street, Birmingham. Midland 3768. Stratnoid, Birmingham.
Sturdy Electric Co., 1, Wesley Terrace, Dipton, Newcastle-on-Tyne. Dipton 21.
Sullivan, Ltd., H. W., Leo St., Peckham, S.E.15. New Cross 1702. Deadbeat, Peck, London.
Sunbeam Electric, Ltd., Park Royal Road, N. Acton, London. Willesden 1575, Sunberad, Harles, London.
Supremus Specialities, Ltd., 118, High Street, Erdington, Birmingham. Erdington 1212. Supremus, Erdington, Birmingham.
Swift Levick and Sons, Ltd., Clarence Steel Works, Sheffield. Sheffield 20371. Levick, Sheffield.
Sylvex, Ltd., 144, Theobald's Road, W.C.1. Holborn 6456.
Synchronome Co., Ltd., 19, Caxton House, London, S.W.1. Whitehall 4157.
Synchrophone, Ltd., 24, Berners Street, W.1. Museum 4876 (3 lines) Synchro-phone, London. Works, Gashouse Lane, Hertford 156.

## T

Tannoy Products (Guy R. Fountain, Ltd.), Canterbury Grove, W. Norwood, S.E.27. Streatham 4122 (6 lines). 2, Whitworth Street West, Deansgate, Manchester. Central 6830. Riddells Arcade, Belfast. 119, George Street, Edinburgh. Edinburgh 21541.
Tarry's, 78, Wellingboro' Road, Northampton.
Taylor and Petters, Ltd., 3/11, Westmoreland Place, City Road, N.1. Clerkenwell 4105. Micaylor, London.
Taylor, Tunnicliff and Co., Ltd., 110, Cannon Street, E.C.4. Mansion House 7211.
Telegraph Condenser Co., Ltd., Wales Farm Road, Acton, W.3. Acorn 0061. Telefarad, Act, London.
Telephone Manufacturing Co., Ltd., Hollingsworth Works, Martell Road, S.E.21. Sydenham 7060. Bubastis, Norstow, London.
Television Instruments, Ltd., 323, City Road, London, E.C.1. Clerkenwell 4494. Quinintab, London.
Terry and Sons, Ltd., Herbert, Redditch. Redditch 61. Springs, Redditch.
Thibouville-Lamy and Co., J., 10 and 12, Charterhouse Street, E.C.1. Holborn 5042. Tibouvil, London.
Thomas, B., Worsley Street, Hulme, Manchester. Breaker, Manchester. 28, Victoria Street, S.W.1. Victoria 2737.
Thompson, Diamond and Butcher, 34, Farringdon Road, London, E.C.1. Clerkenwell 5492 (8 lines). Thomdibu, London. Factory: 22–3, Clerkenwell Close, E.C.1. 104, Bath Street, Glasgow, C.2. Douglas 1223. Thomdibu, Glasgow.
Three Star Accumulators, Ltd., Rosebery Avenue, N.17. Tottenham 2777-8. Threcetar, Southtott, London.
Time Recorder and Equipment Co., West Bank Works, Barking. Grangewood 0310. 24, Cotswold Road, Westcliff-on-Sea.
Tod, T. M., 13, Stonelaw Road, Rutherglen Rutherglen 502.
Toubkin, J., Faraday House, Todd Street, Manchester, 3. Blackfriars 9348 and 9349. Toubkin, Manchester. 130, High Holborn, W.C.1. Holborn 5997. Toubkin, London.
Trent Electric Wire Works, Ltd., 1, Dyott Street, Shaftesbury Avenue, W.C.2. Temple Bar 3791.
Triotron Radio Co., Ltd., 26, Bloomsbury Street, London, W.C.1. Museum 1908. Radiunited, Westcent.
Trix Electrical Co., Ltd., The, 8–9, Clerkenwell Green, London, E.C.1. Clerkenwell 3014–5. Trixadio, Smith, London. 50, Wellington Street, Glasgow. 5, Evans Terrace, Trealaw. Glam.
True Screws, Ltd., 99, Clerkenwell Road, E.C.1. Holborn 2618 and 9100. Truescrews, Holb, 2618.
Truphonic Radio (Putney) Ltd., Dryad Street and 27a, Bangalore Street, Putney, S.E.15. Putney 6451.
Truwind Products, Ltd., Idris Yard, Pratt Street, Camden Town, N.W.1. Euston 2161.
Tunewell Radio, Ltd., 54, Station Road, New Southgate, London, N.11. Palmers Green 0089.
Tungsram Electric Lamp Works (Great Britain), Ltd., 72, Oxford Street, W.1. Museum 5053. Tungselec, Rath, London.
Tungstalite, Ltd., Electric Lamp House, Farringdon Road, E.C.1. Holb. 2322. Tungslamp, Smith, London.
Tungstone Accumulator Co., Ltd., 3, St. Bride's House, Salisbury Square, E.C.4. Central 8156. Typify, Fleet, London. Dilutum, London.
Tyrela Electric, Ltd., 21/26, East Road, N.1. Clerkenwell 4871. Tylarad, Nordo, London.
Tyrela Gramophones, Ltd., 21/26, East Road, N.1. Clerkenwell 4871. Tylagramo, Nordo, London.
T.M.C.–Harwell (Sales) Ltd., Britannia House, 233, Shaftesbury Avenue, W.C.2. Temple Bar 0055 (3 lines). Arwelidite, Westcent. London.
T.X. Products Co., Ltd., 407, Lordship Lane, N.17. Tottenham 4640.

## U

Ultra Electric, Ltd., Ultra Works, Erskine Road, Chalk Farm, London, N.W.3. Primrose 3333. Radwaves, London.

Union Radio Co., Ltd., U.R. Works, Campbell Road, Croydon. Thornton Heath, 1533.
United Chemical Engraving Co., Ltd., Higham Place, Newcastle-on-Tyne. Newcastle 21938. Chemigrave, Newcastle-on-Tyne.
United Radio Manufacturers, Ltd., 79a, Parkhurst Road, London, N.7. North 3883.
Universal Electric Time and Telephone Systems, Ltd., Wellington Buildings, Strand, Liverpool.
Universal Gramophone and Radio Co., Ltd., Ryland Road, Kentish Town, London, N.W.5. Gulliver 1165-6-7. Unigramrad, Kentish, London.
Universal High Voltage Radio, Ltd., 28-9, Southampton Street, and 18, New Street, St. Martins Lane. London, W.C.2. Temple Bar 4985-8608. Hyvoltstar, Rand, London.
Univolt Electric, Ltd., 119-125, Finsbury Pavement, London, E.C.2. National 6828-9. Belrad, 'Phone, London.

## V

Van Raden and Co., Ltd., Coventry. Coventry 8644. Vanraden.
Vandervelde, L., 35, Minories, London, E.C.3. Royal 1261. Splittings, Ald., London.
Vandervell, Ltd., C. A., Well Street, Birmingham. Northern 5201.
Varley (proprietors, Oliver Pell Control, Ltd.) 103, Kingsway, W.C.2. Holborn 5303-5, Olipel, Phone, London. 12, Victoria Street, Bristol. Bristol 21230. 11, Bothwell Street, Glasgow. Central 4339. Market Lane, Pilgrim Street, Newcastle-on-Tyne. Newcastle 22096. 39, Blakesley Road, Yardley, Birmingham. Steckford 2514. 104, Overcliff Drive, Southbourne, Hants. Southbourne 318. 9, Clifton Road, Exeter.
Varsity Eliminator Co., Ltd., Tower Works, Old Town, Clapham, S.W.4. Macaulay 1858.
Vee Cee Dry Cell Co. (1927), Ltd., Northwold Road, Stoke Newington, N.16. Clissold 4646.
Venner Time Switches, Ltd., Kingston By-Pass Road, New Malden, Surrey. Cloxwiches, Phone, London.
Victor Battery Co., 15, Park Street, Islington, N.1. North 2161.
Voigt Patents, Ltd., The Courts, Silverdale, Sydenham, London, S.E.26. Sydenham 4114.
Vulco Dry Battery Co., Ltd., Vulco Works, Marlborough Road, London, N.19. Archway 1895. Vulcobatri.
V.G. Mfg. Co., Ltd., Gorst Road, Park Royal, London, N.W.10. Willesden 1632.

## W

Walvis Engineering Co., Ltd., Minerva Road, Chase Estate, Park Royal, London, N.W.10. Willesden 1585.
Walsall Electrical Co., Ltd., 61, Bridge Street, Walsall. Walsall 2045. Electrical, Walsall.
Walter, Ltd., J. and H., 31a, Farm Lane, Fulham, S.W.6. Fulham 5645.
Ward and Goldstone, Ltd., Frederick Road, Pendleton, Manchester. Pendleton 2442-6, Multum, Manchester. 5, Percy Street, London, W.1. Museum 8371. Akros, Rath, London. Upton's Yard, 49a, Briggate, Leeds. Leeds 26812. Multum, Leeds. 30, Blythswood Street, Glasgow, C.2. Central 6681. Faneeka, Glasgow.
Watmel Wireless Co., Ltd., Imperial Works, High Street, Edgware, Middlesex, Edgware 0323.
Watson, Saville and Co., Ltd., Bruce Steel Works, Mowbray Street, Sheffield. Sheffield 20266-7. Savico, Sheffield.
Webb Condenser Co., Ltd., 42, Hatton Garden, London, E.C.1. Holborn 2260. Webbconden, Smith, London.
Webber, Ltd., R. A., 8, Old King Street, Bristol. Bristol 23668. Webber, 23668, Bristol.
Weedon Power Link Radio Co., 80, Lonsdale Avenue, East Ham, London, E.6. Grangewood 1837.
Wego Condenser Co., Ltd., Bideford Avenue, Perivale, Middlesex. Perivale 2477 and 3891.
Wendell Mfg. Co., Abbey Road, Park Royal, N.W.10. Willesden 0300.
West, W. G., 3, Bedford Road, Clapham, S.W.4. Brixton 6182.
Westinghouse Brake and Saxby Signal Co., Ltd., 82, York Road, N.1. Terminus 6432. Westinghouse, Kincross, London. Westinghouse, London.
Westinghouse Electric International Co., 2, Norfolk Street, London, W.C.2. Temple Bar 3883. Wemcoexpo, Estrand, London.
Weston Electrical Instrument Co., Ltd., Kingston By-Pass, Surbiton, Surrey. Elmbridge 6400. Pivoted, Surbiton.
Wharfedale Wireless Works, 62, Leeds Road, Bradford. Bradford 4346. Wharfdel.
White Bros. and Jacobs, Ltd., 46, Chalk Farm Road, London, N.W.1. Gulliver 5146. Luminware, Camroad, London.
Whitelegg, F., 35, Union Road, London, S.E.16. Bermondsey 1264.
Whiteley Electrical Radio Co., Ltd., Victoria Street, Mansfield, Notts. Mansfield 762-3. Whitebon, Mansfield.
Wilday and Sons, John, Stanley Works, Bond Street, Birmingham. Central 1004.
Wilkins and Wright, Ltd., Utility Works, Holyhead Road, Birmingham. Northern 2974 5. Utility, Birmingham. 11, Newman Street, London, W.1. Museum 6616.
Wilkinson, L., 8, City Road, Finsbury Square, E.C.1. Metropolitan 7359.
Williams and Gray, Ltd., Paramount Works, 75, Villa Street, Birmingham. Northern 3727.
Williams and Moffat, Ltd., Ladypool Road, Sparkbrook, Birmingham. Vic. 0659. Taffom, Birmingham.
Willis and Co. (Meritus), Ltd., 46a, Caledonian Road, London, N.1. North 2853.
Willmott, Son and Phillips, Ltd., St. John's House, Minories, E.C.3. Royal 8051. Imagica, Ald., London.
Wilson, E., 46, Navigation Street, Wolverhampton. Wolverhampton 20969.
Wingrove and Rogers, Ltd., 188-9, Strand, W.C.2. Temple Bar 2244. Compounded, Estrand, London. Polar Works, Old Swan, Liverpool.
Wolf and Co., Ltd., S., 115, Southwark Street, S.E.1. Hop 2733. Widerstand, London.
Wood, L. R., Bridge Street, Cork, I.F.S. Cork 1581. 16, Duke Street, Dublin. Dublin 44479.
Woodhams, Dade and Co., 74, Great Tower Street, E.C.3. Mansion House 0712 (two lines). Woodade, London.
Wright and Weaire, Ltd., 740, High Road, Tottenham, N.17. Tottenham 3847-8-9. Writewea, Southtot, London. Writewea, London.
Wurlitzer Lyric Radio, Ltd., 33, King Street, London, W.C.2. Temple Bar 2231.
W.R.C., Ltd., Cobbold Road, London, N.W.10. Willesden 4534.

## Y

Yeldon (Radio), Ltd., 44, London Road, Portsmouth. Portsmouth 6005. Yeldons, Phone 6005, Portsmouth.
Young Accumulator Co. (1929), Ltd., Burlington Works, Arterial Road, New Malden, Surrey. Malden 1171-2-3. Youngacc, New Malden.

## Z

Zelco, Ltd., 53, Farringdon Road, E.C.1. Holborn 2053.
Zenith Electric Co., Ltd., Zenith Works, Villiers Road, Willesden Green, N.W.2. Willesden 4087-8. Voltaohm, Willroad, London.
Zetavox Radio and Television, Ltd., 3, Bayer Street, E.C.1. Clerkenwell 1157.

## MISCELLANEOUS.

362 Radio Valve Co., Ltd., Stoneham Road, Northwold Road, London, E.5. Clissold 1294.

# RADIO and RADIO-GRAMOPHONE WHOLESALERS

## A

Accessories (Edinburgh), Ltd., 4, Queensferry Street Lane, Edinburgh. Edinburgh 23107. Ignition. 18, Bank Street, Dundee. Dundee 6046. Magneto.

Albion Electric Stores, Albion House, New Station Street, Leeds. Leeds 20196/8. Filaments. Albion House. 15, Toll Street, Nottingham. Nottingham 42989.

Alger's Wholesale Supplies, Ltd., 160, Dock Street, Newport, Mon. Newport 2235, Alger, Newport.

Altham Radio Co., 25, Mosley Street, Manchester. Central 6427. Staportco, Manchester.

Anderson, Clark and Moir, Ltd., 34-36, Marsh Street, Bristol 1. Bristol 24337. 7, Torquay Road, Paignton, Paignton 57020.

Andrews and Co., A. E., 31, Tollington Park, London, N.4. Archway 1948.

Anglo Auto Accessories Co., Ltd., 11, Great Queen Street, W.C.2. Holborn 4464.

Appletons (Leeds), Ltd., Hanover Place, Leeds. Leeds 21694. 96, New Bridge Street, Newcastle 2. Newcastle 27651. Gramophones, Newcastle.

Arthurs (proprietors, Arthur Gray, Ltd.), 150, Charing Cross Road, London, W.C.2. Temple Bar 5833.

Ashton and Co., Ltd., G., 1a, Queen Street, Edinburgh. Edinburgh 20874.

Attwoods (Factors), Ltd., Attwood House, Fryer Street and Long Street, Wolverhampton. Wolverhampton 21686. Attwoods 21686. Wolverhampton.

## B

Baker and Co., Ltd., G. F., Xaltona House, Leeke Street Corner, King's Cross Road, London, W.C.1. Terminus 4302. Ocrekab, Kincross, London.

Balmford, Ltd., Walter, 116, Steelhouse Lane, Birmingham. Central 1264-5. Balmford, Birmingham. 23, Park Avenue, Shelton. Stoke-on-Trent. Hanley 48131.

Barker and Son, Ltd., A., 87, Anlaby Road, Hull. Hull 15089. Garage, Hull.

Baxendale and Co., Ltd., Miller Street, Manchester. Blackfriars 8282 (26 lines). Grassmarket, Edinburgh. Edinburgh 27047 (4 lines). Capel Street, Dublin. Dublin 21607/8/9. Hanover Street and School Lane, Liverpool Royal 5555 (6 lines).

Beadle and Co., Ltd., T., 3-5, Castle Street, Hull. Hull 33836. 4-8, Thomas Street, Liverpool. Bank 5824. 368-370, Cleethorpes Road, Grimsby. Grimsby 3146. 92, Rutland Street, Leicester. Leicester 20522. 96, Hamilton Street, Birkenhead. Birkenhead 2617. 12, Fletcher Gate, Nottingham. Nottingham 2276-7. Cleaver Street Works, Blackburn. Blackburn 4282. 91, Abbey Street, Derby. Derby 1667. 17, Queen Street, Manchester, Blackfriars 7030.

Beardsall and Co., Ltd., W. E., Victoria Bridge, Manchester. Blackfriars 4255 (5 lines). Moonstone.

Beaumont and Son, Ltd., J., 36, Carliol Street, Newcastle. Newcastle 24904. 28, Scotch Street, Carlisle.

Beaver Electrical Supply Co., 5, Gt. Chapel Street, Oxford Street, W.1. Gerrard 3335-7.

Beck, F. J., 134, Culford Road, London, N.1. Clissold 3262. Autobaby, Kinland, London.

Bedford Electrical and Radio Co., Ltd., 22, Campbell Road, Bedford, Bedford 2343.

Black, Ltd., Michael, 80, Blytheswood Street, Glasgow, C.2. Central 6681. Faneeka, Glasgow. 57-59, Elder Street, Edinburgh. Edinburgh 30390. 30-32, Chapel Street, Aberdeen. Aberdeen 2908.

Blitz Bros., 7, Shaa Road, Acton, London, W.3. Shepherd's Bush 3613.

Boynton and Co., Ltd., 65-68, Stafford Street, 139, Corporation Street, and 3 and 5, Hill Street, Birmingham. Central 1525-6. Portables, Birmingham.

Brand, T., 33, Frankfort Street, Plymouth. Plymouth 3181/2. Flashlamps, Plymouth.

Bridger, Ltd., J., Poplar Walk, Croydon. Croydon 2663. Pneumatic, Croydon.

British Central Electrical Co., Ltd., 6-8, Rosebery Avenue, London, E.C.1. Clerkenwell 2525. Briticent, Holb, London.

Brown Brothers, Ltd. (allied companies Thomson and Brown Brothers, Ltd., and Brown Brothers (Ireland), Ltd.), Great Eastern Street, London, E.C.2. Bishopsgate 7654. Imbrowned, Finsquare, London. 126, George Street, Edinburgh. Edinburgh 22033. Accelerate Edinburgh. Branches: 74, Huntly Street, Aberdeen. Aberdeen 3324. Accessory. Aberdeen. 31, Adelaide Street, Belfast, Belfast 4276. Imbrowned, Belfast. 77-81, Bristol Street, Birmingham. Midland 0149. Imbrowned, Birmingham. 25, Temple Street, Bristol. Bristol 25341. Imbrowned, Bristol. 86-88, Adam Street, Cardiff. Cardiff 3904. Imbrowned, Cardiff. Cherry Orchard Road, Croydon. Fairfield 4411. Vindec, Croydon. Dunlop House, Lower Abbey Street, Dublin. Dublin 45154. Imbrowned, Dublin. 80, North Lindsay Street, Dundee; Dundee 3151; Factor, Dundee. 65, Mitchell Street, Glasgow. Central 4980. Accelerate, Glasgow. Kingsway Works, Lombard Street, Hull; Central 31607; Webco, Hull. 62, Eastgate, Inverness; Inverness 808; Accelerate, Inverness. 19-23, Grace Street, Leeds. Leeds 27351. Imbrowned, Leeds. 3-7, Colquitt Street, Liverpool. Royal 6170; Imbrowned, Liverpool. 14 and 15, Upper Marylebone Street, London (West End), W.1. Museum 1002. Submotoris, Euston Road, London. 265-273, Deansgate, Manchester. Blackfriars 2472. Broncho, Manchester. Carliol Square, Newcastle-on-Tyne. Newcastle 20631. Distribute, Newcastle-on-Tyne. Marsh Lane, Southampton. Southampton 2181. Imbrowned, Southampton.

Brown Bros. (Ireland), Ltd. (See Brown Bros., Ltd.).

Burner Radio Electric Factors, The, 51, Wellington Street, Woolwich, London, S.E.18. Woolwich 2081-2.

Burris and Sons, Ltd., Fred, 7/16, Redcliff Street, Bristol. Bristol 23521. Horsenail, Bristol.

B.N.B. Wireless, Ltd., 65, Renshaw Street, Liverpool. Royal 806. 5, The parsonage, Manchester. Blackfriars 4401. 14, Grove Road, Colwyn Bay. Colwyn Bay 2463. 9, Brunswick Street, Belfast. Belfast 5939. 51, William Street, Dublin. Dublin 21964.

## C

Cadisch and Sons, R., Red Lion Square, W.C.1. Chancery 8700. Cadisches, Holb., London. Princes Street, Ipswich. Ipswich 2253.

Campart, C., 32, Theobalds Road, London, W.C.1. Holborn 3832. Cecampart, London.

## WHOLESALERS' SECTION

Capel's Wholesale Wireless Co., Ltd., Plymouth Street, Queen Street, Cardiff. Cardiff 6660-1. Waves, Cardiff.
Carlton Radio Corp., 169, Piccadilly, London, W.1. Regent 7392.
Celtic Electric Co., 16, Wellington Quay, Dublin, C.4. Dublin 22876.
Cheshire and North Wales Manufacturing Co., Ltd., 161, Foregate Street, Chester. Chester 1873/4. Cyclaxs, Chester.
Chilton, A., 17, St. John's Road, Watford. Watford 2053.
Chorlton Metal Co., Ltd., Millgate House, 55, Blossom Street, Manchester. Central 6642-3, Chorlmet, Manchester 4.
Churchmans, Ltd., 79, Maidenburgh Street, and 7, 8 and 14, George Street, Colchester. Colchester 2831. 18, North Street, Peterborough. Peterborough 3095. 23, St. Helen's Street, Ipswich. Ipswich 4191.
Clarke Bros. (Leicester), Ltd., Victoria House, off London Road, Leicester. Leicester 20891 (4 lines).
Clarkson, H., Back Queens Square, Morecambe. Morecambe 44. 97, Cavendish Street, Barrow-in-Furness. Barrow-in-Furness 725. Back 76, Caunce Street, Blackpool. Blackpool 1292.
Cleave and Co., H. R., 6, Bristol Bridge, Bristol. Bristol 23452. Eclipse, Bristol. 160, Moor Street, Birmingham. Midland 6817/8. Station Road, Plymouth. Plymouth 2641.
Clive and Co., 26, Curzon Street, Derby. Derby 1305.
Coates, Ltd., J. G., King's Mill, Bridge Street, Burnley, Lancs. Burnley 2295. Coates, Ltd., Burnley.
Cohen, S. W., 7-15, King Street, Glasgow, C.1. Bell 212. Violins, Glasgow.
Coleman and Co., A. J., 37-41, The Arcade, Northampton. Northampton 905.
Craftease, 37, Baker Street, Weston-super-Mare.
Currys, Ltd., 24-6-8, Goswell Road, E.C.1. Clerk, 9267-8-9. Currifacta, Phone, London.
Cuthbertson and Co., Ltd., 11, West Nile Street, Glasgow, C.1. Central 1687.

## D

Dallas and Sons, Ltd., John E., 6, Betterton Street, London, W.C.2. Temple Bar 6351.
Daws, Clarke and Co., 23, The Avenue, Bedford Park, W.4. Chiswick 0368.
Dennis and Co., W. F., 70, Queen Victoria Street, E.C.4. City 6983. Fredennis, Cannon, London.
Dew and Co., Ltd., A. J., 32/34, Rathbone Place, W.1. Museum 8686. Dewmofac, London. 113, Moor Street, Birmingham 4. Midland 3322. Dewmofac, Birmingham.
Dibben, Ltd., H., 34, Carlton Crescent, Southampton. Southampton 3171. Kilocycle, Southampton.
Dibben and Sons, Ltd., W., 80, St. Mary's Road, Southampton. Southampton 3141 (6 lines). Stoves.
Dixon Switchgear Co., Leslie, 218, Upper Thames Street, E.C.4. Central 4611. Electradix, Cent, London.
Downes and Davies, 1/9, Stanley Street, Liverpool. Bank 5760 (7 lines). Utis, Liverpool. 3a, Norfolk Street, Pall Mall, Manchester. City 8846/7. Paternoster Row, Carlisle. Carlisle 631.
Drake and Gorham, Wholesale, Ltd., 77, Long Acre, London, W.C.2. Temple Bar 3993/4/5. Dragorlite, Rand, London. 29, Piccadilly, Manchester. City 3700/1. Accumulator, Manchester. 51, Waterloo Street, Glasgow. Central 1903. Accumulator, Glasgow. 35, Broad Street, Bristol. Bristol 23509. Dragorlite, Bristol. 24, Marlborough Place, Brighton. Brighton 3886. 2, Church Lane, College Green, Dublin. Dublin 22672. Accumulator, Dublin.
Drury Radio Co., Ltd., 23, Water Street, Liverpool. Central 2240. 9, Brooklands Avenue. Broughton Preston. Preston 7414. 2, Conwy Street, Rhyl. Rhyl 131. 58, Norlands Lane, Widnes. Widnes 13.
Dulcetto-Polyphon, Ltd., 2/3, Newman Street, W.1. Museum 4201. Dulcetpoly, London. 27, Jamaica Street, Glasgow. Central 8445-6. Dulcetpoly, Glasgow. 31, Quay Street, Manchester. Blackfriars 5006-7. Dulcetpoly. 3, Charlotte Square, Newcastle-on-Tyne. Newcastle 25661-2. Dulcetpoly, Newcastle-on-Tyne. 45, London Road, Southampton. Southampton 6561-2. Dulcetpoly, Southampton.
Dutfield, Thomas J., 260, Victoria Park Road, London, E.9. Amherst 4031.
Duwes Ltd., 12, Hilton Street, Manchester. City 9620. Diagram, Manchester. 10, Castle Street, Sheffield. Sheffield 22875.
Dyson and Co., Ltd., J., 5-7, Godwin Street. Bradford. Bradford 6037. Equipment, Bradford. 2, Coleman Street, London, E.C.2 Metropolitan 7988. Londepot, Ave, London-6, Albion Street Hull. Central 35695. 33, Pilcher Gate, Nottingham. Nottingham 41910. Meadow Road, Salisbury, Wilts. Salisbury 1036.

## E

East London Rubber Co., 29/33, Great Eastern Street, E.C.2. Bishopsgate 4321. Akerene, Phone, London. Kerry House, Furnival Street. Sheffield. Brunswick Street, West Hove Falcon Street, Ipswich, Highcross Street, Leicester, 468, London Road, Croydon.
Eastick, J. J., and Sons, 118, Bunhill Row, E.C.1. Metropolitan 0314/5/6. 9, Library Place, Jersey. Commercial House, Commercial Place, Commercial Road, Portsmouth. 10-11, St. Helen's Place, Swansea. St. Georges, Norwich.
Ecco Radio, Ltd., Ecco House, Princess Street, St. John's Wood, N.W.8; 55, St. Clements. Oxford, and 23a, Palmerston Road, Boscombe, Bournemouth. Paddington 6735 and 8373, Oxford 3397, and Boscombe 1958. Eccoradiim, Padd., London.
Edinburgh Rubber Co., 178/182, Rose Street, Edinburgh. Edinburgh 27168. Insertion, Edinburgh 2.
Edwards and Edwards, Ltd., 3, Brunswick Street, Belfast.
Eirco (W.), Ltd., 29, Wellington Place and 28-30, College Street, Belfast. Belfast 6206. Eirco, Belfast. 9, Strand Road, Londonderry. Londonderry 812.
Electric Lamp Factors, Ltd., Kelvin House, Cleveland Street, W.1. Museum 8623-6. 13, Stanley Street, Liverpool, Central 2922. 36, Topping Street, Blackpool. Blackpool 3577. 51, London Street, Southport. Southport 3813. 5, York Place, Leeds. Leeds 27916. 47, Cresswell Street, Portsmouth. Portsmouth 2031. Leen Lane, Chester. Chester 598. 170, Corporation Street, Preston. Preston 2837. Barbauld Street, Warrington. Warrington 1120. Princes Street, Nuneaton. Nuneaton 591. 53, Hamilton Square, Birkenhead. Birkenhead 1037. 102, Abbey Street, Accrington. Accrington 2774. 13-14, Castle Street, Birmingham.
Electrical Components, Ltd., 88-90, Gt. Charles Street, Snow Hill, Birmingham 3. Central 2282. Clip, Birmingham. 55, Frogmore Street, Bristol. Bristol 23774. Rewley Road, Oxford. Oxford 4481. 35, The Wicker, Sheffield. Sheffield 22539. 45, Leeds Road, Bradford. Bradford 8744. 19, Dale Street, Liverpool. Bank 3929. 3, Greek Street, Manchester. Blackfriars 3692. Old Fire Station. Rutland Street, Leicester. Leicester 59828. 117, Castlegate, Huddersfield. Huddersfield 2575. 25, Phoenix Works, Broad Street, Hanley. Hanley 2757. 11c, King Street, Southport. Southport 2864.
Electrical and General Distributors, Ltd., 154, King's Cross Road, London, W.C.1. Terminus 3067. Elektangen, Kincross, London.

Electrical Ohms, Ltd., 6, Bridge Street, Glasgow South 328.
Electrocet Radio Co., Poplar Road, Solihull, Birmingham. Solihull 0750. Electrocets. Solihull.
Elektra Supplies, 1, Belmont Street, Chalk Farm Road, London, N.W.1. Gulliver 2347.
Ellis and Co., J. G., 3-4, Western Mail Chambers, Cardiff. Cardiff 2892. Teklab, Cardiff.
Ellis and Mort, Ltd., 90/96, Topping Street, Blackpool. Blackpool 3426/7. 134A, Western Road, Brighton. Brighton 5721-2. 207, Corporation Street, Preston. Preston 3354.
Entley Co., Swan Street, Hanley, Staffs. Hanley 2141. Entleys.
Express Radio Factors, Ltd., 17-19, Furnival Street, and 80-82, Eyre Street, Sheffield. Sheffield 21025. Expresrad, Sheffield.
E. G. S. Co., Ltd., 10/12, Trafalgar Street, Newcastle-on-Tyne. Central 23004/5. Volta. Gt. George Street and Woodhouse Lane, Leeds. Leeds 29584/5. Voltage. 18-26, Constitution Hill, Birmingham. Central 3855/6. Voltac.

## F

Factors (Nottm.), Ltd., Woodland Place, Nottingham. Nottingham 40249.
Factors (Oxford), Ltd., Gloucester Street, Oxford. Oxford 3259.
Falk, Stadelmann and Co., Ltd., 83-93, Farringdon Road, E.C.1. Holborn 7654. Lamps, London. Veritas House, Clyde Street, Glasgow C.1. Central 9494. Veritas House, Rochdale Road, Manchester 4. City 8250. Veritas House 81-84, Lionel Street, Birmingham. Central 8031-3. Effesco. Veritas House, 3-11, Prudhoe Street, Newcastle-on-Tyne 2. Newcastle 22483-4. Veritas House, 85-87, Frederick Street, Cardiff. Cardiff 5757. Veritas House, 15-19, New Station Street, Leeds. Leeds 29741. Effesca House, Exchequer Street, Dublin. Dublin 21694-5. 60, Hanover Street, Liverpool. Royal 2942. Telegraphic address in each case ; Trilux, except Birmingham.
Faudels, Ltd., 36-40, Newgate Street, E.C.1. City 5010.
Featherstone Wholesale Radio-Elect, Ltd., 109B, West Hill, St. Leonards-on-Sea, Sussex. Hastings 2182 and 2294.
Fletcher and Co., Ltd., H. J., 168-170, Shaftesbury Avenue, W.C.2. Dulciphone, Phone, London.
Flinders (Wholesale), Ltd., Shaftesbury House, Culver Street, Colchester. Colchester 3131-2. St. Margaret's Street, Ipswich. Ipswich 3781-2. St. Peter's, Haymarket, Norwich. Norwich 2417. 91, Regent Street, Cambridge. Cambridge 2554. Tanners Lane, High Street, Lincoln. Lincoln 1424. East Stockwell Street, Colchester. Colchester 3178.
Flitton Bros., East Road, Cambridge. Cambridge 2440-1. 17, White Lion Street, Norwich. Norwich 2807.
Forum and Co., Ltd., 7 and 9, Pershore Street, Birmingham. Midland 2697.
Fowlers (Aberdeen), Ltd., 51, Huntley Street, and 20-22, Union Wynd, Aberdeen. Aberdeen 2591. Relwof.
Franks (Wholesale), Ltd., A., 3, South King Street, Manchester. Blackfriars 7960. Ukanhear, Manchester.
Furse Wholesale, Ltd., Traffic Street, Nottingham. Nottingham 8213/4/5. Elecshow, Nottingham. 13, Derby Road, Nottingham. Nottingham 43724. Elecshow, Nottingham. Victoria Buildings, 1, London Road, Derby. Derby 685. Furse, 685 Derby. 19, Newarke Street, Leicester. Leicester 20562.

## G

Galliers (Wholesale), Ltd., 32, St. James' Street, Brighton. Brighton 3201.
Gilbert and Co., Ltd., C., Arundel Street, Sheffield. Sheffield 21244. Gilrad, Sheffield. 23, South Street, Hull. Gilrad, Hull. 30, St. Mary's Place, Newcastle-on-Tyne. 37, Pall Mall. Hanley, Stoke-on-Trent. 15, Mawdsley Street, Bolton. 174, Cleethorpes Road, Grimsby. 9, Venn Street, Huddersfield. 10, Gillygate, York. 179-181, Huntingdon Street, Nottingham.
Gledson and Co., Ltd., J., 48/50, Blackett Street, Newcastle - on - Tyne. Newcastle 24137/8/9. Radiate, Newcastle-on-Tyne. 7, Tubwell Row, Darlington. Darlington 3026.
Glickson and Co., 174, High Street, Swansea. Swansea 3749.
Golding, H. J., 138A, Plough Road, Clapham Junction S.W.11. Battersea 1883 (2 lines).
Gothic Electrical Supplies, Ltd., Severn Street, Birmingham. Midland 4511.
Gradley Electrical Co., Ltd., 1, Castle Street, London, E.C.2. Clerkenwel 7218-9 Slickservo Finsquare, London.
Grafton Electric Co., 54, Grafton Street, Tottenham Court Road, W.1. Museum 0241.
Gratrix, Junr., and Bro., Ltd., S., Alport Works, Quay Street, Deansgate, Manchester. Blackfriars 6601. Lead, Manchester.
Gray and Son, Ltd., E., 18/20, Clerkenwell Road, E.C.1. Clerkenwell 0151. Materials, Smith, London.
Great Eastern Rubber Co., Ltd., 31, Norton Folgate, E.1. Bishopsgate 1807.
Greatrex and Co., R. G., Ballards Works, 123-125, High Street, Edgware. Edgware 2813.
Greenman, Ltd., S., 280, Old Street, E.C.1. Bishopsgate 4474.
Gripton and Co., Corner High Street and Lombard Street, West Bromwich. Staffordshire 0438.
G.E.M., Ltd., 62, Hunslet Road, Leeds. Leeds 24512. Gemlectric, Leeds.

## H

Hallamshire Electric Co., Ltd., 11-15, Matilda Street, Moorhead, Sheffield. Sheffield 20157. 14, Forcst Road, Nottingham.

## WHOLESALERS' SECTION.

Harper and Co., W., 93-99, Holm Street, Glasgow, C.2. Central 4559. Immediate, Glasgow.

Harris and Russell, Ltd., 91, Tottenham Court Road, W.1. Museum 1816-6061-2-9776. 4, Blagrave Street, Reading. Reading 2884. 15, Miller's Buildings, Hampshire Terrace, Portsmouth. Portsmouth 4997.

Harrison and Norris, 51, Bedford Street, Leamington Spa. Leamington Spa 279.

Hart, Lionel, 47/49, Sparkenhoe Street, Leicester. Leicester 59463.

Harveyson and Co., E. R., 27, Hendon Lane, Finchley, London, N.3. Finchley 3352-3. 115, Bute Street, Treherbert, Glam. Treherbert 49.

Harwol Specialities Co., 11, Strand Street, Liverpool. Bank 9249. Harwol, Liverpool.

Haslam and Stretton (E. and M.U.), Ltd., 75, Victoria Street, Bristol. Bristol 23690. Thor, Bristol.

Hastings, Factors, Ltd., 15, Havelock Road, Hastings. Hastings 2865. Factors, Hastings.

Hathaway and Co., Ltd., S., 287, Edge Lane, Liverpool. Anfield 843.

Hawnt and Co., 59, Moor Street, Birmingham 4. Central 3661.

Hayward and Son, C., 20-46, New Street, Ashford, Kent. Ashford 334. Hayward, Wireless, Ashfords Wholesale.

Henderson Electrical and Radio, Ltd., Electric House, Queen's Road, Brighton. Brighton 5704-5. Vale Hall, Vale Road, Tunbridge Wells. 109, Chapel Road, Worthing. 12, Grove Road, Eastbourne. 1, Soho Square, W.1.

Heys, Leonard, Faraday House, Henry Street, Blackpool. Blackpool 1894. Saxon, 1894, Blackpool.

Hillman Bros., 123/5, Albion Street, Leeds. Leeds 29574-6. Aerial, Leeds.

Hindleys Wholesale, Ltd., Maypole Yard, Nottingham. Nottingham 43672.

Hirst Bros. and Co., Ltd., 57, Roscoe Street, Oldham, Lancs. Main (Oldham) 3671.

Hirst, Ibbetson and Taylor, Ltd., 9, Blackfriars Street, Manchester. Blackfriars 9381 (6 lines). Beforehand, Manchester. 68, Topping Street, Blackpool. Blackpool 3830. 14, Bridge Street, Burnley. Burnley 2283. 1, Thornton Avenue, Croydon. Thornton Heath 1357. 5, Gt. John Street, Lancaster. Lancaster 966.

Hobday Bros., Ltd., 21/27, Gt. Eastern Street, E.C.2. Bishopsgate 4343. Yadboh, Bath, London. 16/20, Turner Street, Manchester. Central 7020. Yadboh, Manchester. 32/3, Cleveland Road, Wolverhampton. Wolverhampton 21602. Yadboh, Wolverhampton.

Hollingdrake and Son, Ltd., H., Princes Street, Stockport. Stockport 4801-4. Hollingdrake, Phone, Stockport.

Houghtons, The Wholesalers, 88/9, High Holborn, W.C.1. Holborn 6900. Bromide, Phone. 76/78, York Street, Glasgow. Central 4665-6. 7, Park Place, Leeds. Leeds 21064. 20, Orange Street, Swansea. Swansea 4163. 3, Freeman Street, Moor Street, Birmingham. Midland 2695. 56, Wellington Place, Belfast. Belfast 502. 10, Best Lane, Canterbury, Canterbury 999. 18-19, Hills Terrace, Cardiff. Cardiff 641.

Hulme and Co., E., 93A, Station Street, Birmingham. Midland 1263. Hulco, Birmingham.

## I

Imp Radio Co., Imperial Works, Edith Road. Nunhead, London, S.E.15. New Cross 2391 58, Bousfield Road, London, S.E.14. New Cross 3949.

Irvine and Co., Ltd., J. F., Caird Hall, Dundee. Dundee 2853. Irvine, Cairdhall.

Itonia, Ltd., 58, City Road, London, E.C.1. Clerkenwell 2031. Overturish, Finsquare, London. 44, Wellington Street, Leeds. Leeds 30081-2. Overturish, Leeds. 17, Commercial Road, Portsmouth. Portsmouth 2411-2. Overturish, Portsmouth. 20, Rose Lane, Canterbury. Canterbury 1040. Overturish, Canterbury. 56, Rose Street, Edinburgh. Edinburgh 24064. Overturish, Edinburgh. 15, Ellison Place, Newcastle-on-Tyne. Newcastle-on-Tyne 23381.

## J

Johnson Talking Machine Co., Ltd., 96, Clerkenwell Road, London, E.C.1. Clerkenwell 3501. Jolamaco, Smith, London.

Jones and Co., A., Norton Street, Middlesbrough. Middlesbrough 3223. Radium. 24, Bedford Street, Sunderland. Sunderland 2516.

## K

Kay, Ltd., Philip, 167, City Road, Finsbury, London, E.C.1. Clerkenwell 4520.

Keith Prowse and Co., Ltd., 159, New Bond Street, W.1. Regent 6000. Stalls, Wesdo, London.

Kerridge and Co., E., North Pole Road, North Kensington, W.10. Park 6368. 493, Latimer Road, W.10.

Kettle, H. E., Ltd., St. Peter's Street, Maidstone. Maidstone 2206-7. Kettle, Ltd., Maidstone.

## L

Lawrence, P. H., 38, Market Street, Tamworth. Staffs. Tamworth 70.

Lawrie and Co., 72, Holdenhurst Road, Bournemouth. Bournemouth 6814-5. 7A, Broad Street, Canterbury. Canterbury 920.

Lawson, G., 61, Fore Street, London, E.C.2

## WHOLESALER'S SECTION

Metropolitan 1480. Gleldic, Ave., London, Gleldic, London.

Lean, Taylor and Co., Ebrington Street, Plymouth. Plymouth 2901-2. Leantaylor, Plymouth.

Lewarn and Son, J. H., 2A, Bath Parade, Victoria Street, Bristol. Bristol 24720.

Lewis, B., and Co., Pioneer Works, Church Road, Leyton, E.

London Commercial Electrical Stores, Ltd., 13, Farringdon Avenue, London, E.C.4. Central 9471-2. Galvorite, London.

London Electrical Co. (Sherborne Lane), Ltd., 1, Sherborne Lane, King William Street, London, E.C.4. Mansion House 6201-3. Electa, Phone, London. 35, Arch, Great Suffolk Street, London, S.E.1.

London and Provincial Factors, Ltd., 146, Theobalds Road, London, W.C.1. Holborn 3251. Wanieblade, Holb, London. 16, Withy Grove, Manchester.

London Radio Co. (Leeds), Ltd., 26, Queen's Arcade, Leeds. Leeds 24928. 41, The Headrow, Leeds. 50, Savile Street, Hull. Hull 31171. 32, Bridge Street, Northampton. 59, Whitefriar Gate, Hull. Hull 31171 Ext.

Lugton and Co., Ltd., 203, Old Street, London, E.C.1. Clerkenwell 0257-9. Maxitone, Finsquare, London. 161, Howard Street, Glasgow. Central 5602.

L.E.S. Distributors, Ltd., 15/16, Alfred Place, London, W.C.1. Museum 5713.

## M

MacEchern and Co., Ltd., 38, Southwark Bridge Road, London, S.E.1. Hop 3386-7. Celoron, Boroh, London.

McHugh and Co., A. S., 46, Sandhill, Newcastle. Stanhope House, 110, Drury Lane, W.C.2.

Maclennan and Co., J., 115, Newgate Street, London, E.C.1. National 4575/6/7. Vanduara, Cent, London. 166, Ingram Street, Glasgow.

Macowards, Ltd., 235-7, Oxford Street, Swansea. Swansea 2720. Macowards, Swansea.

Manufacturers' Accessories Co. (1928), Ltd., 85, Gt. Eastern Street, E.C.2. Bishopsgate 3511-2-3. Dogeate, Finsquare, London.

Markham and Co., W., 3, Campbell Street, Leicester. Leicester 21658.

Mason and Collins, Ltd., 309, Gray's Inn Road, London, W.C.1. Terminus 4438.

Mattia, H. B., Down Road, Merrow, Guildford, Surrey. Guildford 387.

Metal Agencies Co., Ltd., Queen Square, Bristol. Bristol 21061. Themac, Bristol. "Russells," Colston Street, Bristol. Bristol 10040. Alma, Bristol.

Michelson Brothers, Mark Lane Station Buildings, London, E.C.3. Royal 9056-7. Inland grams: Michemada, Fem., London. Foreign: Michemada, London.

Midland Auto Components, 58, Cambridge Street, Birmingham. Midland 6524 (5 lines). Replace, Birmingham. 169-171, High Road, Willesden, N.W.10. Willesden 3371/3. 1, King Street, Gloucester. Gloucester 3589. And at Coventry.

Midland Wireless Co., 32, The Broadway, Bedford. Bedford 2590.

Moores and Co., J., King's Works, Ravald Street, Blackfriars Road, Salford, 3. Blackfriars 7618.

Morton, W. A., 71-73, Surrey Street, Sheffield. Central 25131 (2 lines). Morton, Sheffield 25131. 16, Tudor Street, Sheffield.

Murdoch Trading Co., 59/61, Clerkenwell Road, London, E.C.1. Clerkenwell 6144. Putiel-Smith, London. 64, Edgbaston Street, Birmingham. 38, Charles Street, Cardiff. 79, Dunlop Street, Glasgow. 7, Bigg Market, Newcastle-on-Tyne.

## N

Needham and Brother, Ltd., C. E., Change Alley and Milk Street, Sheffield. Sheffield 21011 (5 lines). Pumps, Sheffield.

New Era Wireless and Electrical Co., Ltd., 3, Hobmoor Road, Small Heath, Birmingham. Victoria 0744.

Newcastle General Supply Co., Ltd., 10, Leazes Park Road, Newcastle-on-Tyne. Newcastle-on-Tyne 23177.

Newcombe and Co., Ltd., F. D., 39/40, North Street, Exeter. Exeter 4116.

North British Engineering Equipment Co., Milburn House, Newcastle-on-Tyne. Newcastle 25252. Equipment, Newcastle-on-Tyne.

Northern Factors, Ltd., Crescent House, Crescent Road, Middlesbrough. Linthorpe 8271/2. Mocessory, Middlesbrough.

Northern Steel and Hardware Co., Ltd., Northern House, 7, Gartside Street, Manchester. Blackfriars 3871. Assiduous, Manchester. Stores, 23, Larkhill, Blackburn. Blackburn 5833.

Nottingham Radio Supplies, Ltd., Sherwood Buildings, Sherwood Street, Nottingham. Nottingham 44351/2.

## O

Olympia Radio, Ltd., 49A, Shudehill, Manchester. Blackfriars 9128. Olympaphone.

Ormrod and Co., Ltd., A., Wigan. Wigan 3780.

## P

Payne and Hornsby, Ltd., 3, St. Andrews' House, Gallowgate, Newcastle-on-Tyne. Newcastle 24604. 66, Camden Street, North Shields. N. Shields 743. 46, Crowtree Road, Sunderland. Sunderland 2768.

Perseus Manufacturing Co., Perseus Street, Branton Road, Burton-on-Trent, Staffs. Burton 168. Perseus Co.

Priestley and Ford, 3/11, Carrs Lane, Birmingham. Midland 4941. Peeanef, Birmingham. 59, Friar Lane, Nottingham. Nottingham 40326. Peeanef, Nottingham. 21, Bridge Street and 18, King Street, West, Manchester. Blackfriars 9157. Peeanef, Manchester.

Provincial Incandescent Fittings Co., Ltd. (Pifco, Ltd.), Pifco House, Shudehill, Manchester. City 0381 and 4044. Provencal, Manchester. 150, Charing Cross Road, London, W.C.1. Temple Bar 3720. Pifco, Westcent., London.

Pulford Bros., Ltd., 102/104, Whitechapel, Liverpool. Royal 4940. Personal, Liverpool.

## Q

Queen's Radio Supply Co., 12, Queen's Road, S.W.8. Macaulay 2466-7.

# R

Radio Supply Co., Wood Street, Northampton. Northampton 1494. 31, Queen Street, Peterborough. Peterborough 2146. 42, Waterloo Street, Swansea. Swansea 4871.

Radio Traders Supply Co., 9/11, Mark Street Lane, Cardiff. Cardiff 3092.

Radio Trading Co., Service House, 309, Old Street, London, E.C.1. Clerkenwell 0255 and 3940. Tradonli, Finsquare, London.

Radio Wholesalers' Federation, Bloomsbury Mansions, 26, Hart Street, W.C.1. Holborn 2488. Radmofac, Westcent, London.

Regent Fittings Co., 120, Old Street, London, E.C.1. Clerkenwell 2923.

Renshaw Radio Manufacturing Co., 55, Renshaw Street, Liverpool. Royal 1880. Erw Wen Road, Colwyn Bay, North Wales. Colwyn Bay 2463.

Richardsons (R.M.L.), Ltd., 24, Park Lane, Liverpool. Bank 5443/4. Trutone, Liverpool. 24, St. John Street, Deansgate, Manchester. Blackfriars 6477/8. Trutone, Manchester.

Riddlough and Son, F., Simes Street, Westgate, Bradford, Yorks. Bradford 8777/8. Challenger, Bradford.

Riley and Son, Wm., 51, Farringdon Road, E.C.1. Holborn 8180.

Roberts, J., 1/3, Bridgwater Viaduct, Knott Mill, Manchester. Blackfriars 1837/8. 14, Wellington Road South, Stockport. Stockport 3761.

Robertshaw and Co., Ltd., 20, Canal Road, Bradford. Bradford 4502.

Robertson, J., 95, West Nile Street, Glasgow. Douglas 4040. Exhaust, Glasgow.

Robinson, and Son, Ltd., George, River Plate House, South Place, London, E.C.2. Metropolitan 5886/8. Ancomac, Ave., London. 12, Percy Street, London, W.1. Museum 2178. 7, Marton Road, Middlesbrough. Middlesbrough 2141. Parcrosted, Middlesbrough.

Robinson and Hands Electric Co., Ltd., 54/6, Barwick Street, Birmingham. Branches: Lincoln, Stoke and Taunton. Central 8131/3. Rewind, Birmingham.

Rose, Morris, and Co., Ltd., 57, City Road, London, E.C.1. Clerkenwell 5377.

Ross and Adam, 68, Gordon Street, Glasgow. Central 543. Hedros, Glasgow.

Runwell Cycle Co. (Birmingham), Ltd., Lawson Street, Birmingham, 4. Aston Cross 0752. Runwell. 16, Great Eastern Street, London, E.C.2. Bishopsgate 1320. Cycorunel, London. Camp Street. Deansgate, Manchester. Blackfriars 8352/3. Runwell, Manchester. 48, Duke Street, Liverpool. Royal 4725. Runwell, Liverpool. 101, Temple Street, Bristol. Bristol 21695. Runwell, Bristol. 5, Carver Street, Sheffield. Sheffield 23995. Runwell, Sheffield. Rose Lane Works, Norwich. Norwich 2042. Runwell, Norwich. 68, Bridge Street, Cardiff. Cardiff 4732. Runwell, Cardiff. 17, Crown Street, Ipswich. Ispwich 3808. Runwell, Ipswich.

Ryley, J. A., 3/5, Newmarket Street, Birmingham. Central 4354/5. Plugs, Birmingham.

R.C. Radio Electric, Ltd., 51, Whitcombe Street, London, W.C.1. Whitehall 8877. Loudsigs. Lesquare, London.

# S

Sanger and Son, M., 31/31A, King Street, Plymouth. Plymouth 3470. And at Taunton.

Sceats, Ltd., C., 128, Barton Street, Gloucester.

Scott and Co., Ltd., A. C., 39, City Road, Manchester, City 9235. Cromaloy, Manchester.

Selecta Gramophones, Ltd., 81, Southwark Street, S.E.1. Hop 6671. Floradom, Boroh, London.

Sellers of Leeds, Ltd., Standard Bldgs., City Square, Leeds. Leeds 31146 (3 lines). Orion. 25, Glovers Court, Preston. Preston 4433 Selradio.

Sheffield Radio and Electric Co., 39, Eyre Street, Sheffield 1. Sheffield 26121.

Shemelds, Ltd., 51-53, Berry Street, Belfast, N. Ireland. Belfast 2336.

Siemens-Schuckert (Great Britain), Ltd., 30/34, New Bridge Street, London, E.C.4. Central 8461/3. Elefes, Lud., London.

Silcocks Bros., 50, Victoria Street, Bristol 1. Bristol 25263. Silcocks Bristol 25263.

Simpson, Baker and Co., Ltd., 2/5, Nelson Street, Bristol. And at London and Birmingham.

Sinclair J. Corston and Co. (Newcastle), Ltd., 2, St. Nicholas Buildings. Newcastle-on-Tyne 1. Newcastle 22515/6. Rubelpac. Newcastle-on-Tyne.

Sloan Electrical Co., Ltd., 8/12, Golden Lane, E.C.1. National 2040. Slonetric, Barb. 41, Kingsway, London, W.C.2. Temple Bar 8972. 16, Jackson's Row, Deansgate, Manchester. Blackfriars 7081. Slonetric. 79, Hanover Street, Edinburgh. East Central 30041. Slonetric. 143, St. Vincent Street, Glasgow. Central 7874. Slonetric. 44, Victoria Street, Bristol. Bristol 23426. 32/3, Gandy Street, Exeter. Exeter 4106. Slonetric. 58, Uxbridge Road, W.5. Ealing 0286. Slonetric, Barb.

Smethurst, Lincoln, 17, Hanover Bldgs., Southampton. Southampton 6091/2.

Smith and Cookson, 22, Paradise Street, Liverpool 1. Bank 3525/6.

Solway Factoring Co., 128, Queensberry Street, Dumfries. Dumfries 102. Solway.

South Wales Wireless Installation Co., Ltd. 21/22, Edward Terrace, Cardiff. Cardiff 2636/7. Electron.

Southern Factors, Ltd., Cornfield Road, Eastbourne. Eastbourne 2222. Factors, Eastbourne.

Sterno Manufacturing Co., Ltd., 19, City Road, E.C.1. National 5886. Sternoec, Finsquare, London. Sternoec, London.

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.

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. Mountview 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.

## T

Taylor, H. S., Roper Street, Whitehaven, Whitehaven 390. Taylor, Factor, Whitehaven.
Taylor and Co., J. H., Macaulay Street, Huddersfield. Huddersfield 341. Thorough, Huddersfield.
Thompson, Diamond and Butcher, 34, Farringdon Road, E.C.1. Clerkenwell 5492 (6 lines). Thomdibu, London. Factory at 78, St. John Street, 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.
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.

## U

Unity Lamp and Accessories, Ltd., 41, Call Lane, Leeds. Leeds 21375. Unilamp, Leeds. 13, Gothic Arcade, Snow Hill, Birmingham.
Universal Electric Supply Co., Ltd., 4-8, Brown Street Manchester. City 3409. Uniselco, Manchester.

## W

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.
Whiteford and Co., J., 5, Oswald Street, Glasgow, C.1.
Whiteleys Wholesale, Gartside Street, Deansgate, Manchester, Blackfriars 7773.
Whitworth Elec. Lamp Co., Ltd., 6/10, Gorleston Street, West Ken., London, W.14. Fulham 4221. 1, Back of the Walls, Bernard Street, Southampton, Hants. Southampton 6564.
Wholesale Radio Supplies Co., 126, High Road, Leyton, London, E.15. Leytonstone 1396. Leytonex, Leyton.
Wilday and Sons, J., Stanley Works, Bond Street, Birmingham. Central 1004.
Wildbores, 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.
Wilrose Co. (Birmingham), Ltd., Atmos House, 47, Cornwall Street, B'ham. Central 3813.
Wireless-Electric (Wholesale), Ltd., 23/24, North Street, Bristol 1. Bristol 24505. 79B, Holdenhurst Road, Bournemouth, Bournemouth 2882.
Wolsey (Radio and Allied Trades) Wholesale, Ltd., 54, Lamb's Conduit Street, London, W.C.1. Holborn 6455.
Wood, E. A., 100, Aston Road, Birmingham. Aston Cross 2595/6. 105/7, John Bright Street, Birmingham. Midland 4334/5. Crutches, Birmingham. 80, 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, R. C., Pertrix House, 18/19, Hills Terrace, Cardiff. Cardiff 641. Wood, 641, Cardiff. Pertrix House, 22, Park Street, Swansea. Swansea 3385. Wood 3385, Swansea.
Wood and Cairns, Ltd., Argyll House, 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 2910. Equipment.
Woolfson, Ltd., P., 165, Trongate, Glasgow, C.1. Bell 3460. Clocks, Glasgow.
Wrights Midland Electrical Co., Ltd., 113, Coleshill Street, Birmingham 4. Central 1096.

## Y

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.

## Z

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. Fairfield 4131/2. 50, Wellington Street, Glasgow. Central 228, Orme Bldgs., Parsonage, Manchester. Blackfriars 0915/6. 15, Lisle Street, Northumberland Street, Newcastle-on-Tyne. Newcastle 26789. 48, Friar Lane, Nottingham. Nottingham 2838. 48, Queen Street, Derby. Derby 1985.

# TRADE NAMES DIRECTORY

**Inclusion of a trade name in this section of the directory does not necessarily mean the name is registered.**

## A

**Abbey.**—Abbey Engineering Works. Steel tubular masts and aerial accessories.
**Ace.**—John E. Dallas and Sons, Ltd. Gramophone.
**Ace.**—Telsen Electric Co., Ltd. L.F. transformer.
**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.
**Adelec.**—Adams Bros. and Burnley, Ltd. General trade mark.
**Aerialite.**—Aerialite, Ltd. General trade mark.
**Aerialite Levenstrand.**—Aerialite, Ltd. Eleven strand insulated aerial wire.
**Aeromonic.**—Jas. Christie and Sons, Ltd. Components.
**Aerodyne.**—Aerodyne Radio, Ltd. General trade mark.
**Aide-de-Camp.**—L. E. Parkes. Receivers and rectifiers.
**Air-Marshall.**—L. E. Parkes. Rectifier valve.
**Airflo.**—Radio Instruments, Ltd. All-mains receivers and radiograms.
**Airmax.**—J. Dyson and Co. (Wks.), Ltd. Plug-in and 6-pin coils.
**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 flax and black adhesive tape.
**Aladdin.**—Aladdin Gramophone and Accessories Co. Sound boxes, automatic brakes, valves, portable gramophone, turntables and cabinets.
**Aladdinite.**—Electrocolor Products, Ltd. Record lubricant.
**Alba.**—A. J. Balcombe, Ltd. General trade mark.
**Albany.**—Carrington Mfg. Co., Ltd. Cabinet.
**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.
**Alhambra.**—Shalless and Evans. Set.
**Alklum.**—Alklum Storage Batteries, Ltd. Batteries and accumulators.
**Alligator.**—Guillaume and Sons, Ltd. Gramophone needles.
**Allscott.**—James Scott and Co. Receivers and radio-gramophones.
**Allwave.**—Allwave International Radio and Television, Ltd. General trade mark.
**Alpax.**—Birmingham Aluminium Casting (1903) Co., Ltd. Aluminium alloy.
**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.
**Ambassador.**—Carrington Manufacturing Co., Ltd. Cabinet.
**Amplion.**—Amplion (1932), Ltd. General trade mark.
**Amsooite.**—Siemens Elec. Lamps and Supplies, Ltd. Composite insulating material.
**Ancalite.**—Callender's Cable and Construction Co., Ltd. Electric cable.
**Andy.**—Beaufoy, Grimble, Ltd. Accumulator carriers.
**Ankaflex.**—Callender's Cable and Construction Co., Ltd. Unkinkable flexible cord.
**Anodex.**—S. Smith and Sons (M.A.), Ltd. Dry batteries.
**Ansil.**—Gresley Radio, Ltd. Components.
**Antinodal.**—Radio Instruments, Ltd. Short wave adaptor.
**Antistat.**—Lamplugh Radio, Ltd. Aerial unit.
**Antoria.**—J. T. Coppock. Gramophones.
**Apex.**—J. Bennett Heyde and Co. Turntable discs (cork).
**Apollo.**—Accles and Pollock, Ltd. Steel telescopic aerial masts and tubular box spanners.
**Apollo.**—Baxter, Stavridi and Craies, Ltd. Playing-desks, pick-ups, and gramophones.
**Ardwick.**—Runbaken Magneto Co., Ltd. Battery chargers.
**Arega Radio.**—Precision Electric, Ltd. Receivers.
**Aresco.**—Radio Service Co. Receivers, eliminators, radio-gramophones and loudspeakers.
**Argyll.**—Carrington Mfg. Co., Ltd. Cabinet.
**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 Co., Ltd. Car radio.
**Ashley-Ledward.**—Ashley Wireless Telephone Co. (1925), Ltd. Resistance.
**Ashley Radio.**—Ashley Wireless Telephone Co. (1925), Ltd. Sets, amplifiers and components.
**Ashton.**—Ashton's Wireless Depot. General trade mark.
**Aston.**—Carrington Mfg. Co., Ltd. Cabinet.
**Athco.**—A. T. Harrison and Co. Resistors, grid leaks, bakelite tools and mouldings.
**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.
**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.
**Autogram.**—Amplion (1932), Ltd. Radiogramophone.
**Autokoil.**—A. W. Hambling and Co. Tuner.

## TRADE NAMES

**Automatic Tension.**—J. G. Beddoes, Ltd. Automatic safety lock.
**Autovalve.**—Westinghouse Electric International Co. Lightning arrestors.
**Aveco.**—Willmott, Son and Phillips, Ltd. Insulating tape and fibre.
**Avecolite.**—Willmott, Son and Phillips, Ltd. Bakelite sheets, rods and tubes.
**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.**—Goodmans (Clerkenwell), Ltd. Speakers.
**A.A.**—Linolite, Ltd. Earth clip.
**A.B.C.**—Allwood Blackband and Co. Gramophone needles.
**A.C.C.O.**—Alpha Coil and Component Co. Components.
**A.C. Co.**—Alpha Coil and Component Co. Components.
**A.D.**—Le Carbone, Ltd. Batteries and cells.
**A.E.F.**—A.E.F. Manufacturing Co. Accumulators.
**A.R.G.**—Ambassador Radio Gramophones. Pick-ups and electric induction motors.
**A.J.D.**—A. J. Dew and Co., Ltd. Products.
**A.J.H.**—A. J. Hewitt, Ltd. General trade mark.

## B

**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.
**Bantam.**—Reproducers and Amplifiers, Ltd. Speaker.
**Barto.**—J. G. Coates, Ltd. Relay apparatus and components.
**Baty.**—E. J. Baty. Receivers, speakers, and mains units.
**Bayliss.**—W. Bayliss, Ltd. General trade mark.
**Beanco.**—Baxendale and Co., Ltd. Gramophones.
**Bear Brand.**—G. Bowerman, Ltd. H.T. batteries.
**Beasal.**—Beardsall and Co., Ltd. Speakers, batteries and sets.
**Bebe.**—Sydney S. Bird and Sons, Ltd. Variable condensers.
**Bebelog.**—Sydney S. Bird and Sons, Ltd. Baby logarithmetic condensers.
**Becker.**—G. Becker, Ltd. Switches.
**Becol.**—British Ebonite Co., Ltd. Ebonite.
**Becolate.**—British Ebonite Co., Ltd. Composite material.
**Beethoven.**—Beethoven Radio, Ltd. General trade mark.
**Belco.**—Nobel Chemical Finishes, Ltd. Wood finishes for cabinets.
**Bell.**—J. and J. Laker Co., Ltd. Aerial insulators.
**Belling Lee.**—Belling and Lee, Ltd. General trade mark.
**Belmont, British Belmont Radio, Ltd. Receivers.**
**Beltona.**—Murdoch Trading Co. Gramophone records.
**Benchrack.**—B. Thomas. Storage trays for small parts.
**Benbyco.**—J. Bennett, Heyde and Co. Colloidal graphite grease.
**Benjamin.**—Benjamin Electric Ltd. Components.
**Bepu.**—Multitone Electric Co., Ltd. Class B driven transformers.
**Berclif.**—Berclif, Ltd. Sets and components.
**Berco.**—British Electric Resistance Co., Ltd. Fixed and variable resistances, rheostats and resistance wire.
**Berkeley.**—Halford Radio, 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.
**Binode.**—Mullard Wireless Service Co., Ltd. Valves.
**Birmabright.**—Birmingham Aluminium Casting (1903), Ltd. Aluminium alloy.
**Birmal.**—Birmingham Aluminium Casting (1930), Ltd. Registered Trade Mark.
**Birmasil Special.**—Birmingham Aluminium Casting (1903), Ltd. Aluminium alloy.
**Birmite.**—E. Elliott. Synthetic resin mouldings.
**Biscar.**—Cleveleys Engineering Co. Cone aerial.
**Biscolac.**—Bakelite, Ltd. Lacquer.
**Blackfriars.**—Spicers, Ltd. Black adhesive tape and sleeving.
**Blackley.**—Connollys (Blackley), Ltd. Insulating tape.
**Bligh.**—S. W. Bligh. Set and accessories.
**Blue Comet.**—Blue Comet, Ltd. General trade mark.
**Blue Spot.**—British Blue Spot Co., Ltd. General trade mark.
**Boley.**—S. Wolf and Co., Ltd. Precision machine tools.
**Booster.**—Graham Farish Ltd. H.T. Economiser unit.
**Bowerman's.**—George Bowerman, Ltd. Headphones, speakers and cone units.
**Bowl.**—Kingsway Radio, Ltd. Speaker.
**Bridge Megger.**—Evershed and Vignoles, Ltd. Testing instruments.
**Brilliant Label.**—Columbia Graphophone Co., Ltd. Needles.

**Brimar.**—Standard Telephones and Cables, Ltd. Valves.
**Britannia.**—Britannia Lathe and Oil Engine Co., Ltd. Lathe and tools.
**Britannia.**—Britannia Rubber and Kamptulicon Co., Ltd. Ebonite.
**Britannic.**—Ever Ready Co. (Great Britain), Ltd. Dry cell.
**Britinol.**—Bi-Metals. Soldering outfits, cored wire, paste solders and flux.
**British.**—British Battery Co. H.T. dry batteries.
**British Radiogram.**—British Radio Gramophone Co., Ltd. Kit factors.
**British Wolf.**—S. Wolf & Co., Ltd. Portable electric tools.
**Britkam.**—Britannia Rubber and Kamptulicon Co., Ltd. Ebonite and all rubber goods made by the company.
**Broadcaster.**—J. and A. Margolin. Gramophones.
**Broadway.**—Rose, Morris and Co. General trade mark.
**Browne and Sharpe.**—Buck and Hickman, Ltd. Fine tools.
**Brownie.**—R.C. and Wilson Elec., Ltd. Crystal sets and permertectors.
**Brunpoint.**—Brunswick Ltd. Semi-permanent needles.
**Brunswick.**—Brunswick, Ltd. General trade mark.
**Buckman.**—Buck and Hickman, Ltd. Precision gauges.
**Bulgin.**—A. F. Bulgin and Co., Ltd. General 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.
**Burgoyne.**—Burgoyne Wireless (1930), Ltd. Sets.
**Burrell.**—Shalless and Evans, Ltd. Receivers.
**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, amplifiers and receivers.
**B.B.**—George Bowerman, Ltd. Duralumin headbands.
**B.B.B.**—H. E. Kettle, Ltd. H.T. batteries.
**B.B.Co.**—British Battery Co. G.B. battery.
**B.C.N.**—B.C.N. Co. Non-metallic gramophone needles.
**B.E.M.**—British Electric Meters, Ltd. General trade mark.
**B and H.**—B and H. Valve Co. Valves.
**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.

## C

**Cabinet Cone.**—Goodmans (Clerkenwell), Ltd. Cone speaker.
**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.
**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 backets.
**Capehart.**—Giffens (London), Ltd. Automatic record changer.
**Capitol.**—Hobday Bros., Ltd. Components and accessories.
**Carborundum.**—Caradio Services, Ltd. Crystal detectors.
**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.
**Cathode.**—Lithanode Co., Ltd. Accumulators.
**Celastoid.**—British Celanese, Ltd. Non-flam. celluloid sheets.
**Celec.**—Curtis Manufacturing Co., Ltd. Resistances.
**Celestion.**—Celestion, Ltd. General trade mark.
**Celestrola.**—Celestion, Ltd. Loud speakers.
**Cellotone.**—Runwell Cycle Co., (Birmingham), Ltd. Gramophones, sound boxes and needles.
**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.

## TRADE NAMES

**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.**—Reproducers and Amplifiers, Ltd. P.M.-M.C. speaker.
**Challenger.**—Riddiough and Son. Dry batteries.
**Champion.**—Hobday Bros., Ltd. Portable receiver.
**Chaslyn.**—J. H. Collie and Co. Hydrometers and gravity balls.
**Chassiset.** Six-Sixty Radio Co., Ltd. Receiver.
**Chippendale.**—Halford Radio, 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.
**Chromostat.**—Radio Mfg. Co., Receivers.
**Clarion.**—Octron, Ltd. Radio valves.
**Clarion.**—Clarion Radio Valve Co. Valves.
**Claristal.**—Ward and Goldstone, Ltd. Aerial set.
**Claritone.**—Ashley Wireless Telephone Co. (1925), Ltd. Headphones, components and speakers.
**Clarostat.**—Claude Lyons, Ltd. Controls, grid-leaks.
**Classic.**—Goodmans (Clerkenwell), Ltd. Moving coil speaker.
**Classic.**—A. E. Shearing, Ltd. Components.
**Clayton.**—Clayton (Rubber Sales), Ltd. Ebonite.
**Clearer-Tone.**—Benjamin Electric, Ltd. Valve holder.
**Clearertone.**—Benjamin Electric, Ltd. Anti-microphonic valveholders.
**Cleartone.**—Anderson Clark and Moir, 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 cement.
**Coliseum.**—Shalless and Evans, Ltd. Receiver.
**Collaro.**—Collaro, Ltd. General trade mark.
**Collett.**—S. H. Collett Manufacturing Co. Aerial pulley and components.
**Collings.**—N. R. Collings and Co. Bookcase pedestals and playing desks.
**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.
**Comet.**—London Commercial Electrical Stores, Ltd. Switch.
**Compax.**—Wingrove and Rogers, Ltd. Variable condensers.
**Competa.**—A. F. Bulgin and Co., Ltd. Components.
**Concord.**—Concordia Electric Wire Co., Ltd. Extension flexibles and cables.
**Concordin.**—Concordia Electric Wire Co., Ltd. Resistance wire.
**Condensite.**—Bakelite, Ltd. Insulating materials.
**Connectite.**—Concordia Electric Wire Co., Ltd. Connecting wire.
**Connexit.**—Saxon Radio Co. Insulated wire.
**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 concs.
**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.
**Corner Cabinet.**—Jonathan Fallowfield, Ltd. Cabinet set.
**Coronet.**—Faudels, Ltd. Receivers.
**Cortabs.**—Money Hicks, Ltd. Tags for marking connecting wires.
**Cosmocord.**—Cosmocord, Ltd. Pick-ups and potentiometers.
**Cossor.**—A. C. Cossor, Ltd. General trade mark.
**Crabtree.**—J. A. Crabtree and Co., Ltd. General trade mark.
**Cranley.**—Cranley Radio, Ltd. Receivers, radiograms and amplifiers.
**Crawford.**—Romac Motor Accessories, Ltd. Jacks.
**Cressall.**—Cressall Manufacturing Co. Asbestos resistance nets and rheostats.
**Crisptone.**—R. O. Bridger and Co., Ltd. Superpaper cones.
**Cromaloy.**—A. C. Scott and Co., Ltd. Wires and resistances.
**Cromwell.**—Cromwell (Southampton), Ltd. Receivers.
**Crown.**—J. Leibovici. Accessories.
**Cruiser.**—British Lumophon Co. Kits.
**Crypto.**—Lancashire Dynamo and Crypto, Ltd. 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.
**Cumbria.**—Novo Radio Electric Ltd. Super-het receiver.
**Curry.**—Curry's 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.
**Cynthex.**—Acton Battery Co., Ltd. H.T. and G.B. batteries.
**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.**—Clayton Rubber Sales, Ltd. Ebonite.
**C.R.L.**—R. A. Rothermel, Ltd. Rheostat, potentiometer and modulator.
**C.T.S.**—St. Helen's Cable and Rubber Co., Ltd. Electric cable.

## D

**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.**—Wrights Midland Electrical Co. 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.
**Dekkor.**—Adam Hilger, Ltd. Optical devices for engineers.
**De Luxe Label.**—Columbia Graphophone Co., Ltd. Needles.
**Dexim.**—Lissen, Ltd. Batteries.
**Dial.**—Plowden and Thompson, Ltd. Glass tubing, laboratory apparatus, and glass battery tubes.
**Dialite.**—A. F. Bulgin and Co., Ltd. Panel mounting light.
**Dido.**—Kay Bros., Ltd. Cement for celluloid, ebonite, etc.
**Difeed.**—Radio Instruments, Ltd. L.F. transformer.
**Dimic.**—McMichael Radio, Ltd. Coil.
**Disc.**—Graham Farish, Ltd. H.F. choke.
**Discompax.**—Wingrove and Rogers, Ltd. Variable condensers.
**Disque.**—Disque Cabinet Co., Ltd. Cabinets.
**Distavox.**—Distavox, Ltd. General trade mark.
**Dix-Ohmeter.**—Leslie Dixon Switchgear Co. Resistance meter.
**Dix-Wattmeter.**—Leslie Dixon Switchgear Co. Power meter.
**Doelcam.**—McLeod and McLeod. Sleeving (Varnished insulating).
**Dominion.**—Carrington Mfg. Co., Ltd. Cabinet.
**Domino.**—Thos. R. Ellin (Footprint Works), Ltd. Tools.
**Donophone.**—Donophone Public Address Co., Ltd. General trade mark.
**Doric.**—T. O'Brien, Ltd. Cabinets.
**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.
**Dreadnought.**—Lionel Hart, Ltd. H.T. and P.L. batteries.
**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.
**Dubilier.**—Dubilier Condenser Co. (1925), Ltd. General trade mark.
**Duco.**—Brown Brothers, Ltd. Components.
**Dulcetto.**—Dulcetto Polyphon, Ltd. General trade mark.
**Dulux.**—Nobel Chemical Finishes Ltd. Enamels and paints.
**Dumolite.**—Dew and Co., Ltd., A. J. Accumulators and battery tester.
**Duplex.**—McMicheal 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 aerials.
**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 (Wireless), Ltd. Air cored auto S.W. inductance.
**Dynatron.**—H. Hacker and Sons. Radiograms. and receivers.
**D.C.**—Buck and Hickman, Ltd. Screw placers.
**D.E.U.**—McLeod and McLeod. Bobbins, boxes, etc., for batteries, etc., in papier maché.
**D.X.**—J. T. Nichols, Ltd. General trade mark.

# E

**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.
**Earl.**—Earl Manufacturing Co., Ltd. Moving coil speakers.
**Easifil.**—S. Gulterman and Co. Distilled water carrier.
**Easifix.**—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.
**Ebonestos.**—Ebonestos Insulators, Ltd. Moulded plastic, bakelite and other synthetic materials.
**Ebonex.**—Money Hicks, Ltd. Engraved labels.
**Ebonoid.**—Clayton Rubber Sales, Ltd. Mouldings.
**Ecco.**—Ecco Battery Co., Ltd. Wireless batteries.
**Eccoradio.**—Ecco Radio, Ltd. Receivers.
**Eclipse.**—James Neill and Co. (Sheffield), Ltd. Permanent magnets.
**Eddystone.**—Stratton and Co., Ltd. Short wave sets and components, and transmitting coils.
**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.
**Ekco.**—E. K. Cole, Ltd. General trade mark.
**Ekcozene.**—E. K. Cole, Ltd. Mouldings.
**Eldeco.**—Eldeco Radio, Ltd. General trade mark.
**Electone.**—F. J. Gordon and Co., Ltd. Automatic programme selector.
**Electra.**—Vee Cee Dry Cell Co. (1927), Ltd.
**Electrad.**—R. A. Rothermel, Ltd. Resistances and potentiometers.
**Electrocets.**—Electrocet Radio Co. General trade mark.
**Electrocolor.**—Electrocolor Products, Ltd. Non-metallic needles and repointers.
**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.
**Elektron.**—Birmingham Aluminium Casting (1903), Ltd. Magnesium alloy.
**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.
**Eltax.**—Acton Battery Co., Ltd. H.T. and G.B. batteries.

## TRADE NAMES

**Embassy.**—British Needle Co., Ltd. Gramophone needles.
**Embassy.**—Carrington Manufacturing Co., Ltd. Cabinet.
**Embassy.**—Shalless and Evans, Ltd. Receiver.
**Emicol.**—Electrical Measuring Instruments Co. Meters and Servicing apparatus.
**Emitta.**—Barnard Accumulator Co. Accumulators.
**Emitta.**—Shalless and Evans, Ltd. Receiver.
**Emkabe.**—Emkabe Radio Co., Ltd. General trade mark.
**Emo.**—George Emmott (Pawsons), Ltd. Mainsprings for gramophone motors.
**Empire.**—Carrington Manufacturing Co., Ltd. Cabinet.
**Empire.**—Micanite and Insulators Co., Ltd. Insulating material.
**Empire.**—Manufacturers' Accessories Co. (1928), Ltd. Battery.
**Empire Three.**—Mains Power Radio, Ltd. Receiver.
**Empire Sixty.**—Efandem Co., Ltd. H.T. battery.
**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.
**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.**—Epoch Radio Mfg. Co., Ltd. General trade mark.
**Equator Super.**—G. Scott Sessions and Co. S.W. sets.
**Equilode.**—Whiteley Electrical Radio Co., Ltd. Extension speakers.
**Erie.**—Radio Resistor Co.
**Erie.**—Erie Resistor, Ltd. General trade mark.
**Erinoid.**—Erinoid, Ltd. Insulating material.
**Erl.**—Ecco Radio, 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.
**Eta.**—Eta Tool Co. Tools and coil winding machines.
**Ethartrope.**—British Radio Corpn., Ltd. Amplifiers and P.A. equipment.
**Ether Master.**—A. E. Andrews and Co. Coils and sets.
**Etheron.**—St. Helens Cable and Rubber Co., Ltd. Ebonite panel.
**Ethodyne.**—Burndept, Ltd. Receivers.
**Ethovernier.**—Burndept, Ltd. Slow motion dials.
**Eureka.**—London Electric Wire Co. and Smiths, Ltd. Resistance wire.
**Eureka.**—L. Person and Son. General trade mark.
**Evac.**—Evac, Ltd. Batteries.
**Everlast.**—Midland Wireless Co. Batteries.
**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.
**Ewebec.**—Evington Electrical Mfg. Co. Coil former.
**Excel.**—S. H. Collett Manufacturing Co. Terminal tags and fuses.
**Excelsior.**—Carrington Mfg. Co., Ltd. Cabinet.
**Excelsior.**—Ward and Goldstone, Ltd. Resistance wire.
**Exide.**—Chloride Electrical Storage Co., Ltd. Accumulator.
**Exponential Five.**—Charlton Higgs (Radio), Ltd. Receivers.
**Expresvolt.**—Express Radio Factors, Ltd. H.T. batteries.
**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.D.L.**—Electric Depot, Ltd. Accumulator charging equipment.
**E.S.C.**—English Steel Corporation, Ltd. Permanent magnets.
**E.85.**—Reproducers and Amplifiers, Ltd. Speakers.

## F

**Facile.**—Ross Courtney and Co., Ltd. Terminals.
**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.**—Colvern, Ltd. Iron core tuning coils and intermediates.
**Ferrocart.**—British Ferrocart Co., Ltd.
**Fitzall.**—Peto Scott Co., Ltd. Cabinets.
**Filt.**—Graham Farish, Ltd. Percolative earth.
**Filtron.**—Amplion (1932), Ltd. Trickle charger and earthing device.
**Flag.**—Ever Ready Co. (Great Britain), Ltd. Dry cell.
**Flatta.**—Barrow, Hepburn and Gale, Ltd. Patent handles for portable cases.
**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.
**Footprint.**—Thos. R. Ellin (Footprint Works), Ltd. Tools.
**Formapex.**—Ioco Rubber and Waterproofing Co., Ltd. Bakelite type miocarta and varnish.
**Formica.**—Willmott, Son and Phillips, Ltd. Laminated bakelite sheets, rods and tubes.
**Formite.**—Bakelite, Ltd. Insulating materials.
**Formo.**—Formo Products, Ltd. Components.
**Formo Densor.**—Formo Products, Ltd. Pre-set condenser.
**Fotos.**—Concerton Radio and Electrical Co., Ltd. General trade mark.
**Four in One.**—British Homophone Co., Ltd. Records.
**Foursquare.**—Goodmans (Clerkenwell), Ltd. Speakers.
**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.
**Fybros.**—Willmott, Son and Phillips, Ltd. Homogeneous vulcanised fibre rods.
**Fydelitone.**—Bakers Selhurst Radio, Ltd. Speakers.
**F.A.V.**—F. Brown, Ltd. Valve holder.
**F.M.C.**—Fairfield Mfg. Co. Receiver.
**F.W.F.**—F.W.F. and Son. Rectifiers.

## G

**Galloy.**—Climax Radio Electric, Ltd. Earth tubes.
**Galvanic.**—Gresley Radio, Ltd. Earth tube.
**Gambrell.**—Halford Radio, 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.
**Garrick.**—Shalless and Evans, Ltd. Receiver.
**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.

## TRADE NAMES

**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.
**General Instruments.**—R. A. Rothermel, Ltd. Variable condensers.
**Georgian.**—Halford Radio, Ltd. Receivers.
**Gilbert.**—C. Gilbert and Co., Ltd. General trade mark.
**Giplex.**—General Inductance Co. Pressboard sheet and tubes.
**Givrite.**—Le Carbone, Ltd. Carbon resistances.
**Gladiator.**—Murdoch Trading Co. Batteries.
**Glasorwood.**—Eagle Transfer, Ltd. Transfers.
**Glazite.**—London Electric Wire Co. and Smith's, Ltd. Insulated instrument wire.
**Globe.**—Shalless and Evans, Ltd. Receiver.
**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.
**Gold Seal.**—Acton Battery Co., Ltd. H.T. and G.B. batteries.
**Golden Arrow.**—J. Toubkin. Loudspeaker and 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.
**Grampian.**—Grampian Reproducers, Ltd. Speaker units.
**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.**—Manuwares, Co. Multi-plug adaptors.
**Gresley.**—Gresley Radio, Ltd. General trade mark.
**Griffin faturan.**—Maul and Murphy, Ltd. Bakelite sheet.
**Grippleshell.**—Partridge, Wilson and Co., Ltd. Aerial insulator.
**Gripso.**—Gripso Co. General trade mark.
**Grosvenor.**—Carrington Mfg. Co., Ltd. Cabinet.
**Grosvenor.**—Grosvenor Electric Batteries, Ltd. Dry batteries.
**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 Radio, Ltd., Superhet chassis.
**G.H.**—Claude Lyons, Ltd., Laboratory apparatus.
**G.W.Z.**—British G.W.Z. Battery Co., Ltd. Dry Batteries.

## H

**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.
**Handy.**—Lehmann, Archer and Lane, Ltd. Carded tools.
**Harbros.**—Hart Bros. Electrical Mfg. Co., Ltd. General trade mark.
**Harlie.**—Harlie Ltd. Components and accessories.
**Harp.**—N. R. Collings and Co. Speakers.
**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.
**Herculacker.**—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.
**Heron.**—Henry Righton and Co., Ltd. Non-ferrous metals.
**Hesco.**—Octron Ltd. Valves.
**Het.**—Univolt Electric, Ltd. Indoor aerial.
**Heussen.**—Blitz Bros. Valves.
**Hexa.**—F. C. Hill and Co., Ltd. General trade mark.
**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.
**Hobut.**—Howard Butler, Ltd. General trade mark.
**Hoetanic.**—L.P.S. Electrical Co., Ltd. Resistance wire.
**Holbro.**—Holmes Bros. (London), Ltd. Cabinets.
**Holdtite.**—S. H. Collett Mfg. Co. Battery clips.
**Hoynes.**—All Power Transformers, Ltd. Transformer.
**Hoyt.**—F. J. Gordon and Co., Ltd. Testing instruments.
**Huber.**—McLeod and McLeod, Ltd. Wire (silk-covered.)
**Hudson.**—Hudson Record Co., Records.
**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. Miniature 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. and H.**—Hildick and Hildick. Telescopic masts.
**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.

## I

**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.
**Igranicor.**—Igranic Elec. Co., Ltd. Metal core tuning coils.
**Igranipak.**—Igranic Elec. Co., Ltd. Tuning unit.
**Igranite.**—Igranic Electric Co., Ltd. Insulating varnish.

**Igranovox.**—Igranic Electric Co., Ltd. Pick-up.
**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 accessores.
**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 Hilgen, Ltd. Trade mark for special spectroscopic accessories.
**Invincible.**—Goodmans (Clerkenwell), Ltd. Moving coil speaker.
**Ionic.**—Ionic Alkaline Batteries, Ltd. Battery.
**Itonaphone.**—H. J. Goulden, Ltd. Valve sets.
**Itonia.**—Itonia Ltd. Gramophone products.
**Ivalek.**—Ivory Electric. General trade mark.
**Ivorex.**—Money Hicks, Ltd. Engraved labels.

## J

**Jacelite.**—J. A. Crabtree and Co., Ltd. Moulded B.S. gauge, plugs and sockets, tumbler switches.
**Jacobean.**—Halford Radio, Ltd. Receivers and radiograms.
**Janette.**—R. A. Rothermel, Ltd. Rotary converters.
**Jedson.**—John E. Dallas and Sons, Ltd. Gramophones.
**Jelectro.**—Barnard Accumulator Co. (Jelly Electrolyte) accumulators.
**Jockey.**—Connollys (Blackley), Ltd. Adhesive tape.
**Joyster.**—F. M. Storey. H. T. batteries.
**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.

## K

**Kabi.**—F. W. Lechner and Co., Ltd. General trade mark.
**Kabilok.**—W. and T. Lock, Ltd. Wireless cabinets.
**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.
**Karadio.**—Lancashire Dynamo and Crypto, Ltd. Car battery charger.
**Kayvee.**—Kemps Vulcansing Co., Ltd. Accumulators.
**Kelsey.**—Peto Scott Co., Ltd. Shortwave adaptor.
**Ken.**—E. Kerridge and Co. Indoor aerial.
**Kenwell.**—Kenwell Radio, Ltd. Receivers and radiograms.
**Keramot.**—Siemens Elec. Lamps and Supplies, Ltd. Insulating material.
**Kestra.**—G. Castagnoli. Radio-gramophone outfits, valve sets, amplifiers and components.
**Keystone.**—Peto Scott Co., Ltd. Condensers and H.F. chokes.
**Kidkord.**—British Homophone Co., Ltd. Records.
**Kinva.**—Postlethwaite Bros. General trade mark.
**Kitten.**—Kolster-Brandes, Ltd. Receiver.
**Klinx.**—Kay Bros., Ltd. Heat-proof cement.
**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.
**Kobra.**—Kolster-Brandes, Ltd. Receiver.
**Koh-i-Noor.**—Primus Manufacturing Co. H.T. batteries.
**Kolstar.**—Kolster-Brandes, Ltd. Super-Het receiver.
**Konekap.**—Graham-Farish, Ltd. Grid leak.
**Konductite.**—City Accumulator Co. Metallic screening paper.
**Koorak.**—Lissen, Ltd. Batteries.
**K.-B.**—Kolster-Brandes, Ltd. Receivers and speakers.
**K.G. Chromotone.**—Radio Reconstruction Co., Ltd. Recording apparatus.
**K.V.**—Kemps Vulcanizing Co., Ltd. Accumulators, ebonite, etc.

## L

**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 Electrical, Ltd. General trade mark.
**Lassophone.**—East Ham Wireless Supplies. Sets, components and accessories.
**Leatheroid.**—Willmott, Son and Phillips, Ltd. Fibre.
**Lebakite.**—Spicers, Ltd. Bakelite sheets, panels, tubes, formers and rods.
**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.
**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.
**Lisenin.**—Lisenin Wireless Co. General trade mark.
**Lissen.**—Lissen, Ltd. Components.
**Lithanode.**—Lithanode Co., Ltd. Accumulators.
**Litlos.**—Graham-Farish, Ltd. Variable condensers.
**Lively "O."**—Oldham and Son, Ltd. Accumulators, L.T. and H.T.
**Lockwood.**—Lockwood Casework Mfg. Co. General trade mark.
**Loewe Radio.**—Loewe Radio Co., Ltd. General trade mark.
**Logohm.**—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.

## TRADE NAMES

Lorival.—Lorival Manufacturing Co. (1921), Ltd. Mouldings.
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.
Lumophon.—British Lumophon Co. General trade mark.
Lunmet.—London Metal Warehouses, Ltd. Insulated terminals.
L.E.M.—McLeod and McLeod, Ltd. Wound bobbins.
L.E.S.—L.E.S. Distributors, Ltd. Earth tubes.
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.

## M

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.—Benjamin Electric, Ltd., Speakers.
Magna-flux.—Watson, Saville and Co., Ltd. Magnet steel, cobalt and tungsten magnets.
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.
Marbalite.—Clayton (Rubber Sales), Ltd. Ebonite sheets and panels.
Marconi.—M. O. Valve Co., Ltd. Valves.
Marconi.—Marconiphone Co., Ltd. Valves.
Marconiphone.—Marconiphone Co., Ltd. Sets, speakers.
Marlborough.—Electrical and Radio Products (1931), Ltd. Receiver and radiogram.
Massicore.—W. B. Savage. Mains components.
Mastertone.—John E. Dallas and Sons, Ltd. Gramophone.
Mastiff.—Ward and Goldstone, Ltd. Spring connectors.
Matched Tone.—Kolster-Brandes, Ltd. Headphones.
Maxitone.—Lugton and Co., Ltd. General trade mark.
Mavox.—Mavox All Electric Radio. Mains receivers.
Max.—Graham-Farish, Ltd. Parallel feed transformer.
Mazda.—Edison Swan Electric Co., Ltd. Valves.
Mazelite.—M. Feldman. Crystals.
Medium Resistance.—J. Sankey and Sons, Ltd. Transformer laminations.
Megger.—Evershed 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.
Melodes.—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.
Mercure.—Ward and Goldstone, Ltd. Charging plant.
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.
Messenger.—Lionel Hart, Ltd. H.T. and P.L. batteries.
Metaplex.—Peto Scott Co., Ltd. Metallised baseboard.
Metcraft.—Marks and Son, S. General trade mark.
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.
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.
Mika-Densor.—Formo Products Ltd. Mica fixed condensers.
Millgate.—Chorlton Metal Co., Ltd. General trade mark.
Milnes.—Milnes Radio Co., Ltd. H.T. supply unit from L.T. accumulator Speakers and battery sets.
Minivo.—Formo Products Ltd. Battery eliminators.
Minor.—Shalless and Evans, Ltd. Receiver.
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.
Monarch.—Carrington Mfg. Co., Ltd. Cabinet.
Monix.—Money Hicks, Ltd. Components.
Monosonic.—Primus Manufacturing Co. Sets.
Morlicore.—Morleys. Iron-cored coils.
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.
**Multitest.**—Gambrell Bros. and Co., Ltd. Combiner voltmeter, milliameter and ammeter.
**Multivo.**—Formo Products Ltd. Battery eliminators.
**Multi-Volt.**—Varley. Power transformers.
**Mumax.**—Climax Radio Electric Ltd. L.F. transformer.
**Musola.**—Tyrela Gramophones, Ltd. Gramophones.
**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. Set, amplifier and components.
**M.L.**—Rotax, Ltd. General trade mark.
**M. and M.**—McLeod and McLeod, Ltd. General trade mark.
**M.R.**—Mains Radio Mfg. Co. General mark.

## N

**Nail.**—E. Allen and Co., Ltd. Magnet.
**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.
**Neawid.**—Imp Radio Co. Tapped potential dividers heavy duty resistances and potentiometers.
**Neawid-Superflex.**—Imp. Radio Co. Spaghetti type resistances.
**Necol.**—Nobel Chemical Finishes, Ltd. Enamels for metal parts, speakers, etc.
**Needle Tension.**—Dawes Clark & Co. Soundbox diaphragms.
**Negrolac.**—Ward and Goldstone, Ltd. Indoor and outdoor aerials.
**Neutron.**—Neutron (1927), Ltd. Crystals, components and valves.
**Neutron.**—Wolsey (Radio and Allied Trades) Wholesale, Ltd.
**Neutrovernia.**—Gambrell Bros. and Co. Ltd., Neutrodyne and balancing condenser.
**New Empire.**—Victor Battery Co. Dry Batteries.
**New Mascot.**—Churchmans, Ltd. General trade mark.
**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.
**Nigen.**—Formo Products, Ltd. Nickel alloy transformer.
**Nine Lives.**—Boynton and Co., Ltd. Batteries.
**Nivex.**—Runbaken Magneto, Ltd. Meters.
**Nodalizer.**—Ward and Goldstone, Ltd. Potentiometers.
**No-Mast.**—" No-Mast " Patent Aerial Co. Special mastless outdoor (or indoor) aerial.
**No-Mast.**—Caradio Services, Ltd. Aerial.
**No-Mast.**—Central Equipment, Ltd. Aerial.
**Non-Jam.**—J. and J. Laker Co., Ltd. Aerial pulley.
**Norma.**—Norma Technical Products, Ltd.—Soundbox.
**Noroco.**—Wilrose Co. (Birmingham), Ltd. Non-rotary D.C.-A.C. converter.
**Northumbria.**—Novo Radio-Electric, Ltd. Receivers.
**Nosco.**—Northern Steel and Hardware Co., Ltd. Batteries and accumulators.
**Noshok.**—E. W. Bonson. Sockets and couplers.
**Novotone.**—Gambrell Bros. and Co., Ltd. Tone compensator for electrical reproduction of records.
**Nu-Glo.**—Mervyn Sound and Vision Co., Ltd. Television lamps.
**Nutone.**—Carrington Mfg. Co., Ltd. Cabinet.
**Nuvolion.**—Nuvollon Electrics, Ltd. Speakers, P.A. equipment and relay apparatus.
**N.B.L.**—Northern Batteries, Ltd. Batteries.
**N.P.**—N.P. Electrical Co. General trade mark.

## O

**Obo.**—A. E. Andrews and Co. General mark.
**Octacros.**—Synchrophone, Ltd. Records.
**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.
**Organola.**—Gresley Radio, Ltd. Radio-gramophone.
**Orgola.**—Mullard Wireless Service Co., Ltd. General trade mark.
**Original.**—Lehmann, Archer and Lane, Ltd. Tools, taps and dies.
**Ormond.**—Ormond Engineering Co., Ltd. Components.
**Orr.**—Orr Radio, Ltd. General trade mark.
**Orthotone.**—Watmel Wireless Co., Ltd. Components.
**Osborn.**—C. A. Osborn. General trade mark.
**Osram.**—General Electric Co., Ltd. Valves.
**Osram.**—M.O. Valve Co., Ltd. Valves.
**Ostar-Ganz.**—Eugene Forbat. General trade mark
**Overnight.**—F. C. Heayberd and Co. Battery charger.
**Oxford.**—Carrington Mfg. Co., Ltd. Cabinet.
**O.K.**—J. Toubkin. Chokes, batteries, speakers.
**O.K. Presspahn.**—Wilmott, Son and Phillips, Ltd.
**O.P. 58.**—Reproducers and Amplifiers, Ltd. Transformers.

## P

**Pakawa.**—Barrow, Hepburn and Gale, Ltd. Patent handles for portable cases.
**Palladium.**—Shalless and Evans, Ltd. Receiver.
**Pam.**—Claude Lyons, Ltd. D.C. and A.C. operated amplifiers.
**Panachord.**—Brunswick, Ltd. Records.
**Panalite.**—Clayton Rubber Sales, Ltd., Ebonite panels and sheets.
**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-filling cabinets.
**Parex.**—E. Parcussi. Components, accessories and metal cabinets.
**Parlophone.**—Parlophone Co., Ltd. Records and needles.
**Parmeko.**—Partridge and Mee, Ltd. General trade mark.
**Passport.**—Hart Collins, Ltd. Receivers and radiogram.
**Paulette.**—Paulls Wireless Stores. General trade mark.
**Pavilion.**—Shalless and Evans, Ltd. Receivers.
**Paxolin.**—Micanite and Insulators Co., Ltd. General trade mark.
**Peace Products.**—Henry Peace, Ltd. General mark.
**Peak.**—W. Andrew, Bryce and Co. Paper and electrolytic condensers.
**Peerless.**—Bedford Electrical and Radio Co., Ltd. Sets and components.
**Peerlex.**—Clarke Bros. (Leicester), Ltd. H.T. batteries.
**Peero.**—Brown Bros., Ltd. Pocket lamp batteries.
**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.

## TRADE NAMES

**Pentrovol.**—Igranic Electric Co., Ltd. Microphone.
**Perco.**—Gre-Solvent Co. Iron cement.
**Percolite.**—Aerialite, Ltd. Chemical percolative earth tubes.
**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.
**Permcol.**—British Hard Rubber Co., Ltd. Non-discolouring ebonite.
**Perpetuum.**—Aladdin Gramophone and Accessories Co. Gramophone motors.
**Pertinax.**—G. L. Scott and Co., Ltd. Insulation and wire.
**Pertrix.**—Britannia Batteries, Ltd. Dry batteries and accumulators.
**Petmecky.**—Murdoch Trading Co. Gramophone needles.
**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.
**Phœnix.**—Phœnix Telephone and Elec. Works., Ltd. Tinsel.
**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-radio generators.
**Pip.**—Graham Farish, Ltd. L.F. transformers.
**Pirouette.**—A. W. Chapman, Ltd. Turntables, for portables, loud speakers, frame aerials, etc.
**Pix.**—British Pix Co., Ltd. General trade mark.
**Pixie.**—L. R. Wood. General trade mark.
**Plaza.**—British Homophone Co., Ltd. Records.
**Plaza.**—E. H. Maisner and Co., Ltd. H.T. batteries.
**Plew.**—Plew Television Ltd. Television apparatus.
**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.F.S.**—Wingrove and Rogers, Ltd. Components.
**Popular.**—Baker's Selhurst Radio. Speakers.
**Popular.**—Carrington Manufacturing Co., Ltd. Cabinet.
**Popular.**—Ever-Ready Co. (Great Britain), Ltd. H.T. batteries.
**Portadyne.**—Portadyne Radio (Whittingham Smith and Co., Ltd.). Sets.
**Portrola.**—Decca Gramophone Co., Ltd. Portable radio-gram.
**Positive Grip.**—Lisenin Wireless Co. Plugs, sockets, spade ends, pin ends, wander plugs, mains sockets.
**Powerlife.**—Primus Manufacturing Co. H.T. pocket and torch batteries.
**Power Purcher.**—Varley. H.T. economiser.
**Precision Unit Cell.**—Northern Batteries, Ltd. H.T. batteries and replacement cells.
**Premierphone.**—Lisenin Wireless Co. Sets.
**Pre-Selec.**—Radio Instruments Ltd. All-mains and battery receivers.
**Prima Donna.**—Aladdin Gramophone and Accessories Co. Sound boxes.
**Primus.**—Primus Manufacturing Co. Cone units and speakers.
**Primus-Autocel.**—Primus Manufacturing Co. H.T. batteries.
**Primustatic.**—Primus Manufacturing Co. Loud-speaker.
**Prisma.**—Mica Mfg. Co., Ltd. Mouldings.
**Progress.**—British G.W.Z. Battery Co., Ltd. H.T. batteries.
**Protexo.**—H. S. Cooke and Co. Safety aerial earth switch.
**Protograph.**—Siemens Schukert (Gt. Britain), Ltd. Record cutting apparatus.
**Puchoke.**—Multitone Electric Co., Ltd. Universal push-pull output choke.
**Puco.**—Multitone Electric Co., Ltd.—Tone control Q.P.P. transformers.
**Pup.**—Kolster-Brandes, Ltd. Receiver.
**Pushback.**—Ward and Goldstone, Ltd. Connecting wire.
**Pylon.**—Time Recorder and Equipment Co. Electric clocks.
**Pyrex.**—J. A. Jobling and Co., Ltd. Insulators.
**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.

## Q

**Quad-Astatic.**—Radio Instruments, Ltd. H.F. choke.
**Quaker.**—McLeod and McLeod, Ltd. Processing oils.
**Queen Anne.**—Halford Radio, Ltd. Receivers and radiograms.
**Queen Anne "de luxe."**—Halford Radio Ltd.—All-wave 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.

## R

**Radcar.**—Cranley Radio Ltd. Car-Radio and car battery chargers.
**Radco.**—Radio Mfg. Co. Receivers.
**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.
**Radiopak.**—British Radiophone, Ltd. Band pass super het tuning unit.

**Radiotrope.**—Thompson Diamond and Butcher. Gramophone to radio conversion unit.
**Radiovox.**—Radiovox Wireless Services, Ltd. Amplifying equipment.
**Radio XXX.**—M. Feldman. Accumulators and crystals.
**Radvaco.**—Blitz Bros. Valves.
**Rally.**—Decca Gramophone Co., Ltd. Portable gramophone.
**Ranger.**—Consolidated Radio Co., Ltd.
**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) Wholesale, Ltd.
**Reactone.**—Sylvex, Ltd. Coils.
**Readic Lex.**—Money Hicks, Ltd. Tags.
**Receptic on.**—Concordia Electric Wire Co., Ltd. Insulated aerial wire.
**Receptru.**—British Radiophone, Ltd. Anti-static down lead.
**Record.**—Ward and Goldstone, Ltd. Dry battery.
**Rectatone.**—Varley. Transformer.
**Red-ditch.**—Clarkes (Redditch), Ltd. Gramophone needles.
**Red Kap.**—London and Provincial Factors, Ltd. Transformers and speaker units.
**Red Lion.**—R. Cadisch and Sons. General trade mark.
**Redmanol.**—Bakelite, Ltd. Insulating materials.
**Red Triangle.**—Peto Scott Co., Ltd. Ebonite panels.
**Refty.**—Davis and Timmins, Ltd. Terminals.
**Regal.**—Spicers, Ltd. Ebonite.
**Regal-Zonophone.**—Columbia Graphophone Co., Ltd. Records.
**Regentone.**—Regentone, Ltd. Mains and battery receivers.
**Regentone.**—Regent Radio Supply Co. Mains units and mains components.
**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.
**Reliance.**—Emaree, Ltd. General trade mark.
**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.**—Rex Gramophone Co., Ltd. Portable gramophones.
**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.
**Rifanoo.**—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.
**Roebuck.**—Buck and Hickman, Ltd. Belting, pulleys and tools.
**Rola.**—British Rola Co., Ltd. Moving coil speakers.
**Rolls-Caydon.**—Consolidated Radio Co., Ltd.
**Ross, Courtney.**—Ross, Courtney and Co., Ltd. Terminals.
**Rotax.**—Rotax Ltd. Battery chargers and valve rectifiers.
**Rothermel-Brush.**—R. A. Rothermel, Ltd. Pick-ups, speakers and microphones.
**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.
**R. and A.**—Reproducers and Amplifiers, Ltd. General trade mark.
**R.A.P.**—R.A.P., Ltd. General trade mark.
**R.C.**—R. C. and Wilson Elec., Ltd. General trade mark.
**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.M.R.**—R.M. Radio, Ltd. Complete receivers.

## S

**Sackville.**—Halford Radio, 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. B. Savage. Fixed condensers.
**Savana.**—Rose, Morris and Co., Ltd. General trade mark.
**Saville.**—Shalless and Evans, Ltd. Receiver.
**Savoy.**—Shalless and Evans, Ltd. Receiver.
**Saxbestos.**—Saxonia Elec. Wire Co., Ltd. Asbestos cord wires.
**Saxon.**—Saxon Radio Co. Components and aerial wire.
**Saxonia.**—Saxonia Electrical Wire Co., Ltd. General trade mark.
**Sbik.**—Willmott, Son and Phillips, Ltd. Lightning arrestors.
**Scientific.**—Scientific Supply Stores (Wireless) Ltd. General trade mark.
**Scientific.**—Stratton and Co., Ltd. Short wave apparatus and receivers.
**Scott Sessions.**—G. Scott—Sessions and Co. General trade mark.
**Scrufuse.**—Belling and Lee, Ltd. Long path wire fuse.
**Seamark.**—C. E. Needham and Brother, Ltd. Coil.
**Seamless.**—R. O. Bridger and Co., Ltd. Moulded paper cones.
**Secos.**—Lissen, Ltd. Batteries.
**Segio.**—S. Guiterman and Co., Ltd. Battery charging clips.
**Selectanet.**—Spong and Co., Ltd. Indoor and outdoor aerials.
**Selectatune.**—C. G. Chalkley. Tuning unit.
**Senator.**—A. F. Bulgin and Co., Ltd. Transformers.
**Serenada.**—Wolsey (Radio and Allied Trades) Wholesale, Ltd.
**Sesame.**—Finmar, Ltd. Record cabinet.
**Setaw.**—London and Provincial Factors, Ltd. Meters.
**Shakeproof.**—Barber and Colman, Ltd. Lock-washers and locking terminals.
**Shalless.**—Shalless and Evans, Ltd. General trade mark.
**Shearex.**—A. E. Shearing, Ltd. 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.
**Sifam.**—Sifam Elec. Instrument Co., Ltd. General trade mark.
**Silent Sentry.**—Lamplugh Radio, Ltd. Lightning arrestor.
**Siloor.**—Magnetic and Electrical Alloys, Ltd. Silicon iron cores.
**Silktex.**—Celluloid Printers, Ltd. Scales.
**Siltit.**—Caradio Services, Ltd. Earths.

## TRADE NAMES

**Silverdome.**—Octron, Ltd. Valves.
**Silver Ghost.**—Lamplugh Radio, Ltd. General trade mark.
**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.
**Sistoflex.**—Spicers, Ltd. Insulating sleeving and materials.
**Six-Sixty.**—Six-Sixty Radio Co., Ltd. General trade mark.
**Skyscraper.**—Lissen, Ltd. Kits.
**Slipquik.**—Concordia Elec. Wire Co., Ltd. Insulated connecting wire.
**Slot.**—Graham Farish, Ltd. Aerial filter.
**Snap.**—Graham Farish, Ltd. Switches.
**Solex.**—British Homophone Co., Ltd. Records.
**Solex.**—Wilrose Co. (Birmingham), Ltd. Sets, speakers and batteries.
**Songster.**—J. Stead and Co., Ltd. Gramophone and pick-up needles.
**Sonia.**—Murdoch Trading Co. Main springs.
**Sonomac.**—Metal Agencies Co., Ltd. Moving coil speakers.
**Sopranist.**—London and Provincial Factors, Ltd. Accumulators, batteries, components and hydrometers.
**Sorbo.**—Sorbo, Ltd. General trade mark.
**Sound Service.**—Hillman Bros. 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.
**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.
**Squiregram.**—Frederick Squire, Ltd. Portable gramophone attachment with pick-up.
**Stabyl.**—C.I.V.A.R.E., Ltd. Products.
**Stadium.**—Stadium, Ltd. Hydrometers, voltmeters and ammeters.
**Stal.**—Electric Lamp Service Co., Ltd. Transformers.
**Stalloy.**—Joseph Sankey and Sons, Ltd. Transformer lamination and diaphragms.
**Standard.**—Graham Farish, Ltd. Grid leak.
**Standard.**—Shalless and Evans. Receiver.
**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.
**Stentorian.**—Whiteley Electrical Radio Co., Ltd. Speakers.
**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.
**Stremlin.**—Aladdin Gramophone and Accessories Co. Tone arm.
**Stronkor.**—Johnson & Phillips, Ltd. Flexible cable.
**Struckakit.**—Peto Scott Co., Ltd. Kits.
**Sturdy.**—Sturdy Electric Co. Mains transformers.
**Sunbeam.**—Sunbeam Electric, Ltd. General trade mark.
**Sunco.**—Sun Electrical Co., Ltd. General trade mark.
**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.
**Supercision.**—F. C. Heayberd and Co. Measuring instruments.
**Superdyne.**—British Radio Manufacturing Co. (Liverpool), Ltd. Super-heterodyne apparatus and accessories.
**Superial.**—New London Electron Works, Ltd. Insulated aerial wire.
**Superscale.**—Everett, Edgcumbe and Co., Ltd. Moving iron and moving coil ammeters and voltmeters.
**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.
**Sutra.**—C.I.V.A.R.E., Ltd. Components.
**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.**—Walsey (Radio and Allied Trades) Wholesale, 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. Electric clocks.
**Synchrophone.**—Synchrophone Ltd. Home talkie apparatus.
**Synclock.**—Everett, Edgcumbe and Co., Ltd. Synchronous clocks and time switches.
**S. G. Brown.**—National Radio Service Co. Headphones.
**S.I.W.**—Scott Insulated Wire Co., Ltd. Wire.
**S.L.**—Spicers, Ltd. Ebonite.
**S.R.S.**—Stonehouse Radio Supplies. Ultra short wave unit, receivers, coils and screen grid converters.
**S.S.**—F. W. Lechner and Co., Ltd.

## T

**Tablegram.**—Carrington Mfg. Co., Ltd. Cabinet.
**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 Radio, Ltd. Receivers and radiograms.
**Telelux.**—British Television Supplies, Ltd. Television neon lamp.
**Telenduron.**—Thos. De la Rue and Co., Ltd. Bakelite, insulating compounds and mouldings.
**Televisor.**—Baird Television, Ltd. Television receiving apparatus.
**Televuer.**—Plew Television Ltd. Television apparatus.
**Telsen.**—Telsen Electric Co., Ltd. General trade mark.
**Temco.**—Telephone Mfg. Co., Ltd. A.C. electric clocks.
**Tenastine.**—Kay Bros., Ltd. Adhesive cement.
**Termytabs.**—Money Hicks, Ltd. Terminal labels.
**Terralto.**—R. Custerson. Speakers, cones and receiving sets.
**Thermo-Breaknot.**—S. Guiterman and Co., Ltd. Hydrometer.
**Thordarson.**—R. A. Rothermel, Ltd. L.F. transformers and chokes.
**Three Star.**—Three Star Accumulators, Ltd. Accumulators.
**Thunderbolt.**—Buck and Hickman, Ltd. High speed steel, insulated pliers (non-chip).
**Ti.**—Television Instruments Ltd. Television lamps and lenses.
**Tiltrack.**—B. Thomas. Storage trays for small parts.
**Timpani-Tone.**—Lamplugh Radio, Ltd. Baffle.
**Titian.**—H. J. Fletcher and Co., Ltd. Spring motors.
**Toco.**—Multitone Electric Co., Ltd. Tone control transformers.
**Toga.**—Buck and Hickman, Ltd. Small tools and bar iron.
**Tone Selector.**—Harlie, Ltd. Components and accessories.
**Tonostat.**—T.X. Products Co., Ltd.
**Torex.**—Lissen, Ltd. Transformers.
**Touch Stone.**—Gent and Co., Ltd. Speaker.
**Tourist.**—Hart Collins, Ltd. Portable and transportable sets.
**Tournaphone.**—Murdoch Trading Co. Gramophones.
**Transadyne.**—Neutron (1927), Ltd. Receiver.
**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.
**Trellebergs.**—P. C. Michell. Ebonite and bakelite.
**Trier.**—Buck and Hickman, Ltd. Grindstone dressers and safety rests.
**Triotron.**—Elec. Lamp Service Co., Ltd. Valves.
**Triotron.**—Triotron Radio Co., Ltd. General trade mark.
**Triparts.**—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.
**Trump.**—Ardea Vulcanizer Syn., Ltd. Electric soldering irons.
**Trutone.**—Richardsons (R.M.L.), Ltd. Gramophones and components.
**Truvolt.**—R. A. Rothermel, Ltd. Resistance.
**Truvox.**—Universal Gramophone and Radio Co., Ltd. General trade mark.
**Tube Wire.**—J. Moores and Co. Connecting wire.
**Tufnol.**—Ellison Insulations, Ltd. Insulating material, tube rod and panel.
**Tuftest.**—Willmott Son and Phillips, Ltd. Fibre.
**Tunewell.**—Tunewell Radio Co., Ltd. General trade mark.
**Tungar.**—British Thomson-Houston Co., Ltd. Battery charger.
**Tungsram.**—Tungsram Electric Lamp Work (Great Britain), Ltd. Valves.
**Tungstalite.**—Tungstalite, Ltd. Crystal and crystal detector.
**Tungstone.**—Tungstone Accumulator Co., Ltd. Accumulators.
**Tungstyle.**—Gramophone Co., Ltd. Semi-permanent needles.
**Twin-cone.**—Green and Faulconbridge, Ltd. Speakers.
**Twin-Fuse.**—Gambrell Bros. and Co., Ltd. Safety fuses.
**Twingrip.**—J. G. Beddoes, Ltd. Automatic safety lock.
**Twoside.**—Redferns Rubber Works, Ltd. Ebonite panels.
**Tylaphonic.**—Tyrela Gramophones, Ltd. Gramophones and radiograms.
**Tyrela.**—Tyrela Elec., Ltd. General trade mark.
**Tyrela.**—Tyrela Gramophones, Ltd. Gramophones and radiograms.
**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. Condensors.
**T.X.**—T.X. Products Co., Ltd. Adaptors.

## U

**Unic.**—Richardsons (R.M.L.), Ltd. Components and gramophones.
**Uniflex.**—Liverpool Radio supplies. Sets.
**Unigrad.**—Radio Instruments, Ltd. Volume-controls.
**Unigram.**—Cosmocord, Ltd. Playing desks.
**Uni-Knob.**—Wingrove and Rogers, Ltd. Variable condensers.
**Unimains.**—Shalless and Evans, Ltd. Receiver.
**Unipivot.**—Cambridge Instrument Co., Ltd. Galvanometers.
**Unique Radio.**—W. Riley and Son. Batteries.
**Unirad.**—Union Radio Co., Ltd. Allwave and short wave receivers, mains and battery operated.
**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.

## TRADE NAMES

**Universal.**—E. J. Francois. Terminals, wanderplugs and switches.
**Universal.**—Varsity Eliminators Ltd. Eliminators.
**Universal Avominor.**—Automatic Coil Winder and Electrical Equipment Co., Ltd. Testing Instrument.
**Univolt.**—Univolt Elec. Ltd. Radiogram units.
**Utility.**—Wilkins and Wright, Ltd.

### V

**Van Raden.**—Van Raden and Co., Ltd. H.T. and L.T. accumulators.
**Varial.**—New London Electron Works, Ltd. Variable aerial.
**Varicap.**—Radio Instruments, Ltd. Preset condenser.
**Varitone.**—Radio Instruments, Ltd. L.F. Transformer.
**Varsity.**—Guillaume and Sons, Ltd. Gramophone needles.
**Varsity.**—Varsity Eliminators, Ltd. Eliminators.
**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.**—Octron Ltd. Valves, components and accessories.
**Venauto.**—Venner Time Switches, Ltd. Automatic programme selector.
**Vesco.**—H. Joseph. Electric clocks.
**Verto.**—Baxendale and Co., Ltd. Accumulators.
**Vibro.**—Burne Jones and Co., Ltd. Valve-holder.
**Vibrolder.**—Benjamin Electric, Ltd. Anti-microphonic valve holders.
**Victor.**—Victor Battery Co. H.T. Battery.
**Victor.**—R. and A., Ltd. P.M.-M.C. speakers.
**Visitron.**—Claude Lyons, Ltd. Photocells.
**Viva-Radio.**—Columbia Graphophone Co., Ltd. Dry batteries.
**Viva-Tonal.**—Columbia Graphophone Co., Ltd. Portable gramophone.
**Volamp.**—Lithanode Co., Ltd. Accumulators.
**Volex.**—Ward and Goldstone, Ltd. Batteries.
**Volpus.**—Hobday Bros., Ltd. Batteries.
**Voltex.**—Formo Products, Ltd. Battery eliminators.
**Volustat.**—Harlie, Ltd. Components.
**Voluvernia.**—Gambrell Bros. and Co., Ltd. Volume control.
**Vulcan.**—J. Stead and Co., Ltd. Gramophone mainsprings.

### W

**Wanderfuse.**—Belling and Lee, Ltd. Wanderplug with fuse.
**Watmel.**—Watmel Wireless Co., Ltd. Components and valve receivers.
**Wavemaster.**—Webb Condenser Co., Ltd. Variable condenser.
**Waveola.**—Aladdin Gramophone and Accessories Co. Amplifiers.
**Waverley.**—Carrington Mfg. Co., Ltd. Cabinet.
**Waverley.**—M. Sanger and Son. Batteries, accumulators and covered aerial wire.
**Wearite.**—Wright and Weaire, Ltd. Components and accessories.
**Webber.**—R. A. Webber, Ltd. Moving coil loudspeakers, P.A. equipment and microphones.
**Webster.**—R. A. Rothermel, Ltd. Amplifiers.
**Wego.**—Wego Condenser Co., Ltd. Condensers.
**Westbury-Ware.**—Reliance Mfg. Co. (Southwark), Ltd. Mouldings.
**Westector.**—Westinghouse Brake and Saxby Signal Co., Ltd. H.F. metal rectifier.
**Westinghouse.**—Westinghouse Brake and Saxby Signal Co., Ltd. General trade mark.
**Westminster.**—Curry's, Ltd. Sets.
**Weston.**—Weston Electrical Instrument Co., Ltd. Measuring instruments.
**Wharfedale.**—Wharfedale Wireless Works. Loudspeakers.
**Wick.**—Baxendale and Co., Ltd. Dry battery.
**Wilco.**—L. Wilkinson. General trade mark.
**William and Mary.**—Halford Radio, Ltd. Receivers and radiograms.
**Wilson.**—R.C. and Wilson Elec. Ltd. Microphone bar amplifier.
**Wilson.**—E. Wilson. Aerial pulley.
**Windsor.**—Carrington Mfg. Co., Ltd. Cabinet.
**Wing-Nut.**—Thos. R. Ellin (Footprint Works), Ltd. Tools.
**Winner.**—Ever-Ready Co. (Gt. Britain), Ltd. H.T. and G.B. dry batteries.
**Wirelect.**—Wireless Electric (Wholesale), Ltd. H.T. batteries, aerial wire and accumulators.
**Wolf.**—S. Wolf and Co., Ltd. Electrical soldering iron and portable electric tools.
**Woodland.**—Brown, Brew and Co., Ltd. Sets and components.
**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. and W. Ltd.**—Wright and Weaire, Ltd. Components.

### X

**Xaltona.**—G. F. Baker and Co., Ltd. Gramophones and portable radio.
**X.L.N.T.**—W. G. West. Cabinets and accumulator crates.

### Y

**Yaxley.**—R. A. Rothermel, Ltd. Rheostats and switches.
**Yeldon.**—Yeldon (Radio), Ltd. Receivers and mains units.
**Yeoman.**—Hillman Bros. H.T. and G.B. batteries.
**Young.**—Young Accumulator Co. (1929), Ltd. General trade mark.

### Z

**Zalma.**—Lissen, Ltd. Batteries.
**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.
**Zimal.**—Birmingham Aluminium Casting (1903), Ltd. Zinc base alloy.
**Zip.**—Victor Battery Co. H.T. batteries.
**Zodac.**—Dawkins Trading Co., Ltd. Accumulators.
**Zonophone.**—British Zonophone Co., Ltd. Gramophone pick-ups, batteries and needles.
**Zwietusch.**—Siemens Schuckert (Gt. Britain), Ltd. Condensers and factory conveyors.

## MISCELLANEOUS.

**3 E.**—Claude Lyons, Ltd. Rheostat.
**99.**—J. and J. Laker Co., Ltd. Aerial wire.
**60.**—Reproducers and Amplifiers, Ltd. M.I. speakers.
**362.**—362 Radio Valve Co., Ltd. Valves.
**55 R.**—Charlton Higgs (Radio), Ltd. Receivers.
**55 T.**—Charlton Higgs (Radio), Ltd. Receivers.
**55 T.G.**—Charlton Higgs (Radio), Ltd. Receivers.
**800.**—Reproducers and Amplifiers, Ltd. Speakers.
**600.**—Reproducers and Amplifiers, Ltd. Speakers.

# RADIO PRODUCTS SUPPLIED

## ACCUMULATORS, L.T.

Alklum Storage Batteries, Ltd.
Alton Battery Co., Ltd.
A.E.F. Manufacturing Co.
Barnard Accumulator Co.
Batteries, Ltd.
Baxendale & Co., Ltd.
Blue Comet, Ltd.
Britannia Batteries, Ltd.
Chloride Electrical Storage Co., Ltd.
Cranley Radio, Ltd.
Dawkins Trading Co., Ltd.
Dyson & Co., Ltd., J.
Edison Swan Electric Co., Ltd.
Ever Ready Co. (Great Britain), Ltd.
General Electric Co., Ltd.
Grosvenor Electric Batteries, Ltd.
Havenand, Lewis & Co.
Hellesens, Ltd.
Heys, Leonard.
Imp. Radio Co.
Kay, Ltd., P.
Lampex Radio & Elec. Co.
Lissen, Ltd.
Lithanode Co., Ltd.
London & Provincial Factors, Ltd.
London Radio Co. (Leeds), Ltd.
Lucas, Ltd., J.
Lugton & Co., Ltd.
Manufacturers' Accessories Co. (1928), Ltd.
Oldham & Son, Ltd.
Peto & Radford.
Rawson (Sheffield & London), Ltd., H. C.
Sanger & Son, M.
Thompson Diamond & Butcher.
Toubkin, J.
Van Raden & Co., Ltd.
Vandervell, Ltd., C. A.
Young Accumulator Co. (1929), Ltd.

## ACCUMULATORS, H.T.

Alklum Storage Batteries, Ltd.
Alton Battery Co., Ltd.
Barnard Accumulator Co.
Black, Ltd., Michael.
Chloride Electrical Storage Co., Ltd.
Cranley Radio, Ltd.
Evac, Ltd.
General Electric Co., Ltd.
Grosvenor Electric Batteries, Ltd.
Hellesens, Ltd.
Lampex Radio & Elec. Co.
Lissen, Ltd.
London & Provincial Factors, Ltd.
London Radio Co. (Leeds), Ltd.
Manufacturers' Accessories Co. (1928), Ltd.
Milnes Radio, Ltd.
Oldham & Son, Ltd.
Peto & Radford.
Van Raden & Co., Ltd.
Vandervell, Ltd., C. A.
Young Accumulator Co. (1929), Ltd.

## ACCUMULATOR BOXES.

A.E.F. Manufacturing Co.
Barnard Accumulator Co.
Bligh, S. W.
De la Rue & Co., Ltd., Thomas.
Lockwood Casework Mfg. Co.
Maul & Murphy, Ltd.
Osborn, C. A.
Peto & Radford.

## ACCUMULATOR CARRIERS.

Barnard Accumulator Co.
Beaufoy Grimble & Co., Ltd.
Bligh, S. W.
Laker & Co., Ltd., J. & J.
Osborn (Woodworkers, Ltd.), C.
West, W. G.

## ACCUMULATOR ACCESSORIES.

Alton Battery Co., Ltd.
Barnard Accumulator Co.
Chloride Electrical Storage Co., Ltd.
Collie & Co., J. H.
Cookson & Co.
Crystalate Gramophone Record Mfg. Co., Ltd.
Gordon & Co., Ltd., F. J.
Lithanode Co., Ltd.
Oldham & Son, Ltd.
Osborn (Woodworkers, Ltd.), C.
Peto & Radford.
Radiamp Co., Ltd.
Sharplin, Ltd., W. J.
Young Accumulator Co. (1929), Ltd.

## ACCUMULATOR ACID.

Beaufoy Grimble & Co., Ltd.
Blue Comet, Ltd.

## ACCUMULATOR CHARGERS, A.C.

Bedford Elec. & Radio Co., Ltd.
Bligh, S. W.
Correx Amplifiers.
Cranley Radio, Ltd.
Custerson, R.
Diggle & Co., A.
Eagle Engineering Co., Ltd.
Edison Swan Electric Co., Ltd.
Fel Electric Radio.
General Electric Co., Ltd.
Gordon & Co., F. J.
Heayberd & Co., F. C.
London Electrical Co. (Sherborne Lane), Ltd.
McLeod & McLeod.
Meritus (Barnet), Ltd.
Partridge, Wilson & Co.
Philips, Industrial (Philips Lamps, Ltd.).
Precision-Electric, Ltd.
Ray Engineering Co., Ltd.
Roberts, J.
Salisbury Transformer & Elec. Co.
Sound Sales, Ltd.
Tannoy Products, Ltd.
Trix Electrical Co., Ltd.
Ward & Goldstone, Ltd.
Westinghouse Brake & Saxby Signal Co., Ltd.

## ACCUMULATOR CHARGERS, D.C.

Cranley Radio, Ltd.
Custerson, R.
Diggle & Co., A.
Edison Swan Electric Co., Ltd.
Fel Electric Radio.
General Electric Co., Ltd.
Gordon & Co., F. J.
Heayberd & Co., F. C.
London Electrical Co. (Sherborne Lane), Ltd.
McLeod & McLeod.
McMillan & Co., J.
Meritus (Barnet), Ltd.
Partridge, Wilson & Co.
Precision-Electric, Ltd.
Ray Engineering Co., Ltd.
Roberts, J.
Salisbury Transformer & Elec. Co.
Sound Sales, Ltd.
Tannoy Products.
Walsall Elec. Co., Ltd.
Ward & Goldstone, Ltd.

## ACCUMULATOR STATION PLANT.

Custerson, R.
Diggle & Co., A.
Edison Swan Electric Co., Ltd.
General Electric Co., Ltd.
Gordon & Co., F. G.
Heayberd & Co., F. C.
Meritus (Barnet), Ltd.
Oldham & Son, Ltd.
Ray Engineering Co., Ltd.
Roberts, J.
Salisbury Transformer & Elec. Co.
Sound Sales, Ltd.
Tannoy Products.
Trix Electrical Co., Ltd.

## PRODUCTS SUPPLIED

Walsall Elec. Co., Ltd.
Ward & Goldstone, Ltd.
Westinghouse Brake & Saxby Signal Co., Ltd.
Weston Electrical Instrument Co., Ltd.

### AERIALS (frame, indoor and portable).

Aerialite, Ltd.
Altham Radio Co.
Birmingham Sound Reproducers, Ltd.
British Pix Co., Ltd.
British Radio Mfg. Co. (Liverpool), Ltd.
Bromley-Langton Elec. Wire & Insulator Co., Ltd.
Caradio Services, Ltd.
Colvern, Ltd.
Concordia Electric Wire Co., Ltd.
Daly, H. C.
Duray.
Eastick & Sons, J. J.
Elvy, C. L.
Eon Vacuum Wireless Co.
Ivory Electric, Ltd.
McLeod & McLeod.
Merrington Bros., Ltd.
New London Electron Works, Ltd.
Plessey Co., Ltd.
Reliance Electric Wire Co.
R.C. Radio Electric, Ltd.
Shearing, A. E.
Spong & Co., Ltd.
Toubkin, J.
Trent Electric Wire Works, Ltd.
Univolt Electric, Ltd.
Ward & Goldstone, Ltd.
Wright & Weaire, Ltd.

### ALUMINIUM (sheet and panel).

Adams Bros., and Burnley, Ltd.
Andrews & Co., A. E.
Bedford Elec. & Radio Co., Ltd.
Braby & Co., Ltd., F.
British Aluminium Co., Ltd.
British Insulated Cables, Ltd.
City Accumulator Co.
Colvern, Ltd.
General Electric Co., Ltd.
Harrison & Co., A. T.
Ivory Electric, Ltd.
Lockwood Casework Mfg. Co.
London Electrical Co. (Sherborne Lane), Ltd.
Marks & Son, S.
Righton & Co., Ltd., H.
Tannoy Products.
White Bros. & Jacob, Ltd.
Whiteley Elec. Radio Co., Ltd.

### BAKELITE AND SYNTHETIC RESIN (sheet and raw).

Bakelite, Ltd.
Bowyer-Lowe & A. E. D., Ltd.
Brandon & Sons, Ltd., J.
British Lumophon, Ltd.
Bromley-Langton Electric Wire & Insulator Co., Ltd.
Bulgin & Co., Ltd., A. F.
Burndept, Ltd.
Crystalate Gramophone Record Mfg. Co., Ltd.
De la Rue & Co., Ltd., Thomas.
General Electric Co., Ltd.
Harrison & Co., A. T.
Lorivale Mfg. Co. (1921), Ltd.
McLeod & McLeod.
Maul & Murphy, Ltd.
Micanite & Insulators Co., Ltd.
Moores & Co., J.

### BAKELITE AND SYNTHETIC RESIN (mouldings).

Charlsworth Mouldings, Ltd.
Cole, Ltd., E. K.
Elliott, E.
Ferranti, Ltd.
General Electric Co., Ltd.
General Inductance Co.
General Mouldings Co., Ltd.
Gresley Radio, Ltd.
Lissen, Ltd.
Lorivale Mfg. Co. (1921), Ltd.
McLeod & McLeod.
Maul & Murphy, Ltd.
Moores & Co., J.
Morton, Ltd., E. R.
Paroussi, E.
Philips Lamps, Ltd.
Pooley, G. J.
Radiamp Co., Ltd.
Ray Engineering Co., Ltd.
Reliance Mfg. Co. (Southwark), Ltd.
St. Helens Cable & Rubber Co., Ltd.
Sharplin, Ltd., W. J.
Shearing, A. E.
Stadium, Ltd.
T.M.C.-Harwell (Sales), Ltd.
T.X. Products Co., Ltd.
Ward & Goldstone, Ltd.
Westinghouse Electric International Co.
W.R.C., Ltd.

### BATTERIES, H.T. (dry).

Baxendale & Co., Ltd.
Black, Ltd., Michael.
British Battery Co.
British G.W.Z. Battery Co., Ltd.
Burndept, Ltd.
Chloride Electrical Storage Co., Ltd.
Cranley Radio, Ltd.
Dyson & Co., Ltd., J.
Eagle Engineering Co., Ltd.
Ever Ready Co. (Gt. Britain), Ltd.
General Electric Co., Ltd.
Gilbert & Co., Ltd., C.
Grosvenor Electric Batteries, Ltd.
Hellesens, Ltd.
Imp. Radio Co.
Lampex Radio & Elec. Co.
Le Carbone Co., Ltd.
Lissen, Ltd.
London & Provincial Factors, Ltd.
London Radio Co. (Leeds), Ltd.
Lyons, Ltd., Claude.
McLeod & McLeod.
Midland Auto Components.
Midland Wireless Co.
Mile End Radio Co.
Mountford Rubber Co., Ltd.
Northern Batteries, Ltd.
Oldham & Son, Ltd.
Pifco, Ltd.
Rawson (Sheffield & London), Ltd., H. C.
Riddough & Son, F.
Riley & Son, W.
Sanger & Son, M.
Siemens Electric Lamps & Supplies, Ltd.
Thompson, Diamond & Butcher.
Toubkin, J.
Vandervell, Ltd., C. A.
Whiteley Elec. Radio Co., Ltd.
Wireless Elec. (Wholesale), Ltd.

### BATTERIES (grid bias).

British Battery Co.
British G.W.Z. Battery Co., Ltd.
Burndept, Ltd.
Chloride Electrical Storage Co., Ltd.
Cranley Radio, Ltd.
Dundas Fox, Ltd.
Eagle-Engineering Co., Ltd.
Ever Ready Co. (Gt. Britain), Ltd.
General Electric Co., Ltd.
Gilbert & Co., Ltd., C.
Grosvenor Electric Batteries, Ltd.
Hellesens, Ltd.
Hewitt, Ltd., A. J.
Le Carbone Co., Ltd.
Lissen, Ltd.
London & Provincial Factors, Ltd.
London Radio Co. (Leeds), Ltd.
McLeod & McLeod.
Midland Auto Components.
Midland Wireless Co.
Mile End Radio Co.
Mountford Rubber Co., Ltd.
Northern Batteries, Ltd.

**FOUR MILLION AERIALS LEAD DOWN TO**

Oldham & Son, Ltd.
Pifco, Ltd.
Riddough & Son, F.
Sanger & Son, M.
Siemens Electric Lamps & Supplies, Ltd.
Toubkin, J.
Vandervell, Ltd., C. A.
Ward & Goldstone, Ltd.

### BOBBINS (loudspeaker or transformer).

Amplion (1932), Ltd.
British Lumophon, Ltd.
Bromley-Langton Electric Wire & Insulator Co., Ltd.
Cossor, Ltd., A. C.
Cranley Radio, Ltd.
Crystalate Gramophone Record Mfg. Co., Ltd.
Elvy, C. L.
General Elec. Co., Ltd.
General Mouldings Co., Ltd.
Goodmans (Clerkenwell), Ltd.
Harrison & Co., A. T.
Ivory Electric, Ltd.
Kay, Ltd., P.
Kingsway Radio, Ltd.
McLeod & McLeod.
Mica Mfg. Co., Ltd.
Micanite & Insulators Co., Ltd.
Mile End Radio Co.
Millet, J.
National Radio Service Co.
Radio Development Co.
Sharplin, Ltd., W. J.
Sound Sales, Ltd.
Tannoy Products.
Trix Electrical Co., Ltd.
Weedon Power Link Radio Co.
W.R.C., Ltd.

### BOXES (cardboard, display cartons, etc.).

Boxfoldia, Ltd.
McLeod & McLeod.

### BRACKETS (panel and baseboard).

Bulgin & Co., Ltd., A. F.
Burne Jones & Co., Ltd.
Christie & Sons, Ltd., Jas.
Collet Mfg. Co., S. H.
General Electric Co., Ltd.
Harrison & Co., A. T.
Ivoru Electric, Ltd.
Lockwood Casework Mfg. Co.
Marks & Son, S.
Morton, Ltd., E. R.
Radiamp Co., Ltd.
Tannoy Products,
Trix Electrical Co., Ltd.
Whiteley Elec. Radio Co., Ltd.
Wright & Weaire, Ltd.

### BRASSWORK.

Amplifiers, Ltd.
Andrews & Co., A. E.
Automobile Accessories (Bristol), Ltd.
Beddoes, Ltd., J. G.
Belling & Lee, Ltd.
Bligh, S. W.
Castle Fuse & Engineering Co., Ltd.
Christie & Sons, Ltd., J.
Colvern, Ltd.
Eagle Engineering Co., Ltd.
Edmonds, Ltd., G.
Elvy, C. L.
Francois, E. J.
Gee (Birmingham), Ltd.
Goodmans (Clerkenwell), Ltd.
Green & Co., G.
Gripso Co.
Harris, G. & R.
Harrison & Co., A. T.
Henderson & Co., Ltd., D. M.
Ivory Electric, Ltd.
Jackson Bros. (London), Ltd.
Lilley & Son, Ltd., S.
Lisenin Wireless Co.
Manor Works (Aston), Ltd.
Marks & Son, S.
Meyer & Co., E.
Muller & Co. (England), Ltd.
Person & Son, L.
Plessey Co., Ltd.
Prideaux, Junr., R.
Radiamp Co., Ltd.
Reliance Mfg. Co. (Southwark), Ltd.
Righton & Co., H.
Ross, Courtney & Co., Ltd.
Shearing, A. E.
Toubkin, J.
TrixElectrical Co., Ltd.
True Screws, Ltd.
Whiteley Electrical Radio Co., Ltd.
Wilkins & Wright, Ltd.
Williams & Gray, Ltd.
Williams & Moffat, Ltd.
Wright & Weaire, Ltd.

### CABINETS (wood).

Automobile Accessories (Bristol), Ltd.
Baxter Stavridi & Craies, Ltd.
Bligh, S.W.
British East Light, Ltd.
Burndept, Ltd.
Carrington Mfg. Co., Ltd.
City Accumulator Co.
Collings & Co., N.R.
Conways Electric, Ltd.
Cossor, Ltd.
Custerson, R.
Dallow Mfg. Co., Ltd.
Digby, F.
Disque Cabinet Co., Ltd.
Doherty & Sons, Edward.
Eagle Engineering Co., Ltd.
Eastick, J. J. & Sons.
Electrico.
Elliotts.
E.M.G. Hand-Made Gramophones, Ltd.
Ferranti, Ltd.
General Electric Co., Ltd.
Gould, Harper & Co., Ltd.
Gresley Radio.
Joseph, H.
Kay, Ltd., P.
Lampex Radio & Elec. Co.
Lathwood, J.
Lock, Ltd., W. & T.
Lockwood Casework Mfg. Co.
London Electrical Co. (Sherborne Lane), Ltd.
Manuwares, Co.
Margolin, J. & A.
Millards.
Miscellaneous Trading Co.
Moores & Co., J.
Morton & Co., R.
Northampton Plating Co.
Osborn (Woodworkers, Ltd.), C.
Picketts Cabinets.
Ramsey, F. W.
Regent Fittings Co.
R.A.P., Ltd.
Shalless & Evans, Ltd.
Shearing, A. E.
Standard Telephones & Cables, Ltd.
Storrar & Balls.
Synchrophone, Ltd.
Tarry's.
Tyrela Electric, Ltd.
Tyrela Gramophones, Ltd.
West, W. G.
Wood, L. R.

### CABINETS (for portables).

Dallow Mfg. Co., Ltd.
Kay, Ltd., P.
Lampex Radio & Electric Co.
Lockwood Casework Mfg. Co.
Millards.
Osborn (Woodworkers, Ltd.), C.
Regent Fittings Co.

### CABINETS (metal).

Adams Bros. and Burnley, Ltd.
British East Light, Ltd.
Ferranti, Ltd.
Gresley Radio, Ltd.
Harrison & Co., A. T.

## PRODUCTS SUPPLIED

Hounslow & Co., C.
Kay, Ltd., P.
Lockwood Casework Mfg. Co.
London Electrical Co. (Sherborne Lane), Ltd.
Marks & Son, S.
Parousai, E.
Stratton & Co., Ltd.
Tannoy Products.
White Bros. & Jacobs, Ltd.
Williams & Gray, Ltd.

### CABINETS (moulded composition).

Bakers Selhurst Radio, Ltd.
Birkbys, Ltd.
British East Light Ltd.
Cole, Ltd., E. K.
De La Rue & Co., Ltd., T.
General Electric Co., Ltd.
General Mouldings Co., Ltd.
Gresley Radio, Ltd.
Merrington Bros., Ltd.
Parousai, E.
Reliance Mfg. Co. (Southwark), Ltd.

### CAR RADIO.

Altham Radio Co.
Anglo-American Industries Corp.
Arvin Electric Co., Ltd.
Bakers Selhurst Radio, Ltd.
Betterset Radio, Ltd.
Blue Comet, Ltd.
British Radiophone, Ltd.
Cole, Ltd., E. K.
Cranley Radio, Ltd.
Custerson, R.
Elliotts.
Eon Vacuum Wireless Co.
Ferranti, Ltd.
General Electric Co., Ltd.
Halson Radio Co., Ltd.
Kolster-Brandes, Ltd.
Lampex Radio & Elec. Co.
Lissen, Ltd.
London Electrical Co. (Sherborne Lane), Ltd.
Lyons Ltd., Claude.
Mains Radio Mfg. Co.
Page Car Radio, Ltd.
Parkes, L. E.
Philco, Ltd.
Plessey Co., Ltd.
Radio Development Co.
Rotax, Ltd.
Shalless & Evans, Ltd.
Toubkin, J.
Trix Electrical Co., Ltd.
Tyrela Electric, Ltd.
Wurlitzer Lyric Radio, Ltd.

### CAR RADIO ACCESSORIES.

Adams Bros., and Burnley, Ltd.
Altham Radio Co.
Arvin Electric Co., Ltd.
Bakers Selhurst Radio, Ltd.
Bird & Sons, Ltd., Sydney, S.
Blue Comet, Ltd.
British Radiophone, Ltd.
British Rola Co., Ltd.
Bulgin & Co., Ltd., A. F.
Burne Jones & Co., Ltd.
Caradio Services, Ltd.
Cole, Ltd., E. K.
Cranley Radio, Ltd.
Dubilier Condenser Co. (1925), Ltd.
Elliotts.
Eon Vacuum Wireless Co.
Erie Resistor, Ltd.
General Electric Co., Ltd.
Goodmans (Clerkenwell) Ltd.
Grampian Reproducers, Ltd.
Halson Radio Co., Ltd.
Harrison & Co., A. T.
Kay, Ltd., P.
London Electrical Co. (Sherborne Lane), Ltd.
Lyons, Ltd., Claude.
Morton, Ltd., E. R.
Page Car Radio, Ltd.
Plessey Co., Ltd.
Radio Development Co.
Radio Resistor Co.
Reproducers & Amplifiers, Ltd.
Sound Sales, Ltd.
Standard Telephones & Cables, Ltd.
Toubkin, J.
Tyrela Electric Ltd.
Ward & Goldstone, Ltd.

### CASTINGS.

Allen & Co., Ltd., E.
Birmingham Aluminium Casting (1930) Co., Ltd.
Ferranti, Ltd.
Green & Co., G.
Harris, G. & R.
McLeod & McLeod.
Peace, Ltd., Henry.

### CHATTERTON'S COMPOUND.

British Insulated Cables, Ltd.
Bromley Langton Elec. Wire & Insulator Co., Ltd.
Cranley Radio, Ltd.
General Electric Co., Ltd.
Moores & Co., J.
Pomona Rubber Co.

### CHOKES H.F.

Advance Components, Ltd.
Aerodyne Radio, Ltd.
Alpha Coil & Component Co.
Altham Radio Co.
Amplion (1932), Ltd.
Andrews & Co., A. E.
Ashley Wireless Telephone Co. (1925), Ltd.
Automobile Accessories (Bristol), Ltd.
Bayliss, William, Ltd.
Bedford Elec. & Radio Co., Ltd.
Belling & Lee, Ltd.
Benjamin Electric, Ltd.
Berclif, Ltd.
Birmingham Sound Reproducers, Ltd.
British Ferrocart Co., Ltd.
British Sampson Products.
British Television Supplies Ltd
Brown, Brew & Co., Ltd.
Bulgin & Co., Ltd., A. F.
Burne Jones & Co., Ltd.
Castagnoli, G.
Chorlton Metal Co., Ltd.
Climax Radio Electric, Ltd.
Cossor, Ltd., A. C.
Cranley Radio, Ltd.
Custerson, R.
Daly, H. C.
Dyson & Co., Ltd., J.
Eagle Engineering Co., Ltd.
Elliotts.
Ferranti, Ltd.
General Electric Co., Ltd.
Graham Farish, Ltd.
Harrison & Co., A. T.
Hartley Turner Radio, Ltd.
Heayberd & Co., F. C.
Hewitt, Ltd., A. J.
Igranic Electric Co., Ltd.
Imp Radio Co.
Ivory Electric, Ltd.
Kay, Ltd., P.
Kingsway Radio, Ltd.
Lissen, Ltd.
London & Provincial Factors, Ltd.
Lotus Radio (1933), Ltd.
Mile End Radio Co.
Nichols, Ltd., J. T.
Patton, Ltd., D. J.
Peace, Henry, Ltd.
Plessey Co., Ltd.
Pooley, G. J.
Posthlewaite Bros.
Quartz Crystal Co.
Radiamp Co., Ltd.
Radio Development Co.
Salford Elec. Instruments, Ltd.
Shearing, A. E.
Siemens Schuckert (G.B.), Ltd.
Sound Sales, Ltd.

Stratton & Co., Ltd.
Tannoy Products.
Trix Electrical Co., Ltd.
Varley.
Varsity Eliminator Co., Ltd.
Ward & Goldstone, Ltd.
Whiteley Electrical Radio Co., Ltd.
Wright & Weaire, Ltd.
W.R.C., Ltd.

### CHOKES L.F.

Aerodyne Radio, Ltd.
All Power Transformers, Ltd.
Altham Radio Co.
Bayliss, William, Ltd.
Bedford Elec. & Radio Co., Ltd.
Benjamin Electric, Ltd.
Birmingham Sound Reproducers.
British Ferrocart Co., Ltd.
British Sampson Products.
British Television Supplies, Ltd.
Brown, Brew & Co., Ltd.
Bryce & Co., W. A.
Bulgin & Co., Ltd., A. F.
Bullphone Radio.
Castagnoli, G.
Climax Radio Electric, Ltd.
Coates, Ltd., J. G.
Correx Amplifiers.
Cossor, Ltd., A. C.
Cranley Radio, Ltd.
Custerson, R.
Daly, H. C.
Distavox, Ltd.
Dyson & Co., Ltd., J.
Eagle Engineering Co., Ltd.
Elliotts.
Fel-Electric Radio
Ferranti, Ltd.
General Electric Co., Ltd.
Graham Farish, Ltd.
Halson Radio Co., Ltd.
Harrison & Co., A. T.
Hartley Turner Radio, Ltd.
Igranic Electric Co., Ltd.
Ivory Electric, Ltd.
Kay, Ltd., P.
Kingsway Radio, Ltd.
Lissen, Ltd.
London Electrical Co. (Sherborne Lane), Ltd.
London & Provincial Factors, Ltd.
Midland Radio & Television Co.
Mile End Radio Co.
Multitone Electric Co., Ltd.
Nichols, Ltd., J. T.
Partridge & Mee, Ltd.
Partridge, Wilson & Co.
Peace, Henry, Ltd.
Plessey Co., Ltd.
Radio Development Co.
Radioformer, Ltd.
Regent Radio Supply Co.
Reproducers & Amplifiers, Ltd.
Salford Electrical Instruments, Ltd.
Savage, W. B.
Scott, Sessions & Co., G.
Shearing, A. E.
Sound Sales, Ltd.
Standard Tels. & Cables, Ltd.
Stratton & Co., Ltd.
Tannoy Products.
Tod, T. M.
Trix Electrical Co., Ltd.
Varley.
Varsity Eliminator Co., Ltd.
Voigt Patents, Ltd.
Whiteley Electrical Radio Co., Ltd.
Wood, L. R.
Wright & Weaire, Ltd.
W.R.C., Ltd.
Zenith Electric Co., Ltd.

### CHOKE COUPLING UNITS.

Benjamin Electric, Ltd.
Bulgin & Co., Ltd., A. F.
Burne-Jones & Co., Ltd.
Cossor, Ltd., A. C.
Cranley Radio, Ltd.
Ferranti, Ltd.
General Electric Co., Ltd.
Graham Farish, Ltd.
Harrison & Co., A. T.
Kay, Ltd., P.
Kingsway Radio, Ltd.
London Electrical Co. (Sherborne Lane), Ltd.
Partridge & Mee, Ltd.
Tannoy Products.
Trix Electrical Co., Ltd.
Whiteley Electrical Radio Co., Ltd.

### CHOKES (smoothing).

Aerodyne Radio, Ltd.
All Power Transformers, Ltd.
Bayliss, Ltd., W.
Bedford Elec. & Radio Co., Ltd.
Birmingham Sound Reproducers.
British Radio Corp., Ltd.
British Sampson Products.
British Television Supplies, Ltd.
Brown, Brew & Co., Ltd.
Bryce & Co., W. A.
Bulgin & Co., Ltd., A. F.
Castagnoli, G.
Climax Radio Electric, Ltd.
Correx Amplifiers.
Cossor, Ltd., A. C.
Cranley Radio, Ltd.
Custerson, R.
Daly, H. C.
Dyson & Co., Ltd.
Eagle Engineering Co., Ltd.
Elliott Radio Mfg. Co., Ltd.
Ferranti, Ltd.
General Electric Co., Ltd.
Gresley Radio.
Hartley Turner Radio, Ltd.
Heayberd & Co., F. C.
Kay, Ltd., P.
Kimber Allen & Co., B.
Kingsway Radio, Ltd.
Lissen, Ltd.
London Electrical Co. (Sherborne Lane), Ltd.
Lyons, Ltd., Claude.
Mains Radio Mfg. Co.
Metal Agencies Co., Ltd.
Midland Radio & Television Co.
Mile End Radio Co.
Multitone Electric Co., Ltd.
Nassak Mfg. Co., Ltd.
Nichols, Ltd., J. T.
Partridge & Mee, Ltd.
Partridge, Wilson & Co.
Plessey Co., Ltd.
Radio Development Co.
Radioformer, Ltd.
Regent Radio Supply Co.
Rich & Bundy, Ltd.
Salisbury Transformer & Elec. Co.
Savage, W. B.
Scott Sessions & Co., G.
Shearing, A. E.
Sound Sales, Ltd.
Standard Tels. & Cables, Ltd.
Tannoy Products.
Tod, T. M.
Trix Electric Co., Ltd.
Varley.
Voigt Patents, Ltd.
Weedon Power Link Radio Co.
Whiteley Electrical Radio Co., Ltd.
Wright & Weaire, Ltd.

### CLASS B. CONVERTERS.

Automobile Accessories (Bristol), Ltd.
British Lumophon, Ltd.
Burne-Jones & Co., Ltd.
Charlton Metal Co., Ltd.
Cranley Radio, Ltd.
Ferranti, Ltd.
Kay, Ltd., P.
Kingsway Radio, Ltd.
Lotus Radio (1933), Ltd.
Multitone Electric Co., Ltd.
Sound Sales, Ltd.
Tannoy Products.
Trix Electric Co., Ltd.
Varley.
Whiteley Electric Radio Co., Ltd.

## PRODUCTS SUPPLIED

Wood, L. R.
Wright & Weaire, Ltd.
362, Radio Valve Co., Ltd.

### COIL FORMERS.

Altham Radio Co.
Andrews & Co., A. E.
Automobile Accessories (Bristol), Ltd.
Bedford Elec. & Radio Co., Ltd.
British Ferrocart Co., Ltd.
British Radio Gramophone Co., Ltd.
British Sampson Products.
Bromley-Langton Electric Wire & Insulator Co., Ltd.
Colvern, Ltd.
Cranley Radio, Ltd.
General Electric Co., Ltd.
General Inductance Co.
General Mouldings Co., Ltd.
Harrison & Co., A. T.
Ivory Electric, Ltd.
Kay, Ltd., P.
McLeod & McLeod.
Micanite & Insulators Co, Ltd.
Michell, P. C.
Moores & Co., J.
Morleys.
Patton, Ltd., D. J.
Radiamp Co., Ltd.
Salford Elec. Instruments, Ltd.
Sharplin, Ltd., W. J.
Shearing, A. E.
Stratton & Co., Ltd.
Tannoy Products.
Trix Electrical Co., Ltd.
Ward & Goldstone, Ltd.
Whiteley Electrical Radio Co., Ltd.
Wright & Weaire, Ltd.
W. R. C., Ltd.

### COILS (plug in, all types).

British Radiophone, Ltd.
British Television Supplies, Ltd.
Bulgin & Co., Ltd., A. F.
Burne Jones & Co., Ltd.
Cranley Radio, Ltd.
Daly, H. C.
Dyson & Co., Ltd., J.
Ferranti, Ltd.
Gambrell Bros. & Co., Ltd.
Harrison & Co., A. T.
Igranic Electric Co., Ltd.
Ivory Electric, Ltd.
Morleys.
Nichols, Ltd., J. T.
Northampton Plating Co.
Plessey Co., Ltd.
Radiamp Co., Ltd.
Stratton & Co., Ltd.
Tannoy Products.
Wright & Weaire, Ltd.
W. R. C., Ltd.
Zimba Radio Co.

### COILS (dual range).

Aerodyne Radio, Ltd.
Alpha Coil & Component Co.
Altham Radio Co.
Amplion (1932), Ltd.
Andrews & Co., A. E.
Anglo-American Industries Corp.
Bedford Elec. & Radio Co., Ltd.
Berclif, Ltd.
British Ferrocart Co., Ltd.
British General Manufacturing Co., Ltd.
British Lumophon, Ltd.
British Radiophone, Ltd.
British Television Supplies, Ltd.
Brown, Brew & Co., Ltd.
Bulgin & Co., Ltd., A. F.
Burne-Jones & Co., Ltd.
Chalkley, C. G.
Chorlton Metal Co., Ltd.
Colvern, Ltd.
Cossor, Ltd., A. C.
Cranley Radio, Ltd.
Custerson, R.
Dyson & Co., Ltd.
Eagle Engineering Co., Ltd.
Elliott Radio Mfg. Co., Ltd.
General Electric Co., Ltd.
Graham-Farish, Ltd.
Gresley Radio, Ltd.
Halson Radio Co., Ltd.
Hewitt, Ltd., A. J.
Imp Radio Co.
Ivory Electric, Ltd.
Lissen, Ltd.
Lotus Radio (1933), Ltd.
Merrington Bros., Ltd.
Morleys.
Nichols, Ltd., J. T.
Northampton Plating Co.
Novo Radio-Electric, Ltd.
Plessey Co., Ltd.
Pooley, G. J.
Radiamp Co., Ltd.
Salford Elec. Instruments, Ltd.
Scientific Supply Stores (Wireless), Ltd.
Shearing, A. E.
Tannoy Products.
Telsen Electric Co., Ltd.
Varley.
Ward & Goldstone, Ltd.
Watmel Wireless Co., Ltd.
Wright & Weaire, Ltd.
W. R. C., Ltd.

### COILS (iron-cored).

Alpha Coil & Component Co.
Altham Radio Co.
Berclif, Ltd.
British Ferrocart Co., Ltd.
British Radiophone, Ltd.
Brown Brew & Co., Ltd.
Colvern, Ltd.
Cossor, Ltd., A. C.
Cranley Radio, Ltd.
Elliott Radio Mfg. Co., Ltd.
General Electric Co., Ltd.
Graham Farish, Ltd.
Heayberd & Co., F. C.
Ivory Electric, Ltd.
Lissen, Ltd.
Lotus Radio (1933), Ltd.
Morleys.
Novo Radio-Electric, Ltd.
Phœnix Telephone & Elec. Works, Ltd.
Plessey Co., Ltd.
Pooley, G. J.
Salford Elec. Instruments, Ltd.
Shearing, A. E.
Standard Tels. and Cables, Ltd.
Tannoy Products.
Varley.
Ward & Goldstone, Ltd.
Whiteley Elec. Radio Co., Ltd.
Wright & Weaire, Ltd.

### COIL WINDING MACHINES.

Amalgamated Manufacturers.
Burne Jones & Co., Ltd.
Cranley Radio, Ltd.
Eta Tool Co.
McLeod & McLeod.
Plessey Co., Ltd.
Whitelegg, F.

### CONDENSERS (fixed, Mansbridge).

Alpha Products.
Altham Radio Co.
Amplion (1932), Ltd.
Ashley Wireless Telephone Co. (1925), Ltd.
British Insulated Cables, Ltd.
British Radiophone, Ltd.
British Television Supplies, Ltd.
Bryce & Co., W. A.
Burndept, Ltd.
Cossor, Ltd.
Daly, H. C.
General Electric Co., Ltd.
Graham Farish, Ltd.
Ivory Electric, Ltd.

Kay, Ltd., P.
Lissen, Ltd.
Loewe Radio Co., Ltd.
London & Provincial Factors, Ltd.
Lyons, Ltd., Claude.
McLeod & McLeod.
Millet, J.
Muirhead & Co., Ltd.
Plessey Co., Ltd.
Savage, W. B.
Sound Sales, Ltd.
Standard Telephones & Cables, Ltd.
Supremus Specialities, Ltd.
Telegraph Condenser Co., Ltd.
T.M.C.-Harwell (Sales), Ltd.

### CONDENSERS (fixed, mica).

Altham Radio Co.
Amplion (1932), Ltd.
Ashley Wireless Telephone Co. (1925), Ltd.
British Television Supplies, Ltd.
Castagnoli, G.
Dubilier Condenser Co. (1925), Ltd.
Emkabe Radio Co., Ltd.
Ferranti, Ltd.
General Electric Co., Ltd.
Graham Farish, Ltd.
Harrison & Co., A. T.
Hellesens, Ltd.
Ivory Electric, Ltd.
Kay, Ltd., P.
Lechner & Co., Ltd., F. W.
Lissen, Ltd.
Millet, J.
Muirhead & Co., Ltd.
Taylor & Petters, Ltd.
Telegraph Condenser Co., Ltd.
Telsen Electric Co., Ltd.
Trix Electrical Co., Ltd.
Ward & Goldstone, Ltd.
Wingrove & Rogers, Ltd.
W. R. C., Ltd.

### CONDENSERS (electrolytic).

Alpha Products.
Ashley Wireless Telephone (1925), Ltd.
British Insulated Cables, Ltd.
British N.S.F. Co., Ltd.
British Radiophone, Ltd.
Bryce & Co., W. A.
Cifel Products, Ltd.
Concerton Radio & Electrical Co., Ltd.
Dubilier Condenser Co. (1925), Ltd.
Ferranti, Ltd.
General Electric Co., Ltd.
Halson Radio Co., Ltd.
Hellesens, Ltd.
Kay, Ltd., P.
Lyons, Ltd., Claude.
Millet, J.
Plessey Co., Ltd.
Rothermel, Ltd., R. A.
Telegraph Condenser Co., Ltd.
Wingrove & Rogers, Ltd.

### CONDENSERS (variable).

Altham Radio Co.
Andrews & Co., A. E.
Bird & Sons, Sidney S.
British Pix Co., Ltd.
British Radio Gramophone Co., Ltd.
British Television Supplies, Ltd.
Bulgin & Co., Ltd., A. F.
Burndept, Ltd.
Castagnoli, G.
Chorlton Metal Co., Ltd.
Cossor, Ltd.
Ferranti, Ltd.
General Electric Co., Ltd.
Graham Farish, Ltd.
Hewitt, Ltd., A. J.
Ivory Electric, Ltd.
Jackson Bros. (London), Ltd.
Kay, Ltd., P.
Lissen, Ltd.
Lotus Radio (1933), Ltd.
Morton, Ltd., E. R.
Pooley, G. J.
Radiamp Co., Ltd.
Reliance Mfg. Co. (Southwark), Ltd.
Rothermel, Ltd., R. A.
Shearing, A. E.
Trix Electrical Co., Ltd.
Webb Condenser Co., Ltd.
Wilkins & Wright, Ltd.
Williams & Moffat, Ltd.
Wingrove & Rogers, Ltd.
W. R. C., Ltd.

### CORDS
### (battery, headphone and speaker).

Altham Radio Co.
Belling & Lee, Ltd.
British Insulated Cables, Ltd.
Bulgin & Co., Ltd., A. F.
Concordia Electric Wire Co., Ltd.
General Electric Co., Ltd.
Halson Radio Co., Ltd.
Hart Bros. Electrical Mfg. Co., Ltd.
Henry Ford Radio, Ltd.
Ivory Electric, Ltd.
Kay, Ltd., P.
London Electric Wire Co. & Smiths, Ltd.
McLeod & McLeod.
Millet, J.
Phœnix Telephone & Electric Works, Ltd.
Reliance Electric Wire Co.
Siemens Elec. Lamps & Supplies, Ltd.
Trix Electrical Co., Ltd.
Ward & Goldstone, Ltd.

### CRYSTAL (quartz oscillating).

Altham Radio Co.
Hilger, Ltd., Adam.
Lyons, Ltd., Claude.
Millet, J.
Quartz Crystal Co.
Radio Reconstruction Co.

### DIALS (standard, slow motion).

Altham Radio Co.
Anglo-American Industries Corp.
British Radiophone, Ltd.
Burne Jones & Co., Ltd.
Celluloid Printers, Ltd.
Chorlton Metal Co., Ltd.
Crystalate Gramophone Record Mfg. Co., Ltd.
Elliotts.
General Electric Co., Ltd.
Graham Farish, Ltd.
Gresley Radio, Ltd.
Harrison & Co., A. T.
Igranic Electric Co., Ltd.
Ivory Electric, Ltd.
Jackson Bros. (London), Ltd.
Kay, Ltd., P.
McLeod & McLeod.
Morton, Ltd., E. R.
Plessey Co., Ltd.

## PRODUCTS SUPPLIED

Rothermel, Ltd., R. A.
Standard Telephones & Cables, Ltd.
Stratton & Co., Ltd.
Telsen Electric, Ltd.
Webb Condenser Co., Ltd.
Wilkins & Wright, Ltd.
Williams & Moffat, Ltd.
Wingrove & Rogers, Ltd.
W.R.C., Ltd.

### DIALS (drum control).

Celluloid Printers, Ltd.
Crystalate Gramophone Record Mfg. Co., Ltd.
Elliotts
Gresley Radio, Ltd.
Ivory Electric, Ltd.
Jackson Bros. (London), Ltd.
Kay, Ltd., P.
Lissen, Ltd.
Morton, Ltd., E. R.
Rothermel, Ltd., R. A.
Webb Condenser Co., Ltd.
Wilkins & Wright, Ltd.
Williams & Moffat, Ltd.
Wingrove & Rogers, Ltd.
W.R.C. Ltd.

### DIAPHRAGMS (phone and speaker).

Bridger & Co., R. O.
Custerson, R.
General Electric Co., Ltd.
Ivory Electric, Ltd.
National Radio Service Co.
Regent Fitting Co.
Sankey & Sons, Ltd., Joseph.
Taylor & Petters, Ltd.
Voigt Patents, Ltd.
Weedon Power Link Radio Co.

### EARTH TUBES (plates, mats and clips).

Altham Radio Co.
Blue Comet, Ltd.
British Hard Rubber Co.
British Insulated Cables, Ltd.
British Pix Co., Ltd.
Climax Radio Electric, Ltd.
Colvern, Ltd.
Custerson, R.
Eastick, J. J., & Sons.
Gee (Birmingham), Ltd.
General Electric Co., Ltd.
Gresley Radio, Ltd.
Gripso Co.
Ivory Electric, Ltd.
Laker Co., Ltd., J. & J.
Lilley & Son, Ltd., S.
Linolite, Ltd.
London Electrical Co. (Sherborne Lane), Ltd.
London and Provincial Factors, Ltd.
Millet, J.
New London Electron Works, Ltd.
Plessey Co., Ltd.
Precision-Electric, 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.
British Hard Rubber Co., Ltd.
General Electric Co., Ltd.
Harrison & Co., A. T.
McLeod & McLeod, Ltd.
Marks & Son, S.
Maul & Murphy, Ltd.
Michell, P. C.
Moores & Co., J.
Mountford Rubber Co., Ltd.
Radiamp Co., Ltd.
St. Helen's Cable & Rubber Co., Ltd.
Siemens Electric Lamps & Supplies, Ltd.
Ward & Goldstone, Ltd.

### EBONITE (mouldings and turnings).

American Hard Rubber Co. (Britain), Ltd.
Brandon & Sons, Ltd., J.
British Hard Rubber Co., Ltd.
Elliott Radio Mfg. Co., Ltd.
General Electric Co., Ltd.
Harrison & Co., A. T.
London Electrical Co. (Sherborne Lane), Ltd.
McLeod & McLeod, Ltd.
Maul & Murphy, Ltd.
Merrington Bros., Ltd.
Michell, P. C.
Moores & Co., J.
Mountford Rubber Co., Ltd.
Radiamp Co., Ltd.
St. Helen's Cable & Rubber Co., Ltd.
Siemens Electric Lamps & Supplies, Ltd.

### EBONITE CEMENT.

Maul & Murphy, Ltd.

### ELECTRIC CLOCKS.

A.E.G.. Electric Co., Ltd.
Amalgamated Manufacturers.
Anglo-American Industries Corpn., Ltd.
Blue Comet, Ltd.
Earl Manufacturing Co., Ltd.
Everett, Edgcumbe & Co., Ltd.
Ferranti, Ltd.
G.E.C., Ltd.
Gordon Co., Ltd., F. J.
Joseph, H.
Kay, Ltd, P.
London Electric Clock, Co.
Philips Lamps, Ltd.
Siemens Schuckert (Gt. Britain), Ltd.
Sifam Electrical Instrument Co., Ltd.
Smiths English Clocks, Ltd.
Stockall, Marples & Co., Ltd.
Toubkin, J.
T.M.C.—Harwell (Sales,) Ltd.
Universal Electric Time and Telephone System, Ltd.

### ELECTRO-PLATING.

Bedford Electrical & Radio Co., Ltd.
Ferranti, Ltd.
Grampian Reproducers, Ltd.
Plessey Co., Ltd.

### ENGRAVING.

Automobile Accessories (Bristol), Ltd.
Bedford Electrical & Radio Co., Ltd.
Belling & Lee, Ltd.
Brandon & Sons, Ltd., J.
Burndept, Ltd.
Burne-Jones and Co., Ltd.
Ferranti, Ltd.
Jeacocks.
Lectro Linx, Ltd.
Marks & Son, S.
Money & Hicks, Ltd.
Stebbings, J. R.
Stilwell & Sons.

### ENGRAVING MACHINES.

Automobile Accessories (Bristol), Ltd.
General Electric Co., Ltd.
Ward & Goldstone, Ltd.

### ERINOID AND CASEIN PRODUCTS.

Belling & Lee, Ltd.
Brandon & Sons, Ltd., J.
Castle Fuse & Engineering Co., Ltd.
Erinoid, Ltd.
Freed, S. R. F.
Harrison & Co., A. T.
Lilley & Son, Ltd., S.
McLeod & McLeod, Ltd.
Radiamp Co., Ltd.

### FIBRE.

Austin & Hayes.
General Electric Co., Ltd.

McLeod & McLeod, Ltd.
Marks & Son, S.
Micanite & Insulators Co., Ltd.
Moores & Co., J.
Mountford Rubber Co., Ltd.
Osborn (Woodworkers), Ltd., C.
Radiamp Co., Ltd.
Spicers, Ltd.

### FITTINGS (for cabinets).

Brandon & Sons, Ltd., J.
Harris, G. & R.
Lilley & Son, Ltd., S.
Lockwood Casework Mfg. Co.
Osborn (Woodworkers), Ltd., C.
Regent Fittings Co., Ltd.

### FUSES.

Advance Components, Ltd.
Belling & Lee, Ltd.
Beswick, Ltd., K.E.
Bulgin & Co., Ltd., A. F.
Collett Manufacturing Co., S. H.
Ferranti, Ltd.
Gambrell Bros. & Co., Ltd.
General Electric Co., Ltd.
Ivory Electric, Ltd.
Lechner & Co., Ltd., F. W.
Lissen, Ltd.
Loewe Radio Co., Ltd.
London Electrical Co. (Sherborne Lane), Ltd.
McLeod & McLeod.
Millet, J.
Nassak Mfg. Co., Ltd.
Phœnix Telephone & Elec. Works, Ltd.
Radiamp Co., Ltd.
Reliance Mfg. Co. (Southwark), Ltd.
Siemens Electric Lamps & Supplies, Ltd.
Siemens Schuckert (Gt. Britain), Ltd.
Sifam Electrical Instrument Co., Ltd.
Sound Sales, Ltd.
Toubkin, J.
Tyrela Electric, Ltd.
Ward & Goldstone, Ltd.

### GENERATORS (rotary).

Bakers Selhurst Radio, Ltd.
Custerson, R.
General Electric Co., Ltd.
Midland Radio & Television Co.
Roberts, J.
Rothermel, Ltd., R. A.
Siemens Schuckert (Gt. Britain), Ltd.

### GRAMOPHONES (acoustic).

Baker & Co., Ltd., G. F.
Balcombe, Ltd., A. J.
Baxendale & Co., Ltd.
British Homophone Co., Ltd.
Coppock, J. T.
Decca Gramophone Co., Ltd.
Dulcetto-Polyphon, Ltd.
E.M.G. Hand Made Gramophones, Ltd.
Gilbert & Co., Ltd., C.
Gramophone Co., Ltd.
Gresley Radio, Ltd.
Itonia, Ltd.
Kay, Ltd., P.
Lugton & Co., Ltd.
Margolin, J. & A.
Regent Fittings Co.
Robertshaw & Co., Ltd., E.
Rose Morris and Co., Ltd.
Stockall, Marples & Co., Ltd.
Thompson, Diamond & Butcher.
Tyrela Gramophones, Ltd.

### GRAMOPHONES (electric).

Ambassador Radio Gramophones.
Automobile Accessories (Bristol), Ltd.
Baker & Co., Ltd., G. F.
Balcombe, Ltd., A. J.
Baxter, Stavridi & Craies Ltd.
Bayliss, Ltd., W.
Bligh, S. W.
British Radio Corpn., Ltd.
British Radio Mfg. Co. (Liverpool), Ltd.
Brown Brew Co., Ltd.
Burndept, Ltd.
Castagnoli, G.
Charlton Higgs (Radio), Ltd.
Coppock, J. T.
Elliott Radio Mfg. Co., Ltd.
E.M.G. Hand Made Gramophones, Ltd.
General Electric Co., Ltd.
Gramophone Co., Ltd.
Hacker & Sons, H.
Hartley Turner Radio, Ltd.
Kay, Ltd., P.
London Elec. Co. (Sherborne Lane), Ltd.
Margolin, J. & A.
Midgley Harmer, Ltd.
Midland Radio & Television Co.
Parkes, L. E.
Partridge & Mee, Ltd.
Philips Industrial (Philips Lamps, Ltd.).
Precision Electric, Ltd.
Radio Reconstruction Co., Ltd.
Regent Fittings Co.
Rose Morris & Co., Ltd.
Savage, W. B.
Scott Sessions & Co., G.
Shalless & Evans, Ltd.
Siemens Schuckert (Gt. Britain), Ltd
Smurthwaite, Ltd., F. W.
Tannoy Products.
Thompson, Diamond & Butcher.
Trix Electrical Co., Ltd.
Tyrela Gramophones, Ltd.
Voigt Patents, Ltd.

### GRAMOPHONES (portable).

Baker & Co., Ltd., G. F.
Balcombe, Ltd., A. J.
Baxter, Stavridi & Craies, Ltd.
British Homophone Co., Ltd.
Brunswick, Ltd.
Coppock, J. T.
Decca Gramophone Co., Ltd.
Dulcetto-Polyphon, Ltd.
Gilbert & Co., Ltd., C.
Gramophone Co., Ltd.
Itonia, Ltd.
Kay, Ltd., P.
Lugton & Co., Ltd.
Margolin, J. & A.
Millards.
Regent Fittings Co.
Robertshaw & Co., Ltd., E.
Rose, Morris & Co., Ltd.
Stead & Co., Ltd., J.
Stockall, Marples & Co., Ltd.
Thompson, Diamond & Butcher.
Tyrela Gramophones, Ltd.

### HEADPHONES.

Edison Swan Electric Co., Ltd.
General Electric Co., Ltd.
Ivory Electric, Ltd.
Kay, Ltd., P.
Kolster-Brandes, Ltd.
Lissen, Ltd.
Millet, J.
Multitone Electric Co., Ltd.
National Radio Service Co.
Phœnix Telephones & Elec. Works, Ltd.
Plessey Co., Ltd.
Siemens Elec. Lamps & Supplies, Ltd.
Siemens-Schuckert (Gt. Britain), Ltd.
Standard Telephones & Cables, Ltd.
Ward & Goldstone, Ltd.

### HOME TALKIE APPARATUS.

Grosvenor Works (Holloway), Ltd.
Kay, Ltd., P.
Partridge & Mee, Ltd.
Plessey Co., Ltd.
Radio Reconstruction Co., Ltd.
Radiovox Wireless Services, Ltd.
Salford Electrical Instruments, Ltd.
Synchrophone, Ltd.
Tannoy Products.
Trix Electrical Co., Ltd.

## PRODUCTS SUPPLIED

### HORNS.

Adams Bros. & Burnley, Ltd.
Castagnoli, G.
General Electric Co., Ltd.
Regent Fittings, Co.
Savage, W. B.
Scientific Supply Stores (Wireless), Ltd.
Trix Electrical Co., Ltd.
Universal Gramophone & Radio., Ltd.
Volgt Patents, Ltd.

### HYDROMETERS.

Chloride Electric Storage Co., Ltd.
Cookson & Co.
Cranley Radio, Ltd.
General Electric Co., Ltd.
Gordon, Fredk. J.
Ivory Electric, Ltd.
Millet, J.
Partridge, Wilson & Co., Ltd.
Stadium, Ltd.
Ward and Goldstone, Ltd.

### INSULATORS.

Altham Radio Co.
Blue Comet, Ltd.
British Insulated Cables, Ltd.
Crystalate Gramophone Record Mfg. Co., Ltd.
General Electric Co., Ltd.
General Mouldings Co., Ltd.
Ivory Electric, Ltd.
Jobling & Co., J. A.
Joseph, H.
Laker Co., Ltd., J. & J.
Lectro Linx, Ltd.
Lesingham, F. L.
Lorivale Manufacturing Co. (1921), Ltd.
Mica Manufacturing Co., Ltd.
Micanite & Insulators Co., Ltd.
Millet, J.
Moores & Co., J.
Partridge, Wilson & Co., Ltd.
Quartz Crystal, Co.
Siemens Elec. Lamps & Supplies, Ltd.
Trix Electrical Co., Ltd.
Ward & Goldstone Ltd.

### INSULATING MATERIALS (other than ebonite).

A.E.G. Electric Co., Ltd.
Bakelite, Ltd.
Belling & Lee, Ltd.
British Insulated Cables, Ltd.
Callenders Cable & Construction Co., Ltd.
Concordia Electric Wire Co., Ltd.
Cranley Radio Ltd.
Crystalate Gramophone Record Mfg. Co., Ltd.
De la Rue & Co., Ltd.
Ellison Insulations, Ltd.
Erinoid, Ltd.
General Electric Co., Ltd.
General Inductance Co.
Harrison & Co., A. T.
Igoo Rubber & Waterproofing Co., Ltd.
Lesingham, F. L.
London Electrical Co. (Sherborne Lane), Ltd.
Lorivale Mfg. Co. (1921), Ltd.
McLeod & McLeod.
Maul & Murphy, Ltd.
Mica Mfg. Co., Ltd.
Micanite & Insulators Co., Ltd.
Mountford Rubber Co., Ltd.
Pomona Rubber Co.
Siemens Elec. Lamps & Supplies, Ltd.
Sound Sales, Ltd.

### INTERFERENCE ELIMINATORS.

Altham Radio Co.
Automobile Accessories (Bristol), Ltd.
Bayliss, Ltd., W.
Bedford Electrical & Radio Co., Ltd.
Belling & Lee, Ltd.
British Pix Co., Ltd.
Cranley Radio, Ltd.
Custerson, R.
Dubilier Condenser Co. (1925), Ltd.
Erie Resistor, Ltd.
Ferranti, Ltd.
General Electric Co., Ltd.
Graham Farish Ltd.
Kolster-Brandes, Ltd.
London Electrical Co. (Sherborne Lane), Ltd.
Meritus (Barnet), Ltd.
Midland Radio & Television Co.
Muirhead & Co., Ltd.
Osdur Manufacturing Co.
Partridge & Mee, Ltd.
Radioformer, Ltd.
Radio Reconstruction Co., Ltd.
Radio Resistor Co.
Rich & Bundy, Ltd.
Salford Electrical Instruments, Ltd.
Scott, Sessions & Co., G.
Shalless & Evans, Ltd.
Siemens-Schuckert (Gt. Britain), Ltd.
Tannoy Products.
Telegraph Condenser Co., Ltd.
Trix Electrical Co., Ltd
Ward & Goldstone, Ltd.
362 Radio Valve Co., Ltd.

### KIT SETS.

Andrews & Co., A. E.
British Lumophon, Ltd.
British Television Supplies, Ltd.
Burne-Jones & Co., Ltd.
City Accumulator Co.
Cossor, Ltd.
Cranley Radio, Ltd.
Ferranti, Ltd.
Forbat, Eugen.
Hartley Turner Radio, Ltd.
Kay, Ltd., P.
Lissen, Ltd.
Nassak Mfg. Co., Ltd.
Northampton Plating Co.
Plessey Co., Ltd.
Scott Sessions & Co., G.
Shearing, Ltd., A. E.
Siemens Elec. Lamps & Supplies, Ltd.
Stratton & Co., Ltd.

### KNOBS AND DIALS.

Ashley Wireless Telephone Co. (1925), Ltd.
British Radiophone, Ltd.
Bulgin & Co., Ltd., A. F.
Chorlton Metal Co., Ltd.
Cole, Ltd., E. K.
Crystalate Gramophone Record Mfg. Co., Ltd.
General Electric Co., Ltd.
General Mouldings Co., Ltd.
Graham Farish, Ltd.
Gresley Radio, Ltd.
Harrison & Co., A. T.
Ivory Electric, Ltd.
Jackson Bros. (London), Ltd.

Kay, Ltd., P.
Maul & Murphy, Ltd.
McLeod & McLeod.
Plessey Co., Ltd.
Radiamp Co., Ltd.
Reliance Mfg. Co. (Southwark), Ltd.
Stratton & Co., Ltd.
Webb Condenser Co., Ltd.
Wilkins & Wright, Ltd.
Wingrove & Rogers, Ltd.
W.R.C., Ltd.

## LABELS AND SCALES.

Brandon & Sons, Ltd., J.
Celluloid Printers, Ltd.
Jackson Bros. (London), Ltd.
McLeod & McLeod.
Money Hicks, Ltd.
Pollock & Co., Ltd., W. J.
Stilwell & Sons.

## LABORATORY INSTRUMENTS.

Aerodyne Radio, Ltd.
Bird & Sons, Ltd., Sydney S.
Birmingham Sound Reproducers, Ltd.
British Radiophone, Ltd.
Brown Radio Co., W. F.
Burndept, Ltd.
Cambridge Instrument Co., Ltd.
Castagnoli, G.
Cole, Ltd., E. K.
Cossor, Ltd., A. C.
Everett, Edgcumbe & Co., Ltd.
Ferranti, Ltd.
General Electric Co., Ltd.
Hartley Turner Radio, Ltd.
Kay, Ltd., P.
London Electrical Co. (Sherborne Lane), Ltd.
Lyons, Ltd., Claude.
Muirhead & Co., Ltd.
Partridge & Mee, Ltd.
Plessey Co., Ltd.
Pullin & Co., Ltd., R. B.
Quartz Crystal Co.
Radio Reconstruction Co., Ltd.
Salford Electrical Instruments, Ltd.
Siemens-Schuckert (Gt. Britain), Ltd.
Sifam Electrical Instruments Co., Ltd.
Standard Telephones & Cables, Ltd.
Tannoy Products.
Voigt Patents, Ltd.
Weston Electrical Instrument Co., Ltd.
Wilkinson, L.

## LEAD-IN TUBES.

Altham Radio Co.
Ashley Wireless Telephone Co. (1925), Ltd.
Automobile Accessories (Bristol), Ltd.
Bedford Electrical & Radio Co., Ltd.
Bird & Sons, W.
Bligh, S. W.
Blue Comet, Ltd.
British Insulated Cables, Ltd.
Castle Fuse & Engineering Co., Ltd.
Coates, Ltd., J. G.
Colvern, Ltd.
Eagle Engineering Co., Ltd.
Eastick & Sons, J. J.
Elektra Supplies.
Ellison Insulations, Ltd.
Francois, E. J.
General Electric Co., Ltd.
Ivory Electric, Ltd.
Laker Co., Ltd., J. & J.
Lilley & Son, Ltd., S.
London Electrical Co. (Sherborne Lane), Ltd.
London & Provincial Factors, Ltd.
Michell, P. C.
Moores & Co., J.
Radiamp Co., Ltd.
Sparkes & Co., J.
Stratton & Co., Ltd.
Trix Electrical Co., Ltd.
Toubkin, J.
Ward & Goldstone, Ltd.
Wood, L. R.
Wright & Weaire, Ltd.

## PRODUCTS SUPPLIED

### LIGHTNING ARRESTERS.

Altham Radio Co.
Andrews & Co., A. E.
Ashley Wireless Telephone Co. (1925), Ltd.
Automobile Accessories (Bristol), Ltd.
Blue Comet, Ltd.
British Insulated Cables, Ltd.
British Pix Co., Ltd.
Bulgin & Co., Ltd., A. F.
Christie & Sons, Ltd., Jas.
General Electric Co., Ltd.
Graham Farish, Ltd.
Ivory Electric, Ltd.
Kay, Ltd., P.
Laker Co., Ltd., J. & J.
Lamplugh Radio, Ltd.
Lissen, Ltd.
Millet, J.
Philips Lamps, Ltd.
Phœnix Telephone & Elec. Works, Ltd.
Pioneer Mfg. Co.
Siemens Elec. Lamps & Supplies, Ltd.
Ward & Goldstone, Ltd.
Westinghouse Electric International Co.

### MAGNETS (telephone and speaker)

Adams Bros. & Burnley, Ltd.
Allen & Co., Ltd., E.
English Steel Corporation.
Ferranti Ltd.
General Electric Co., Ltd.
Neill & Co. (Sheffield), Ltd., James.
Swift Levick & Sons, Ltd.
Whiteley Electrical Radio, Co., Ltd.

### MAINS SUPPLY UNITS A.C.

All-Power Transformers, Ltd.
Altham Radio Co.
Baty, E. J.
Bayliss, Ltd., W.
Bedford Electrical & Radio Co., Ltd.
Bligh, S. W.
British Lumophon Co.
British Sampson Products.
Brown, Brew & Co., Ltd.
Bryce & Co., W. A.
Bullphone Radio.
Castagnoli, G.
Climax Radio Electric, Ltd.
Cole, E. K., Ltd.
Cossor, Ltd., A. C.
Cranley Radio, Ltd.
Dulci Electrical Co., Ltd.
Duray.
Dyson & Co. (Works), Ltd., J.
Eagle Engineering Co., Ltd.
Elliott Radio Mfg. Co., Ltd.
Faraday All-Wave Wireless.
Fel-Electric Radio.
Ferranti Ltd.
Heayberd & Co., F. C.
Ivory Electric, Ltd.
Kay, Ltd., P.
Lissen, Ltd.
London Electrical Co. (Sherborne Lane), Ltd.
Meritus (Barnet), Ltd.
Midland Radio & Television Co.
Mile End Radio Co.
Nicholls Ltd., J. T.
Parkes, L. E.
Partridge & Mee, Ltd.
Philips Industrial (Philips Lamps, Ltd.).
Philomel Radio Equipment Co.
Plessey Co., Ltd.
Radio Development Co.
Regent Radio Supply Co.
Shalless & Evans, Ltd.
Smurthwaite, Ltd., F. W.
Sound Sales, Ltd.
Standard Telephones & Cables, Ltd.
Supremus Specialities, Ltd.
Tannoy Products.
Tarrys.
Thompson, Diamond & Butcher.
Tod, T. M.
Trix Electrical Co., Ltd.
Varsity Eliminator Co., Ltd.
Wood, L. R.

### MAINS SUPPLY UNITS, D.C.

All-Power Transformers, Ltd.
Altham Radio Co.
Baty, E. J.
Bayliss, Ltd., W.
Bligh, S. W.
British Lumophon Co.
British Radio Mfg. Co. (Liverpool), Ltd.
British Sampson Products.
Brown Brew & Co., Ltd.
Castagnoli, G.
Climax Radio Electric, Ltd.
Cole, E. K., Ltd.
Cranley Radio, Ltd.
Dulci Electrical Co., Ltd.
Duray.
Dyson & Co. (Works), Ltd., J.
Eagle Engineering Co., Ltd.
Eon Vacuum Wireless Co.
Faraday All-Wave Wireless.
Fel-Electric Radio.
Heayberd & Co., F. C.
Ivory Electric, Ltd.
Kay, Ltd., P.
Lissen, Ltd.
London Electrical Co. (Sherborne Lane), Ltd.
Meritus (Barnet), Ltd.
Merrington Bros., Ltd.
Midland Radio & Television Co.
Nicholls, Ltd., J. T.
Partridge & Mee, Ltd.
Philips Industrial (Philips Lamps, Ltd.).
Plessey Co., Ltd.
Radio Development Co.
Regent Radio Supply Co.
Shalless & Evans, Ltd.
Smurthwaite, Ltd., F. W.
Sound Sales, Ltd.

Supremus Specialities, Ltd.
Tannoy Products.
Tarrys.
Thompson, Diamond & Butcher.
Tod, T. M.
Trix Electrical Co., Ltd.
Varsity Eliminator, Co., Ltd.
Wood, L. R.

### MASTS (aerial).

Accles & Pollock, Ltd.
Laker Co., Ltd., J. & J.
London Electrical Co. (Sherborne Lane), Ltd.
Osborn (Woodworkers), Ltd., C.

### METALS, RARE.

Hilger, Ltd., Adam.

### METERS.

British Electric Meters, Ltd.
Bulgin Co., Ltd., A.F.
Electrical Measuring Instruments Co.
Everett, Edgecumbe & Co.
Ferranti, Ltd.
General Electric Co., Ltd.
Harrison & Co., A. T.
Healey, Ltd., P.
Howard, Butler, Ltd.
Ivory Electric, Ltd.
Kay, Ltd., P.
McLeod & McLeod.
McMillan & Co., J.
Millet, J.
Pifco, Ltd.
Pullin & Co., Ltd., R. B.
Salford Electrical Instruments, Ltd.
Siemens Electric Lamps & Supplies, Ltd.
Siemens-Schuckert (Gt. Britain), Ltd.
Sifam Electrical Instrument Co., Ltd.
Stadium, Ltd.
Toubkin, J.
Walsall Electrical Co., Ltd.
Westinghouse Electric International Co.
Weston Electrical Instrument Co., Ltd.
Wilkinson, L.

### MICROPHONES.

Adolph, F.
Altham Radio Co.
Amplion (1932), Ltd.
Anglo-American Industries Corp.
Burndept, Ltd.
Castagnoli, G.
Correx Amplifiers.
Dent & Co. & Johnson, Ltd.
Dulci Electrical Co., Ltd.
Edison Swan Electric Co., Ltd.
Electromicro Manufacturing Co.
Film Industries, Ltd.
General Electric Co., Ltd.
Grampian Reproducers, Ltd.
Igranic Electric Co., Ltd.
Ivory Electric, Ltd.
London Electric Co. (Sherborne Lane), Ltd.
Lyons, Ltd., Claude.
Metal Agencies Co., Ltd.
National Radio Service Co.
Partridge & Mee, Ltd.
Philips Industrial (Philips Lamps, Ltd.)
Phœnix Telephones & Elec. Works, Ltd.
Pooley, G. J.
Radiovox Wireless Services, Ltd.
Rothermel, Ltd., R. A.
Savage, W. B.
Scientific Supply Stores (Wireless), Ltd.
Siemens-Schuckert (Gt. Britain), Ltd.
Sonochorde Reproducers, Ltd.
Standard Telephones & Cables, Ltd.
Tannoy Products.
Trix Electrical Co., Ltd.
Voigt Patents, Ltd.
Webber, Ltd., R. A.

### MODULATED OSCILLATORS.

Allwave International Radio & Television, Ltd.
Birmingham Sound Reproducers, Ltd.
Brown Radio Co., W. F.
Cole, Ltd., E. K.
Cossor, Ltd., A. C.
Cranley Radio, Ltd.
Custerson, R.
Eastick & Sons, J. J.
Everett Edgcumbe & Co., Ltd.
Hartley Turner Radio, Ltd.
London Electrical Co. (Sherborne Lane), Ltd.
Lyons, Ltd., Claude.
Muirhead & Co., Ltd.
Parkes, L. E.
Plessey Co., Ltd.
Siemens Schuckert (Gt. Britain), Ltd.
Sifam Electrical Instrument Co., Ltd.
Standard Telephones & Cables, Ltd.
Tannoy Products.
Weston Electrical Instrument Co., Ltd.

### MOTORS (gramophone, A.C.)

Ambassador Radio Gramophones.
British Sampson Products.
Collaro, Ltd.
Coppock, J. T.
Corona Engineering & Motor Co., Ltd.
Cosmocord, Ltd.
Garrard Engineering & Manufacturing Co., Ltd.
General Electric Co., Ltd.
Gramophone Co., Ltd.
Kay, Ltd., P.
Kingsway Radio, Ltd.
London Electrical Co. (Sherborne Lane), Ltd.
Lugton & Co., Ltd.
McLeod & McLeod, Ltd.
Regent Fittings Co.
Rose, Morris & Co., Ltd.
Siemens-Schuckert (Gt. Britain), Ltd.

### MOTORS (gramophone, D.C.)

British Sampson Products.
Collaro, Ltd.
Coppock, J. T.
Cosmocord, Ltd.
Garrard Engineering & Mfg. Co., Ltd.
General Electric Co., Ltd.
Gramophone Co., Ltd.
Kay, Ltd., P.
Lugton & Co., Ltd.
Regent Fittings Co.
Rose, Morris & Co., Ltd.
Siemens-Schuckert (Gt. Britain), Ltd.

### MOTORS (gramophone spring).

Collaro, Ltd.
Coppock, J. T.
Garrard Engineering & Manufacturing Co., Ltd.
Harris, G. & R.
Kay, Ltd., P.
Lugton & Co., Ltd.
McLeod & McLeod, Ltd.
Regent Fittings Co.
Rose, Morris & Co., Ltd.
Thompson, Diamond & Butcher.

### MOTORS (gramophone, universal).

Collaro, Ltd.
Coppock, J. T.
Cosmocord, Ltd.
Garrard Engineering & Mfg. Co., Ltd.
Kay, Ltd., P.
Lugton & Co., Ltd.
Regent Fittings Co.
Rose, Morris & Co., Ltd.
Univolt Electric, Ltd.

### MOULDINGS (other than ebonite).

Ashley Wireless Telephone Co. (1925), Ltd.
Brandon & Sons, Ltd., J.
Bulgin & Co., Ltd., A. F.
Callender's Cables & Construction Co., Ltd.
Cole, Ltd., E. K.
Crystalate Gramophone Record Mfg. Co., Ltd.
Daly, H. C.
De-La-Rue & Co., Ltd., Thos.
Ellison Insulations, Ltd.
Ferranti, Ltd.
Freed, S. R. F.
General Electric Co., Ltd.

## PRODUCTS SUPPLIED

General Mouldings Co., Ltd.
Harrison & Co., A. T.
Lorival Mfg. Co. (1921), Ltd.
Lucas, Ltd.
Maul & Murphy, Ltd.
McLeod & McLeod.
Mica Mfg. Co., Ltd.
Osborn (Woodworkers), Ltd., C.
Parcussi, E.
Pooley, G. J.
Precision Radio & Mfg. Co., Ltd.
Radiamp Co., Ltd.
Reliance Mfg. Co. (Southwark), Ltd.
Rotax, Ltd.
St. Helen's Cable & Rubber Co., Ltd.
Sharplin, Ltd., W. J.
T. M. C. Harwell (Sales), Ltd.
T.X. Products Co., Ltd.
Westinghouse Brake & Saxby Signal Co.
Whiteley Electrical Radio Co., Ltd.
Wilkins & Wright, Ltd.
W.R.C., Ltd.

### MOULDING POWDERS.

Bakelite, Ltd.
General Electric Co., Ltd.
Gresley Radio, Ltd.

### NEEDLE CUPS AND CONTAINERS.

Beddoes, Ltd., J. G.
British Goldring Products, Ltd.
Bulgin & Co., Ltd., A. F.
Gilbert & Co., Ltd., C.
Grosvenor Works (Holloway), Ltd.
Harris, G. & R.
Leibovici, J.
Lockwood Casework Mfg. Co.
Lugton & Co., Ltd.
Morton, Ltd., E. R.
Regent Fittings Co.
Rose, Morris & Co., Ltd.
Wendell Radio, Ltd.
Williams & Gray, Ltd.

### NEEDLES (fibre).

Amplifiers, Ltd.
Brunswick, Ltd.
Coppock, J. T.
Daws, Clarke & Co.
E.M.G. Hand-Made Gramophones, Ltd.
Gramophone Co., Ltd.
Lugton & Co., Ltd.
Parlophone Co., Ltd.
Regent Fittings Co.
Rose, Morris Co., Ltd.
Thompson, Diamond & Butcher.
Wright & Weaire, Ltd.

### NEEDLES (steel).

Allwood Blackband & Co.
Balcombe, Ltd., A. J.
British Needle Co., Ltd.
Coppock, J. T.
Crystalate Gramophone Record Mfg. Co., Ltd.
Decca Gramophone Co., Ltd.
Gilbert & Co., Ltd., C.
Gramophone Co., Ltd.
Guillaume & Sons, Ltd.
Lissen, Ltd.
Lugton & Co., Ltd.
Regent Fittings Co.
Rose, Morris & Co., Ltd.
Thompson, Diamond & Butcher.
Wright & Weaire, Ltd.

### NEEDLES (semi-permanent).

Allwood, Blackband & Co.
Balcombe, Ltd., A. J.
British Needle Co., Ltd.
Brunswick, Ltd.
Coppock, J. T.
Gramophone Co., Ltd.
Guillaume & Sons, Ltd.
Kay, Ltd., P.
Lugton & Co., Ltd.
Rose, Morris & Co., Ltd.
Thompson, Diamond & Butcher.

### PHOTO-ELECTRIC CELLS.

Adolph, F.
Blue Comet, Ltd.
Clarion Radio Valve Co.
Concerton Radio & Electrical Co., Ltd.
Edison-Swan Electric Co., Ltd.
Everett, Edgcumbe & Co., Ltd.
General Electric Co., Ltd.
Kay, Ltd., P.
Lyons, Ltd., Claude.
Octron, Ltd.
Philips Industrial (Philips Lamps, Ltd.).
Salford Electrical Instruments, Ltd.
Siemens-Schuckert (Gt. Britain), Ltd.
Weston Electrical Instrument Co., Ltd.
362 Radio Valve Co., Ltd.

### PICK-UPS.

Ambassador Radio Gramophones.
Amplifiers, Ltd.
Amplion (1932), Ltd.
Anglo-American Industries Corpn.
Balcombe, Ltd., A. J.
Belling & Lee, Ltd.
Bowyer Lowe & A.E.D., Ltd.
British Blue Spot Co., Ltd.
British Goldring Products, Ltd.
British Lumophon Co.
British Radiophone, Ltd.
Bulgin & Co., Ltd., A. F.
Burndept, Ltd.
Chorlton Metal Co., Ltd.
Collaro, Ltd.
Coppock, J. T.
Cosmocord, Ltd.
Edison Swan Electric Co., Ltd.
E.M.G. Hand Made Gramophones, Ltd.
Garrard Engineering & Mfg. Co., Ltd.
General Electric Co., Ltd.
Gramophone Co., Ltd.
Grosvenor Wks. (Holloway), Ltd.
Kay, Ltd., P.
Kingsway Radio, Ltd.
Kolster-Brandes, Ltd.
Lissen, Ltd.
Loewe Radio Co., Ltd.
Lotus Radio (1933), Ltd.
Lugton & Co., Ltd.
Lyons, Ltd., Claude.
Oppenheim & Co., Ltd., E.
Parlophone Co., Ltd.
Philips Lamps, Ltd.
Plessey Co., Ltd.
Rawson (Sheffield & London), Ltd., H. C.
Rose, Morris & Co., Ltd.
Rothermel, Ltd., R. A.
Siemens-Schuckert (Gt. Britain), Ltd.
Thompson Diamond & Butcher.
Toubkin, J.
Varley (Proprietors, Oliver Pell Control, Ltd.
W.R.C., Ltd.

### PICK-UP ARMS.

Adams Bros. & Burnley, Ltd.
Amplifiers, Ltd.
Anglo-American Industries Corpn.
Bowyer-Lowe & A. E. D., Ltd.
British Goldring Products, Ltd.
British Ideal Patents, Ltd.
British Lumophon Co.
Bulgin & Co., Ltd., A. F.
Chorlton Metal Co., Ltd.
Coppock, J. T.
Edison Swan Electric Co., Ltd.
E.M.G. Hand Made Gramophones, Ltd.
Garrard Engineering & Mfg. Co., Ltd.
General Electric Co., Ltd.
Grosvenor Works (Holloway), Ltd.
Kay, Ltd., P.
Loewe Radio Co., Ltd.
London Electrical Co. (Sherborne Lane), Ltd.
Lotus Radio (1933), Ltd.
Oppenheim & Co., Ltd., E.

Parlophone Co., Ltd.
Plessey Co., Ltd.
Regent Fittings Co.
Rose, Morris & Co., Ltd.
Varley (Oliver Pell Control, Ltd.).
W.R.C., Ltd.

## PLAYING DESKS.

Automobile Accessories (Bristol), Ltd.
Balcombe, Ltd., A. J.
Baxter, Stavridi & Craies, Ltd.
Bayliss, Ltd., W.
Bowyer Lowe & A.E.D., Ltd.
British Radio Corpn., Ltd.
Caradio Services, Ltd.
Castagnoli, G.
City Accumulator Co.
Collings & Co., N. R.
Cosmocord, Ltd.
Edison Swan Electric Co., Ltd.
Elliotts.
E.M.G. Hand Made Gramophones, Ltd.
General Electric Co., Ltd.
Gramophone Co., Ltd.
Hartley Turner Radio, Ltd.
Joseph, H.
Kay, Ltd., P.
Lockwood Casework Mfg. Co.
London Electrical Co. (Sherborne Lane), Ltd.
Lugton & Co., Ltd.
Margolin, J. & A.
Midland Radio & Television Co.
Radio Reconstruction Co., Ltd.
Radiovox Wireless Services, Ltd.
Siemens-Schuckert (Gt. Britain), Ltd.
Smurthwaite, Ltd., F. W.
Tannoy Products.
Thompson Diamond & Butcher.
Trix Electrical Co., Ltd.
Voigt Patents, Ltd.

## PLUGS AND JACKS.

Ashley Wireless Telephone Co. (1925), Ltd.
Francois, E. J.
General Electric Co., Ltd.
Harris, G. & R.
Igranic Electric Co., Ltd.
Ivory Electric.
Lissen, Ltd.
Millet, J.
Phoenix Telephone & Electric Works, Ltd.
Standard Telephones & Cables, Ltd.
T.M.C. & Harwell (Sales), Ltd.
Wright & Weaire, Ltd.
W.R.C., Ltd.

## PLUGS AND SOCKETS.
### (not jack or wander plugs).

Andrews & Co., A. E.
Belling & Lee, Ltd.
Castle Fuse and Engineering Co., Ltd.
Crabtree, J. A., & Co., Ltd.
Eastick, & Sons, J. J.
Francois, E. J.
General Electric Co., Ltd.
Graham & Co., R. F.
Gripso Co.
Ivory Electric. Ltd.
Lectro Linx, Ltd.
Lilley & Son, Ltd., S.
Lisenin Wireless Co.
Lundberg & Sons, Ltd., A. P.
Millet, J.
True Screws, Ltd.
Ward & Goldstone, Ltd.
Wright & Weaire, Ltd.
W.R.C., Ltd.

## POTENTIOMETERS.

Bowyer-Lowe & A. E. D., Ltd.
British Goldring Products, Ltd.
British N.S.F. Co., Ltd.
British Radiophone, Ltd.
Burne-Jones & Co., Ltd.
Castagnoli, G.
Cosmocord, Ltd.
Cossor, Ltd., A. C.
Eagle Eng., Co., Ltd.
Edison Swan Elec. Co., Ltd.
Erie Resistor, Ltd.
Ferranti, Ltd.
General Electric Co., Ltd.
Goodmans (Clerkenwell), Ltd.
Graham Farish, Ltd.
Harrison & Co., A. T.
Igranic Electric Co., Ltd.
Imp Radio Co.
Kay, Ltd., P.
Lechner & Co., F. W.
Lissen, Ltd.
Lyons, Ltd., Claude.
Plessey Co., Ltd.
Radiamp Co., Ltd.
Reliance Mfg. Co. (Southwark), Ltd.
Rothermel, Ltd., R. A.
Salford Electrical Instruments, Ltd.
Savage, W. B.
Siemens-Schuckert (Gt. Britain), Ltd.
Tannoy Products.
Varley.
Ward & Goldstone, Ltd.
Watmel Wireless, Ltd.
Wingrove & Rogers, Ltd.
Wright & Weaire, Ltd.
W.R.C., Ltd.
Zenith Electric Co., Ltd.

## PRESSINGS.

Adams Bros., & Burnley, Ltd.
Allwave International Radio & Television, Ltd.
Alpha Products.
Ashley Wireless Telephone Co. (1925), Ltd.
Baker & Finnemore, Ltd.
Beddoes, Ltd., J. G.
Bedford Elec. & Radio Co., Ltd.
Burne-Jones & Co., Ltd.
Busby & Co., Ltd.
Christie & Sons, Ltd., Jas.
Eagle Eng. Co., Ltd.

## PRODUCTS SUPPLIED

Edmonds, Ltd., G.
Gee (Birmingham), Ltd.
General Electric Co., Ltd.
Goodmans (Clerkenwell), Ltd.
Grosvenor Works (Holloway), Ltd.
Harris, G. & R.
Harrison & Co., A. T.
Jackson Bros. (London), Ltd.
Lilley & Son, Ltd., S.
Manor Works (Aston), Ltd.
Marks & Son, S.
Money Hicks, Ltd.
Person & Son, L.
Radiamp Co., Ltd.
Reliance Mfg. Co. (Southwark), Ltd.
Ross Courtney & Co., Ltd.
Sankey & Sons, Ltd., Joseph.
True Screws, Ltd.
Walsall Electrical Co., Ltd.
White Bros. & Jacobs, Ltd.
Wilkins & Wright, Ltd.
Williams & Gray, Ltd.
Williams & Moffat, Ltd.

### PUBLIC ADDRESS EQUIPMENT.

Adolph, F.
Allwave International Radio & Television, Ltd.
Amplion (1932), Ltd.
Austin Mills & Co.
Automobile Accessories (Bristol), Ltd.
Baker's Selhurst Radio, Ltd.
Bayliss, Ltd., W.
Birmingham Sound Reproducers, Ltd.
Bligh, S. W.
Blue Comet, Ltd.
British Radio Corpn.
British Radio Mfg. Co. (Liverpool), Ltd.
Brown, Brew & Co., Ltd.
Burndept, Ltd.
Castagnoli, G.
City Accumulator Co.
Charlton Higgs (Radio), Ltd.
Correx Amplifiers.
Cranley Radio, Ltd.
Dent & Co., & Johnson, Ltd.
Donophone P. A. Co., Ltd.
Edison Swan Electric Co., Ltd.
Electrocet Radio Co.
Electro Technical Products, Ltd.
Elliotts.
Ferranti, Ltd.
Film Industries, Ltd.
Forbat, E.
General Electric Co., Ltd.
Goodmans (Clerkenwell), Ltd.
Hacker & Sons, H.
Hartley Turner Radio, Ltd.
Heayberd & Co., F. C.
Kay, Ltd., P.
London Electric Co. (Sherborne Lane), Ltd.
Lyons, Ltd., Claude.
Metal Agencies Co., Ltd.
Midgley Harmer, Ltd.
Midland Radio & Television Co.
Mobile Amplifiers, Ltd.
Nuvolion Electrics, Ltd.
Philips Industrial (Philips Lamps, Ltd.).
Radio Reconstruction Co., Ltd.
Radiovox Wireless Services, Ltd.
Ray Engineering Co.
Rich & Bundy, Ltd.
Rothermel, Ltd., R. A.
Savage, W. B.
Scientific Supply Stores (Wireless), Ltd.
Scott-Sessions & Co., G.
Shalless & Evans, Ltd.
Siemens-Schuckert (Gt. Britain), Ltd.
Sifam Electrical Instrument Co., Ltd.
Smurthwaite, Ltd., F. W.
Sound Sales, Ltd.
Tannoy Products.
Trix Electrical Co., Ltd.
Universal Gramophone & Radio Co., Ltd.
Universal High Voltage Radio, Ltd.
Voigt Patents, Ltd.
Webber, Ltd., R. A.

### RADIO-GRAMOPHONES (Spring and Battery-driven).

Aerodyne Radio, Ltd.
Allwave International Radio & Television, Ltd.
Automobile Accessories (Bristol), Ltd.
Balcombe, Ltd., A. J.
Bligh, S. W.
Blue Comet, Ltd.
British Lumophon Co.
British Radio Mfg. Co. (Liverpool), Ltd.
Burndept, Ltd.
Burne Jones & Co., Ltd.
Castagnoli, G.
Chalkley, C. G.
City Accumulator Co.
Cranley Radio, Ltd.
Eagle Eng. Co., Ltd.
Elliotts.
E.M.G. Hand Made Gramophones, Ltd.
Kay, Ltd., P.
Kolster Brandes, Ltd.
London Electrical Co. (Sherborne Lane), Ltd.
Scott Sessions & Co., G.
Shalless & Evans, Ltd.
Smurthwaite, Ltd., F. W.
Tannoy Products.
Trix Electrical Co., Ltd.
Truphonic Radio (Putney) Ltd.
Wood, L. R.

### RADIO-GRAMOPHONES (all-mains A.C.)

Aerodyne Radio, Ltd.
Allwave International Radio & Television, Ltd.
Ambassador Radio Gramophones.
Amplion (1932), Ltd.
Automobile Accessories (Bristol), Ltd.

Balcombe, Ltd., A. J.
Bayliss, Ltd., W.
Betterset Radio, Ltd.
Birmingham Sound Reproducers, Ltd.
Bligh, S. W.
Blue Comet, Ltd.
British Lumophon Co.
British Radiophone, Ltd.
Brown Brew & Co., Ltd.
Burndept, Ltd.
Burne Jones & Co., Ltd.
Castagnoli, G.
Charlton Higgs (Radio), Ltd.
City Accumulator Co.
Climax Radio Electric, Ltd.
Cole, Ltd., E. K.
Conways Elec., Ltd.
Cossor, Ltd., A. C.
Cranley Radio. Ltd.
Decca Gramophone Co., Ltd.
Eagle Eng. Co., Ltd.
Edge Radio, Ltd.
Electrical & Radio Products (1931), Ltd.
Eldeco Radio, Ltd.
Elliotts.
E.M.G. Hand Made Gramophones, Ltd.
Faraday Allwave Wireless.
Ferranti, Ltd.
Forbat, E.
Fox Industrial, Ltd.
General Electric Co., Ltd.
Gramophone Co., Ltd.
Hacker & Sons, H.
Halcyon Radio, Ltd.
Hart Collins, Ltd.
Hartley Turner Radio, Ltd.
Haynes Radio.
I.M.S. Radio Co.
Kay, Ltd., P.
Kolster Brandes, Ltd.
Lampex Radio & Elec. Co.
London Electrical Co. (Sherborne Lane), Ltd.
London Radio Co. (Leeds) Ltd.
Marconiphone Co., Ltd.
Merrington Bros., Ltd.
Midgley Harmer, Ltd.
Midland Radio & Television Co.
Murphy Radio, Ltd.
Partridge & Mee, Ltd.
Philips Lamps, Ltd.
Plessey Co., Ltd.
Portland Radio Co., Ltd.
Precision Electric, Ltd.
Pye Radio, Ltd.
Radio Development Co.
Rawson (Sheffield & London) Ltd., H. C.
Riley & Son, W.
R. A. P., Ltd.
Scott Sessions & Co., G.
Shalless & Evans, Ltd.
Smurthwaite, Ltd., F. W.
Sunbeam Electric, Ltd.
Tannoy Products.
Trix Electrical Co., Ltd.
Truphonic Radio (Putney) Ltd.
Ultra Electric, Ltd.
Universal High Voltage Radio, Ltd.
Voigt Patents, Ltd.
Wood, L. R.
Wurlitzer Lyric Radio, Ltd.

## RADIO-GRAMOPHONES (D.C.).

Aerodyne Radio, Ltd.
Allwave International Radio & Television, Ltd.
Balcombe, Ltd., A. J.
Bayliss, Ltd., W.
Betterset Radio, Ltd.
Bligh, S. W.
Blue Comet, Ltd.
British Lumophon Co.
British Radio Mfg. Co. (Liverpool), Ltd.
Brown Brew Co., Ltd.
Burndept, Ltd.
Castagnoli, G.
Charlton Higgs (Radio), Ltd.
Climax Radio Electric, Ltd.
Cole, Ltd., E. K.
Conways Elec., Ltd.
Cranley Radio, Ltd.
Decca Gramophone Co., Ltd.
Eagle Eng. Co., Ltd.
Electrical & Radio Products (1931), Ltd.
Elliotts.
Faraday Allwave Wireless Co.
Forbat, E.
Fox Industrial, Ltd.
General Electric Co., Ltd.
Gramophone Co., Ltd.
Hacker & Sons, H.
Hart Collins, Ltd.
I. M. S. Radio Co.
Kay, Ltd., P.
Lampex Radio & Elec. Co.
London Electrical Co. (Sherborne Lane) Ltd.
Marconiphone Co., Ltd.
Midland Radio & Television Co.
Murphy Radio, Ltd.
Paramount Gramophone Co.
Plessey Co., Ltd.
Precision Electric, Ltd.
Pye Radio, Ltd.
Radio Development Co.
Rawson (Sheffield & London), Ltd., H. C.
R. A. P., Ltd.
Scott Sessions & Co., G.
Shalless & Evans, Ltd.
Smurthwaite, Ltd., F. W.
Sunbeam Electric Ltd.
Tannoy Products.
Trix Electrical Co., Ltd.
Ultra Electric, Ltd.
Universal High Voltage Radio, Ltd.
Wood, L. R.

## RADIO-GRAMOPHONES (portable).

Allwave International Radio & Television, Ltd.
Blue Comet, Ltd.
Cranley Radio, Ltd.
Decca Gramophone Co., Ltd.
Elliotts.

## PRODUCTS SUPPLIED

Eon Vacuum Wireless Co.
Gramophone Co., Ltd.
Kay, Ltd., P.
Scott Sessions & Co., G.
Shalless & Evans, Ltd.
Tannoy Products.
Trix Electrical Co., Ltd.

### RECEIVERS (crystal).

Automobile Accessories (Bristol), Ltd.
Bligh, S. W.
Burne-Jones & Co., Ltd.
Castagnoli, G.
Chalkley, C. G.
Custerson, R.
East Ham Wireless Supplies.
Elliotts.
Ivory Electric, Ltd.
Lotus Radio (1933), Ltd.
Ward & Goldstone, Ltd.

### RECEIVERS (chassis).

Allwave International Radio & Television, Ltd.
Ambassador Radio Gramophones.
Amplion (1932), Ltd.
Baty, E. J.
Bedford Elec. & Radio Co., Ltd.
Blue Comet, Ltd.
British Lumophon Co.
British Radiophone, Ltd.
Burndept, Ltd.
Burne-Jones & Co., Ltd.
Cossor, Ltd., A. C.
Cranley Radio, Ltd.
Custerson, R.
Eagle Engineering Co., Ltd.
Eldeco Radio, Ltd.
E.M.G. Hand Made Gramophones, Ltd.
Faraday Allwave Wireless.
Forbat, E.
Fox Industrial, Ltd.
Hacker & Sons, H.
I.M.S. Radio Co.
Jackson Bros. (London), Ltd.
Kay, Ltd., P.
London Electrical Co. (Sherborne Lane), Ltd.
Lotus Radio (1933), Ltd.
Mains Radio Mfg. Co.
Marks & Son, S.
Master Radio & Elec. Co., Ltd.
Midland Radio & Television Co.
Elliotts.
Novo Radio-Electric, Ltd.
Parkes, L. E.
Parsonage, W. F.
Plessey Co., Ltd.
Radiovox Wireless Services, Ltd.
R.A.P., Ltd.
Scott Sessions & Co., G.
Shalless & Evans, Ltd.
Tannoy Products.
Trix Electrical Co., Ltd.
Universal High Voltage Radio, Ltd.
Whiteley Electrical & Radio Co., Ltd.
Wood, L. R.

### RECEIVERS (valve, all-wave).

Allwave International Radio & Television, Ltd.
Anglo American Industries Corp.
Automobile Accessories (Bristol), Ltd.
Betterset Radio, Ltd.
Birmingham Sound Reproducers, Ltd.
Blue Comet, Ltd.
British Belmont Radio, Ltd.
British Radiophone, Ltd.
Burndept, Ltd.
Burne-Jones & Co., Ltd.
Castagnoli, G.
Climax Radio Elec., Ltd.
Cole, Ltd., E. K.
Cossor, Ltd., A. C.
Cranley Radio, Ltd.
Edge Radio, Ltd.
Eldeco Radio, Ltd.
Eon Vacuum Wireless Co., Ltd.
Faraday Allwave Wireless Co.
Forbat, E.
General Electric Co., Ltd.
Hacker & Sons, H.
Hart Collins, Ltd.
Kay, Ltd., P.
Lampex Radio & Electric Co.
Lissen, Ltd.
London Radio Co. (Leeds), Ltd.
Lyons, Ltd., Claude.
Mavox Radio, Ltd.
Mervyn Sound & Vision Co., Ltd.
Midland Radio & Television Co.
Plessey Co., Ltd.
Portland Radio Co., Ltd.
Radio Development Co.
Scott Sessions & Co., G.
Shalless & Evans, Ltd.
Stonehouse Radio Supplies.
Stratton & Co., Ltd.
Tannoy Products.
Tyrela Electric, Ltd.
Universal High Voltage Radio, Ltd.
Whiteley Electrical & Radio Co., Ltd.
Wurlitzer Lyric Radio, Ltd.

### RECEIVERS (valve, standard battery type).

Aerodyne Radio, Ltd.
Allwave International Radio & Television, Ltd.
Altham Radio Co.
Automobile Accessories (Bristol), Ltd.
Balcombe, Ltd., A. J.
Bedford Elec. & Radio Co., Ltd.
Bligh, S. W.
Blue Comet, Ltd.
British Lumophon Co.
Burndept, Ltd.
Burne-Jones & Co., Ltd.
Burton, C. F. & H.
Bush Radio, Ltd.
Castagnoli, G.
Chalkley, C. G.
City Accumulator Co.
Climax Radio Electric, Ltd.
Cole, Ltd., E. K.
Cossor, Ltd.
Cranley Radio, Ltd.
Cromwell (Southampton), Ltd.
Custerson, R.
Distavox, Ltd.
Eagle Engineering Co., Ltd.
East Ham Wireless Supplies.
Edge Radio, Ltd.
Eldeco Radio, Ltd.
Electrical & Radio Products (1931), Ltd.
Elliotts.
Ferranti, Ltd.
Fox Industrial, Ltd.
General Electric Co., Ltd.
Greatrex & Co., R. G.
Hacker & Sons, H.
Halcyon Radio, Ltd.

Hart Collins, Ltd.
I.M.S. Radio Co.
Kay, Ltd., P.
Kolster-Brandes, Ltd.
Lampex Radio & Electric Co.
Lawrence, P. Harold.
Lissen, Ltd.
London Electrical Co. (Sherborne Lane), Ltd.
London Radio Co. (Leeds), Ltd.
Lotus Radio (1933), Ltd.
Marconiphone Co., Ltd.
McLeod & McLeod, Ltd.
McMichael Radio, Ltd.
Mavox Radio, Ltd.
Merrington Bros., Ltd.
Milnes Radio Co., Ltd.
Mullard Wireless Service, Co., Ltd.
Murphy Radio, Ltd.
Parkes, L. E.
Parsonage, W. F.
Philips Lamps, Ltd.
Plessey Co., Ltd.
Precision Electric, Ltd.
Rawson (Sheffield & London), Ltd., H.C.
Regentone, Ltd.
Scott Sessions & Co., G.
Shalless & Evans, Ltd.
Six Sixty Radio Co., Ltd.
Smurthwaite, F. W.
Truphonic Radio Co. (Putney), Ltd.
Ultra Electric, Ltd.
Wood, L. R.

### RECEIVERS (valve, short wave).

Aerodyne Radio, Ltd.
Allwave International Radio & Television, Ltd.
Automobile Accessories (Bristol), Ltd.
Bijou Radio, Co.
Blue Comet, Ltd.
British Radiophone, Ltd.
British Television Supplies, Ltd.
Burndept, Ltd.
Burne-Jones & Co., Ltd.
Castagnoli, G.
City Accumulator Co.
Cole, Ltd., E. K.
Cossor, Ltd., A. C.
Cranley Radio, Ltd.
Custerson, R.
East Ham Wireless Supplies.
Electric Lamp Service Co., Ltd.
Elliots.
Ferranti, Ltd.
Forbat, E.
General Electric Co., Ltd.
Hacker & Sons, H.
Hart Collins, Ltd.
Kay, Ltd., P.
Lampex Radio & Elec. Co.
London Electrical Co. (Sherborne Lane), Ltd.
Lotus Radio (1933), Ltd.
McLeod & McLeod, Ltd.
McMichael Radio, Ltd.
Mavox Radio, Ltd.
Mechanical Utilities Co., Ltd.
Midland Radio & Television Co.
Plessey Co., Ltd.
Portland Radio Co., Ltd.
Quartz Crystal Co.
Radio Development Co.
Scientific Supplies Stores (Wireless), Ltd.
Scott Sessions & Co., G.
Shalless & Evans, Ltd.
Smurthwaite, F. W.
Stonehouse Radio Supplies.
Stratton & Co., Ltd.
Tannoy Products.
Trix Electrical Co., Ltd.

### RECEIVERS (valve, A.C. mains).

Aerodyne Radio, Ltd.
Allwave International Radio & Television, Ltd.
Ambassador Radio Gramophones.
Amplion (1932), Ltd.
Automobile Accessories (Bristol), Ltd.
Balcombe, Ltd., A. J.
Baty, E. J.
Bayliss, Ltd., W.
Bedford Elec. & Radio Co., Ltd.
Betterset Radio, Ltd.
Birmingham Sound Reproducers, Ltd.
Bligh, S. W.
Blue Comet, Ltd.
British Lumophon Co.
British Radiophone, Ltd.
Brown, Brew & Co., Ltd.
Brunswick, Ltd.
Burndept, Ltd.
Burne-Jones & Co., Ltd.
Burton, C. F. & H.
Bush Radio, Ltd.
Castagnoli, G.
Chalkley, C. G.
Charlton Higgs (Radio), Ltd.
City Accumulator Co.
Climax Radio Electric, Ltd.
Cole, Ltd., E. K.
Conways Elec., Ltd.
Cossor, Ltd.
Cranley Radio, Ltd.
Cromwell (Southampton), Ltd.
Custerson, R.
Distavox, Ltd.
Donophone, P. A. Co., Ltd.
Eagle Engineering Co., Ltd.
East Ham Wireless Supplies.
Edge Radio, Ltd.
Eldeco Radio, Ltd.
Electrocet Radio Co.
Electrical & Radio Products (1931), Ltd.
Elliotts.
E.M.G. Hand Made Gramophones, Ltd.
Ferranti, Ltd.
Forbat, E.
Fox Industrial, Ltd.
General Electric Co., Ltd.
Godfrey (Radio), Ltd., F. E.
Gramophone Co., Ltd.
Greatrex & Co., R. G.
Hacker & Sons, H.
Halcyon Radio, Ltd.
Halson Radio Co., Ltd.

## PRODUCTS SUPPLIED

Hart Collins, Ltd.
Hartley Turner Radio, Ltd.
Haynes Radio.
Impex Electrical, Ltd.
I.M.S. Radio Co.
Kay, Ltd., P.
Kolster-Brandes, Ltd.
Lawrence, P. Harold.
Lissen, Ltd.
London Electrical Co. (Sherborne Lane), Ltd.
London Radio Co. (Leeds), Ltd.
Lotus Radio (1933), Ltd.
McLeod & McLeod.
McMichael Radio, Ltd.
Mains-Radio Mfg. Co.
Marconiphone Co., Ltd.
Master Radio & Electrical Co., Ltd.
Midgley Harmer, Ltd.
Midland Radio & Television Co.
Multitone Electric Co., Ltd.
Murphy Radio, Ltd.
Novo Radio-Electric, Ltd.
Parkes, L. E.
Parsonage, W. F.
Philips Lamps, Ltd.
Plessey Co., Ltd.
Portland Radio Co., Ltd.
Precision-Electric, Ltd.
Pye Radio, Ltd.
Radio Development Co.
Radio Mfg. Co.
Rawson (Sheffield & London), Ltd.. H. C.
Regentone, Ltd.
Riley & Son, W.
R. A. P., Ltd.
Scott Sessions & Co., G.
Shalless & Evans, Ltd.
Six-Sixty Radio Co., Ltd.
Smurthwaite, F. W.
Tannoy Products.
Truphonic Radio (Putney), Ltd.
Trix Electrical Co., Ltd.
Tyrela Electric, Ltd.
Ultra Electric, Ltd.
Universal High Voltage Radio, Ltd.
Whiteley Electrical & Radio Co., Ltd.
Wood, L. R.
Wurlitzer Lyric Radio, Ltd.
Zetavox Radio & Television, Ltd.

### RECEIVERS (valve, D.C. mains).

Aerodyne Radio, Ltd.
Allwave International Radio & Television, Ltd.
Ambassador Radio Gramophones.
Amplion (1932), Ltd.
Automobile Accessories (Bristol), Ltd.
Balcombe, Ltd., A. J.
Baty, E. J.
Bayliss, Ltd., W.
Betterset Radio, Ltd.
Bligh, S. W.
Blue Comet, Ltd.
British Lumophon Co.
Brunswick, Ltd.
Burndept, Ltd.
Burne, Jones & Co., Ltd.
Burton, C. F. & H.
Castagnoli, G.
Charlton Higgs (Radio), Ltd.
Cifel Products, Ltd.
City Accumulator Co.
Cole, Ltd., E. K.
Conways Elec., Ltd.
Cossor, Ltd., A. C.
Cranley Radio, Ltd.
Custerson, R.
Eagle Engineering Co., Ltd.
East Ham Wireless Supplies.
Electrical & Radio Products (1931), Ltd.
Elliotts.
E.M.G. Hand Made Gramophones, Ltd.
Forbat, E.
Fox Industrial, Ltd.
General Electric Co., Ltd.
Gramophone Co., Ltd.
Hacker & Sons, H.
Hart, Collins, Ltd.
Impex Electrical, Ltd.
I.M.S. Radio Co.
Kay, Ltd., P.
Lampex Radio & Electrical Co.
Lissen, Ltd.
London Electrical Co. (Sherborne Lane), Ltd.
McLeod & McLeod, Ltd.
Mains Radio Mfg. Co.
Midland Radio & Television Co.
Murphy Radio, Ltd.
Plessey Co., Ltd.
Precision-Electric, Ltd.
Pye Radio, Ltd.
Radio Development Co.
Radio Mfg. Co.
Regentone, Ltd.
Scott Sessions & Co., G.
Shalless & Evans, Ltd.
Smurthwaite, F. W.
Tannoy Products.
Trix Electrical Co., Ltd
Tyrela Electric, Ltd.
Ultra Electric, Ltd.
Universal High Voltage Radio, Ltd.
Whiteley Electrical & Radio Co., Ltd.
Wood, L. R.

### RECEIVERS (valve, A.C./D.C.).

Aerodyne Radio, Ltd.
Allwave International Radio & Television, Ltd.
Altham Radio Co.
Ambassador Radio Gramophones.
Automobile Accessories (Bristol), Ltd.
Balcombe, Ltd., A. J.
Baty, E. J.
Bayliss, Ltd., W.
Betterset Radio, Ltd.
Blue Comet, Ltd.
British Belmont Radio, Ltd.
British Lumophon Co.
Brown Brew & Co., Ltd.
Burndept, Ltd.
Burne, Jones & Co., Ltd.
Castagnoli, G.
Charlton Higgs (Radio), Ltd.
Climax Radio Elec., Ltd.
Cole, Ltd., E. K.
Conways Elec., Ltd.
Cossor, Ltd., A. C.
Cranley Radio, Ltd.
Cromwell (Southampton), Ltd.
Custerson, R.
Distavox, Ltd.
Elliotts.
Eagle Eng. Co., Ltd.
Faraday Allwave Wireless Co.
Ferranti, Ltd.
Forbat, E.
Fox Industrial, Ltd.
General Electric Co., Ltd.
Hacker & Sons, H.
Halcyon Radio, Ltd.
Halson Radio Co., Ltd.
Hart Collins, Ltd.
Impex Electrical Ltd.
I.M.S. Radio Co.
Kay, Ltd., P.
Kolster-Brandes, Ltd.
London Elec. Co. (Sherborne Lane), Ltd.
Lotus Radio (1933), Ltd.
Mains Radio Mfg. Co.
Marconiphone Co., Ltd.
Mervyn Sound & Vision Co., Ltd.
Midland Radio & Television Co.
Parkes, L. E.
Philips Lamps, Ltd.
Plessey Co., Ltd.
Precision-Electric, Ltd.
Rawson (Sheffield & London), Ltd. ,H. C
R. A. P., Ltd.
Scott Sessions & Co., G.
Shalless & Evans, Ltd.
Smurthwaite, Ltd., F. W.
Stonehouse Radio Supplies.
Sunbeam Electric, Ltd.
Tannoy Products.

Tarry's.
Truphonic Radio (Putney), Ltd.
Trix Electrical Co., Ltd.
Tyrela Electric, Ltd.
Ultra Electric, Ltd.
Universal High Voltage Radio, Ltd.
Whiteley Electrical & Radio Co., Ltd.
Wood, L. R.
Wurlitzer Lyric Radio, Ltd.

## RECEIVERS (valve, portable and transportable).

Aerodyne Radio, Ltd.
Allwave International Radio & Television, Ltd.
Amplion (1932), Ltd.
Automobile Accessories (Bristol), Ltd.
Baker & Co., Ltd., G. F.
Bedford Elec. & Radio Co., Ltd.
Betterset Radio, Ltd.
Blue Comet, Ltd.
British Radiophone, Ltd.
Burndept, Ltd.
Burne-Jones & Co., Ltd.
Castagnoli, G.
City Accumulator Co.
Cole, Ltd., E. K.
Cranley Radio, Ltd.
Custerson, R.
Eldeco Radio, Ltd.
Elliotts.
Ferranti, Ltd.
Fox Industrial, Ltd.
General Electric Co., Ltd.
Gramophone Co., Ltd.
Greatrex & Co., R. G.
Halcyon Radio, Ltd.
Hart-Collins, Ltd.
Henry Ford Radio Ltd.
Kay, Ltd., P.
Kolster Brandes, Ltd.
McLeod & McLeod, Ltd.
McMichael Radio, Ltd.
Mains-Radio Mfg. Co.
Marconiphone Co., Ltd.
Master Radio & Electrical Co., Ltd.
Midland Radio & Television Co.
Multitone Electric Co., Ltd.
Plessey Co., Ltd.
Pye Radio, Ltd.
Scott Sessions & Co., G.
Shalless & Evans, Ltd.
Sunbeam Electric, Ltd.
Tannoy Products.
Trix Electrical Co., Ltd.
Wood, L. R.
Zetavox Radio & Television, Ltd.

## RECORDS (Standard).

British Homophone Co., Ltd.
Brunswick, Ltd.
Crystalate Gramophone Record Mfg. Co., Ltd.
Decca Gramophone Co., Ltd.
Gramophone Co., Ltd.
Parlophone Co., Ltd.
Synchrophone, Ltd.

## RECORD ALBUMS.

Acme Album Service.
Aviss (Rugby), Ltd., A.
British East Light, Ltd.
British Homophone Co., Ltd.
British Ideal Patents, Ltd.
Brunswick, Ltd.
Decca Gramophone Co., Ltd.
Gramophone Co., Ltd.
Lugton & Co., Ltd.
Thompson, Diamond & Butcher.

## RECORD CARRYING CASES.

Acme Album Service.
Aviss (Rugby), Ltd., A.
British East Light, Ltd.
Coppock, J. T.
Gramophone Co., Ltd.
Lugton & Co., Ltd.
Osborn (Woodworkers), Ltd., C.
Regent Fittings Co.
Thompson, Diamond & Butcher.

## RECORD CHANGERS.

Coppock, J. T.
Decca Gramophone Co., Ltd.
General Electric Co., Ltd.
London Elec. Co. (Sherborne Lane), Ltd.
Regent Fittings Co.

## RECORD FILING CABINETS.

Automobile Accessories (Bristol), Ltd.
British East Light, Ltd.
Collings & Co., N. R.
City Accumulator Co.
Decca Gramophone Co., Ltd.
Finmar, Ltd.
Lockwood Casework Mfg. Co.
London Elec. Co. (Sherborne Lane), Ltd.
Lugton & Co., Ltd.
Merrington Bros., Ltd.
Osborn (Woodworkers), Ltd., C.

## RECORDING SYSTEMS.

Lyons, Ltd., Claude.
Partridge & Mee, Ltd.
Siemens-Schuckert (Gt. Britain), Ltd.
Tannoy Products.
Trix Electric Co., Ltd.
Voigt Patents, Ltd.

## RECTIFIERS (metal and dry contact).

Everett, Edgcumbe & Co., Ltd.
Salford Electrical Instruments, Ltd.
Standard Telephones & Cables, Ltd.
Tannoy Products.
Westinghouse Brake & Saxby Signal Co., Ltd.

## RELAY APPARATUS

Amplion (1932), Ltd.
Automobile Accessories (Bristol), Ltd.
Belling & Lee, Ltd.
Birmingham Sound Reproducers, Ltd.
Bligh, S. W.
British Radio Corp., Ltd.
Bulgin & Co., Ltd., A. F.
Coates, Ltd., J. G.
Cranley Radio, Ltd.
Edison-Swan Elec. Co., Ltd.
Everett, Edgcumbe & Co., Ltd.
Ferranti, Ltd.
Film Industries, Ltd.
General Electric Co., Ltd.
Goodmans (Clerkenwell), Ltd.
Nuvolion Electric, Ltd.
Partridge & Mee, Ltd.
Philips Industrial (Philips Lamps), Ltd.
Phœnix Telephone & Elec. Works, Ltd.
Reproducers & Amplifiers, Ltd.
Rich & Bundy, Ltd.
Scott Sessions & Co., G.
Siemens Electric Lamps & Supplies, Ltd.
Siemens-Schuckert (Gt. Britain), Ltd.
Sifam Electrical Instrument Co., Ltd.
Standard Telephones & Cables, Ltd.
Tannoy Products.
Trix Electrical Co., Ltd.
Webber, Ltd., R. A.
362 Radio Valve Co., Ltd.

## REMOTE CONTROL UNITS.

British Pix Co., Ltd.
Bulgin & Co., Ltd., A. F.
Enderlein, E.
General Electric Co., Ltd.

## REPAIRS FOR THE TRADE.

Amplion (1932), Ltd.
Automobile Accessories (Bristol), Ltd.
Bayliss, Ltd., W.
Bligh, S. W.
British Sampson Products.
Brown, Brew & Co., Ltd.
Caradio Services, Ltd.
Castagnoli, G.

## PRODUCTS SUPPLIED

Chalkley, C. G.
Custerson, R.
Godfrey (Radio) Ltd., F. E.
Goodmans (Clerkenwell), Ltd.
Henry Ford Radio Ltd.
Lyons, Ltd., Claude.
National Radio Service Co.
Peace, Ltd., H.
Plessey Co., Ltd.
Radio Development Co.
Radio Reconstruction Co., Ltd.
Radiovox Wireless Services, Ltd.
Ramaco Radio Services.
Scott Sessions & Co., G.
Sturdy Electric Co.
Tod, T. M.
Weedon Power Link Radio Co.
Wood, L. R.

### REPETITION WORK.

Amplifiers, Ltd.
Automobile Accessories (Bristol), Ltd.
Belling & Lee, Ltd.
Burndept, Ltd.
Busby & Co., Ltd.
Castle Fuse & Engineering Co., Ltd.
Christie & Sons, Ltd., Jas.
Custerson, R.
Edmonds, Ltd., G.
Francois, E. J.
Gee (Birmingham), Ltd.
General Electric Co., Ltd.
Goodmans (Clerkenwell), Ltd.
Grampian Reproducers, Ltd.
Grosvenor Works, (Holloway), Ltd.
Harris, G. & R.
Harrison & Co., A. T.
Henderson & Co., D. M., Ltd.
Jackson Bros. (London), Ltd.
Lilley & Son, Ltd., S.
Manor Works (Aston), Ltd.
Marks & Son, S.
Metal Agencies Co., Ltd.
Muller & Co. (England), Ltd.
M. C. L. & Repetition, Ltd.
Person & Son, L.
Plessey Co., Ltd.
Precision-Electric, Ltd.
Prideaux, Junr., R.
Radiamp Co., Ltd.
Radio Development Co.
Reliance Mfg. Co. (Southwark), Ltd.
Reproducers & Amplifiers, Ltd.
Ross, Courtney & Co., Ltd.
Shearing, A. E.
Standard Telephones & Cables, Ltd.
Toubkin, J.
True Screws, Ltd.
Wilkins & Wright, Ltd.
Williams & Gray, Ltd.
Williams & Moffat, Ltd.
Wright & Weaire, Ltd.

### R.C. COUPLING UNITS.

Ashley Wireless Telephone Co. (1925), Ltd.
Bulgin & Co., Ltd., A. F.
Burne-Jones & Co., Ltd.
General Electric Co., Ltd.
Graham Farish, Ltd.
Ivory Electric, Ltd.
Tannoy Products.
Telsen Electric Co., Ltd.
Varley.

### RESISTANCES (composition).

Altham Radio Co.
Anglo-American Industries Corp.
Bowyer-Lowe & A.E.D., Ltd.
British N.S.F. Co., Ltd.
British Television Supplies, Ltd.
Bryce & Co., W. A.
Bulgin & Co., Ltd., A. F.
Cossor, Ltd., A. C.
Curtis Manufacturing Co., Ltd.
Elliott Radio Mfg. Co., Ltd.
Erie Resistor, Ltd.
Ferranti, Ltd.
Graham Farish, Ltd.
Harrison & Co., A. T.
Kay, Ltd., P.
Le Carbone, Ltd.
Lechner & Co., F. W.
Lyons, Ltd., Claude.
Plessey Co., Ltd.
Radio Resistor Co.
Reliance Mfg. Co. (Southwark), Ltd.
Rothermel, Ltd., R. A.
Siemens Schuckert (Gt. Britain), Ltd.
Telsen Electric Co., Ltd.
Varley.
Watmel Wireless Co., Ltd.
Wingrove & Rogers, Ltd.

### RESISTANCES (wire-wound).

Altham Radio Co.
Anglo-American Industries Corp.
Bayliss, Ltd., W.
Bedford Elec. & Radio Co., Ltd.
Bowyer-Lowe & A.E.D., Ltd.
British N.S.F. Co., Ltd.
Bulgin & Co., Ltd., A. F.
Burne-Jones & Co., Ltd.
Castagnoli, G.
Colvern, Ltd.
Concordia Elec. Wire Co., Ltd.
Cossor, Ltd., A. C.
Curtis Mfg. Co., Ltd.
Dubilier Condenser Co. (1925), Ltd.
Elliotts.
Erie Resistor Co.
Ferranti, Ltd.
General Electric Co., Ltd.
Goodmans (Clerkenwell), Ltd.
Graham Farish, Ltd.
Harrison & Co., A. T.
Heayberd & Co., F. C.
Igranic Electric Co., Ltd.
Imp Radio Co.
Kay, Ltd., P.
Lechner & Co., F. W.
Lissen, Ltd.
Loewe Radio Co., Ltd.
Lyons, Ltd., Claude.
Meritus (Barnet), Ltd.
Partridge Wilson & Co., Ltd.
Peace, Ltd., H.
Phœnix Telephones & Elec. Works, Ltd.
Plessey Co., Ltd.
Radiamp Co., Ltd.
Radio Resistor Co.
Reliance Mfg. Co. (Southwark), Ltd.
Roberts, J.
Rothermel, Ltd., R. A.
Siemens-Schuckert (Gt. Britain), Ltd.
Sonochorde Reproducers, Ltd.
Supremus Specialities, Ltd.

Tannoy Products.
Tod, T. M.
Varley.
Ward & Goldstone, Ltd.
Watmel Wireless Co., Ltd.
Wingrove & Rogers, Ltd.
Wright & Weaire, Ltd.
Zenith Electric Co., Ltd.

## RHEOSTATS.

Altham Radio Co.
Bedford Elec. & Radio Co., Ltd.
Bowyer-Lowe & A.E.D., Ltd.
Bulgin & Co., Ltd., A. F.
Castagnoli, G.
Colvern, Ltd.
Curtis Mfg. Co., Ltd.
General Electric Co., Ltd.
Harrison & Co., A. T.
Igranic Electric Co., Ltd.
Kay, Ltd., P.
Lechner & Co., F. W.
Lyons, Ltd., Claude.
McLeod & McLeod, Ltd.
Millet, J.
Plessey Co., Ltd.
Radiamp Co., Ltd.
Reliance Mfg. Co. (Southwark), Ltd.
Roberts, J.
Siemens Schuckert (Gt. Britain), Ltd.
Tannoy Products.
Watmel Wireless Co., Ltd.
Wright & Weaire. Ltd.
Zenith Electric Co., Ltd.

## SCRATCH FILTERS.

Automobile Accessories (Bristol), Ltd.
Birmingham Sound Reproducers, Ltd.
Bulgin & Co., Ltd., A. F.
Burne-Jones & Co., Ltd.
Castagnoli, G.
Cranley Radio, Ltd.
General Electric Co., Ltd.
London Electrical Co. (Sherborne Lane), Ltd.
Midland Radio & Television Co.
Postlethwaite Bros.
Radiamp Co., Ltd.
Radiovox Wireless Services, Ltd.
Reliance Mfg. Co. (Southwark), Ltd.
Salford Electrical Instruments, Ltd.
Tannoy Products.
Trix Electrical Co., Ltd.
Ward & Goldstone, Ltd.
Wright & Weaire, Ltd.

## SCREENS.

Andrews & Co., A. E.
Automobile Accessories (Bristol), Ltd.
British General Mfg. Co., Ltd.
Burne-Jones & Co., Ltd.
Colvern, Ltd.
General Electric Co., Ltd.
Harrison & Co., A. T.
Ivory Electric, Ltd.
London Electrical Co. (Sherborne Lane), Ltd.
McLeod & McLeod, Ltd.
Marks & Son, S.
Morleys.
Morton & Co., E. R.
Paroussi, E.
Radiamp Co., Ltd.
White Bros. & Jacobs, Ltd.
Whiteley Electrical Radio Co., Ltd.
Wright & Weaire, Ltd.

## SHORT WAVE ADAPTORS.

Aerodyne Radio, Ltd.
Allwave International Radio & Television, Ltd.
Birmingham Sound Reproducers, Ltd.
Burne-Jones & Co., Ltd.
Castagnoli, G.
City Accumulator Co.
Elliotts.
Ferranti, Ltd.
Forbat, E.
General Electric Co., Ltd.
Hacker & Sons, H.
London Electrical Co. (Sherborne Lane), Ltd.
Radio Reconstruction Co., Ltd.
Scientific Supply Stores (Wireless), Ltd.
Scott, Sessions & Co., G.
Shalless & Evans, Ltd.
Stonehouse Radio Supplies.
Tannoy Products.
Trix Electrical Co., Ltd.
Universal High Voltage Radio, Ltd.

## SHORT WAVE COMPONENTS.

Allwave International Radio & Television, Ltd.
Altham Radio Co.
British Radiophone, Ltd.
British Television Supplies, Ltd.
Bulgin & Co., Ltd., A. F.
Burndept, Ltd.
Burne-Jones & Co., Ltd.
Castagnoli, G.
Cranley Radio, Ltd.
Eastick & Sons, J. J.
Elliott Radio Mfg. Co., Ltd.
Ferranti, Ltd.
General Electric Co., Ltd.
Graham Farish, Ltd.
Jackson Bros. (London), Ltd.
Kingsway Radio, Ltd.
Lissen, Ltd.
London Electrical Co. (Sherborne Lane), Ltd.
Lyons, Ltd., Claude.
Morton & Co., E. R.
Plessey Co., Ltd.
Pooley, G. J.
Quartz Crystal Co.
Radiamp Co., Ltd.
Salford Electrical Instruments,
Scott, Sessions & Co., G.
Shearing, A. E.
Stonehouse Radio Supplies.
Stratton & Co., Ltd.
Telsen Electric Co., Ltd.
Trix Electrical Co., Ltd.
Ward & Goldstone, Ltd.
Wilkins & Wright, Ltd.
Williams & Moffat, Ltd.
Wingrove & Rogers, Ltd.
Wright & Weaire, Ltd.
362 Radio Valve Co., Ltd.

## SLEEVING (insulating).

Bromley - Langton Electric Wire & Insulator Co., Ltd.
Concordia Elec. Wire Co., Ltd.
Cranley Radio, Ltd.
Ellison Insulation, Ltd.
General Electric Co., Ltd.
Harrison & Co., A. T.
Ivory Electric, Ltd.
Lesingham, F. L.
London Electric Wire Co. & Smiths, Ltd.
London Electrical Co. (Sherborne Lane), Ltd.
McLeod & McLeod.
Micanite & Insulators Co., Ltd.
Millet, J.
Moores & Co., J.
Radiamp Co., Ltd.
Reliance Electrical Wire Co., Ltd.
Scott Insulated Wire Co., Ltd.
Ward & Goldstone, Ltd.

## SOLDERING MATERIALS.

Bi-Metals.
British Insulated Cables, Ltd.
Electromicro Mfg. Co.
Fluxite, Ltd.
General Electric Co., Ltd.
Green & Co., G.
Ivory Electric, Ltd.
Moores & Co.
R. C. & Wilson Electric, Ltd.
Standard Telephones & Cables, Ltd.
Ward & Goldstone, Ltd.

## SOUND BOXES.

Amplifiers, Ltd.
Balcombe, Ltd., A. J.

## PRODUCTS SUPPLIED

British Goldring Products, Ltd.
Coppock, J. T.
Decca Gramophone Co., Ltd.
E.M.G. Hand-Made Gramophones, Ltd.
Gilbert, C., & Co., Ltd.
Grosvenor Works (Holloway), Ltd.
Kay, Ltd., P.
Leibovici, J.
Lugton & Co., Ltd.
Norma Technical Products, Ltd.
Parlophone Co., Ltd.
Regent Fittings Co.
Rose, Morris & Co., Ltd.
Stockall, Marples & Co., Ltd.
Thompson, Diamond & Butcher.
Wendell Mfg. Co.

### SPEAKERS (cone type).

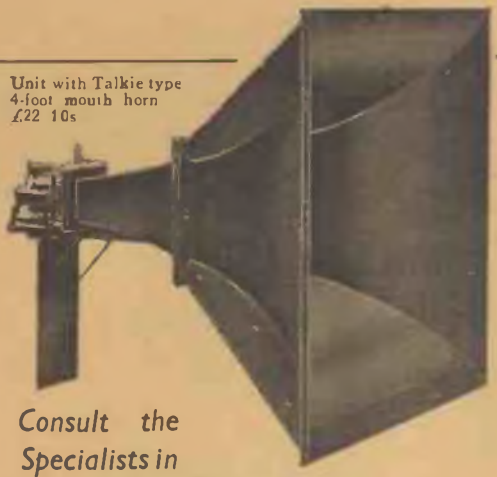
Altham Radio Co.
Amplion (1932), Ltd.
Celestion, Ltd.
Chalkley, C. G.
Collings & Co., N. R.
Custerson, R.
Donophone, P. A. Co., Ltd.
Eon Vacuum Wireless Co.
Film Industries, Ltd.
General Electric Co., Ltd.
Goodmans (Clerkenwell), Ltd.
Grampian Reproducers, Ltd.
Ivory Electric, Ltd.
Kay, Ltd., P.
Lampex Radio & Electric Co.
Lissen, Ltd.
Marks & Son, S.
Partridge & Mee, Ltd.
Reproducers & Amplifiers, Ltd.
Siemens-Schuckert (Gt. Britain), Ltd.
Tannoy Products.
Telsen Electric Co., Ltd.
Thompson, Diamond & Butcher.
Toubkin, J.
V. G. Mfg. Co., Ltd.
Whiteley Electrical Radio Co., Ltd.

### SPEAKERS (inductor dynamic).

Eon Vacuum Wireless Co.
General Electric Co., Ltd.
Goodmans (Clerkenwell), Ltd.
Lamplugh Radio, Ltd.
McLeod & McLeod, Ltd.
Partridge & Mee, Ltd.
Plessey Co., Ltd.
Reproducers & Amplifiers, Ltd.
Siemens-Schuckert (Gt. Britain), Ltd.
Tannoy Products.
Thompson, Diamond & Butcher.
Toubkin, J.
Universal Gramophone & Radio Co., Ltd.

### SPEAKERS, MOVING COIL TYPE, PERMANENT MAGNET.

Amplion (1932), Ltd.
Baker's Selhurst Radio.
Baty, E. J.
Benjamin Elec., Ltd.
Birmingham Sound Reproducers, Ltd.
British Blue Spot Co., Ltd.
British Lumophon Co., Ltd.
British Rola Co., Ltd.
Burndept, Ltd.
Castagnoli, G.
Celestion, Ltd.
Charlton Higgs (Radio), Ltd.
Charlton Metal Co., Ltd.
Collings & Co., N. R.
Cossor, Ltd., A. C.
Custerson, R.
Dent & Co., and Johnson, Ltd.
Distavox, Ltd.
Earl Mfg. Co., Ltd.
Edison Swan Electric Co., Ltd.
Elliotts.
Eon Vacuum Wireless Co.
Ferranti, Ltd.
Film Industries, Ltd.
General Electric Co., Ltd.
Goodmans (Clerkenwell), Ltd.
Grampian Reproducers, Ltd.
Gramophone Co., Ltd.
Greatrex & Co., R. G.
Halson Radio Co., Ltd.
Ivory Electric, Ltd.
Kay, Ltd., P.
Kingsway Radio, Ltd.
Lampex Radio & Elec. Co.
Lamplugh Radio, Ltd.
Lissen, Ltd.
Loewe Radio Co., Ltd.
London & Provincial Factors, Ltd.
London Radio Co. (Leeds), Ltd.
Londona, Ltd.
Lotus Radio (1933), Ltd.
Lugton & Co., Ltd.
McLeod & McLeod, Ltd.
Midgley Harmer, Ltd.
Milnes Radio Co., Ltd.
National Radio Service Co.
Nuvolion Electrics, Ltd.
Partridge & Mee, Ltd.
Philips Industrial (Philips Lamps), Ltd.
Plessey Co., Ltd.
Pye Radio, Ltd.
Rawson (Sheffield & London), Ltd., H. O.
Ray Engineering Co., Ltd.
Reproducers & Amplifiers, Ltd.
Rothermel, R. A., Ltd.
R.A.P., Ltd.
Siemens-Schuckert (Gt. Britain), Ltd.
Sinclair Speakers, Ltd.
Sonochorde Reproducers, Ltd.
Sound Sales, Ltd.
Tannoy Products.
Tarry's.



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## PRODUCTS SUPPLIED

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Toubkin, J.
Ultra Electric, Ltd.
Universal Gramophone & Radio Co., Ltd.
Webber, Ltd., R. A.
Wharfedale Wireless Works.
Whiteley Electrical Radio Co., Ltd.
362 Radio Valve Co., Ltd.

### SPEAKERS, MOVING COIL TYPE (ENERGISED).

Ambassador Radio Gramophones.
Amplion (1932), Ltd.
Baker's Selhurst Radio.
Benjamin Electric, Ltd.
British Blue Spot Co., Ltd.
British Lumophon, Co.
British Rola Co., Ltd.
Burndept, Ltd.
Celestion, Ltd.
Chorlton Metal Co., Ltd.
Correx Amplifiers.
Cossor, Ltd.
Custerson, R.
Earl Mfg. Co., Ltd.
Edison Swan Electric Co., Ltd.
Elliotts.
Eon Vacuum Wireless Co., Ltd.
Ferranti, Ltd.
General Electric Co., Ltd.
Goodmans (Clerkenwell), Ltd.
Grampian Reproducers, Ltd.
Hartley Turner Radio, Ltd.
Haynes Radio.
Ivory Electric, Ltd.
Kay, Ltd., P.
Lampex Radio & Elec. Co.
Lamplugh Radio, Ltd.
Lissen, Ltd.
Lotus Radio (1933), Ltd.
McLeod & McLeod, Ltd.
Midgely-Harmer, Ltd.
Midland Radio & Television Co.
Nuvolion Electrics, Ltd.
Partridge & Mee, Ltd.
Philips Industrial (Philips Lamps), Ltd.
Plessey Co., Ltd.
Rawson (Sheffield & London), Ltd., H. C.
Reproducers & Amplifiers, Ltd.
R.A.P., Ltd.
Siemens-Schuckert (Gt. Britain), Ltd.
Sinclair Speakers, Ltd.
Sonochorde Reproducers, Ltd.
Sound Sales, Ltd.
Tannoy Products.
Tarry's.
Thompson, Diamond & Butcher.
Toubkin, J.
Ultra Electric, Ltd.
Universal Gramophone & Radio Co., Ltd.
Voigt Patents, Ltd.
Webber, Ltd., R. A.
Wharfedale Wireless Works.
Whiteley Electrical Radio Co., Ltd.

### SPEAKERS (cones for).

Altham Radio Co.
Amplion (1932), Ltd.
Bridger & Co., R. O.
Celestion, Ltd.
Christie & Sons, Ltd., Jas.
Custerson, R.
Elektra Supplies.
Ellison Insulations, Ltd.
Eon Vacuum Wireless Co.
General Electric Co., Ltd.
Goodmans (Clerkenwell), Ltd.
Grampian Reproducers, Ltd.
Ivory Electric, Ltd.
Kay, Ltd., P.
Lissen, Ltd.
London & Provincial Factors, Ltd.
McLeod & McLeod, Ltd.
National Radio Service Co.
Plessey Co., Ltd.
Reproducers & Amplifiers, Ltd.
Rothermel, R. A., Ltd.
Tannoy Products.
Ward & Goldstone, Ltd.
Weedon Power Link Radio Co.
Whiteley Electrical Radio Co., Ltd.

### SPEAKER UNITS.

Altham Radio Co.
Amplion (1932), Ltd.
British Rola Co., Ltd.
Celestion, Ltd.
Chorlton Metal Co., Ltd.
Custerson, R.
Ferranti, Ltd.
Film Industries, Ltd.
General Electric Co., Ltd.
Goodmans (Clerkenwell), Ltd.
Grampian Reproducers, Ltd.
Ivory Electric, Ltd.
Kay, Ltd., P.
Kingsway Radio, Ltd.
Lampex Radio & Elec. Co.
Lamplugh Radio, Ltd.
Lissen, Ltd.
Marks & Son, S.
Plessey Co., Ltd.
Reproducers & Amplifiers, Ltd.
Sinclair Speakers, Ltd.
Tannoy Products.
Whiteley Electrical Radio Co., Ltd.
W.R.C., Ltd.

### SPEED TESTERS.

Gramophone Co., Ltd.
Lyons, Ltd., Claude.
Tannoy Products.

### SPRINGS (Motor).

Allwood, Blackband & Co.
Clarkes (Redditch), Ltd.
Coppock, J. T.
Garrard Engineering & Manufacturing Co., Ltd.
Gilbert & Co., Ltd., C.
Harris, G. & R.
Kay, Ltd., P.
Leibovici, J.
Lugton & Co., Ltd.
Regent Fittings Co.
Rose Morris & Co., Ltd.
Thompson, Diamond & Butcher.

### STAMPINGS.

Adams Bros. & Burnley, Ltd.
Alpha Products.
Andrews & Co., A. E.
Ashley Wireless Telephone Co. (1925), Ltd.
Beddoes, Ltd., J. G.
British Goldring Products, Ltd.
Burne-Jones & Co., Ltd.
Busby & Co., Ltd.
Christie & Sons, Ltd., Jas.
Cranley Radio, Ltd.
Custerson, R.
Ferranti, Ltd.
Francois, E. J.
Gee (Birmingham), Ltd.
General Electric Co., Ltd.
Goodmans (Clerkenwell), Ltd.
Grampian Reproducers, Ltd.
Grosvenor Works (Holloway), Ltd.
Harris, G. & R.
Harrison & Co., A. T.
Jackson Bros. (London), Ltd.
Lilley & Son, Ltd., S.
Magnetic & Electrical Alloys, Ltd.
Manor Works (Aston), Ltd.
Marks & Son, S.
Morton, Ltd., E. R.
Nicholls, Ltd., J. T.
Person & Son, L.
Plessey Co., Ltd.
Radiamp Co., Ltd.
Reliance Mfg. Co. (Southwark), Ltd.
Righton & Co., Ltd., H.
Ross, Courtney & Co., Ltd.
Sankey & Sons, Ltd., Joseph.
True Screws, Ltd.

## PRODUCTS SUPPLIED

Waivis Engineering Co., Ltd.
Walsall Electrical Co., Ltd.
Wendell Mfg. Co.
White Bros. & Jacobs, Ltd.
Whiteley Electrical Radio Co., Ltd.
Wilkins & Wright, Ltd.
Williams & Grey, Ltd.
Williams & Moffat, Ltd.
Wright & Weaire, Ltd.

### STOPS (automatic).

Collaro, Ltd.
Garrard Engineering & Manufacturing Co., Ltd.
General Electric Co., Ltd.
Lugton & Co., Ltd.

### SWITCHES.

Amplifiers, Ltd.
Automobile Accessories (Bristol), Ltd.
British Television Supplies, Ltd.
Bromley-Langton Elec. Wire & Insulator Co., Ltd.
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.
Collett Mfg. Co., S. H.
Colvern, Ltd.
Crabtree & Co., Ltd., J. A.
Eagle Engineering Co., Ltd.
Edmonds, Ltd., G.
Ferranti, Ltd.
Francois, E. J.
General Electric Co., Ltd.
Goodmans (Clerkenwell), Ltd.
Graham Farish, Ltd.
Gripso Co.
Harrison & Co., A. T.
Hewitt, Ltd., A. J.
Ivory Electric, Ltd.
Kay, Ltd., P.
Lechner & Co., F. W.
Lesingham F. L.
Lissen, Ltd.
Lundberg & Sons, Ltd., A. P.
Lyons, Ltd., Claude.
McLeod & McLeod, Ltd.
Millet, J.
Morton, Ltd., E. R.
Person & Son.
Phœnix Telephone & Elec. Works, Ltd.
Pioneer Mfg. Co.
Plessey Co., Ltd.
Radiamp Co., Ltd.
Rothermel, Ltd., R. A.
Shearing, A. E.
Siemens-Schuckert (Gt. Britain), Ltd.
Stadium, Ltd.
Standard Telephones & Cables, Ltd.
Toubkin, J.
Trix Electrical Co., Ltd.
Ward & Goldstone, Ltd.
Whiteley Electrical Radio Co., Ltd.
Wilkins & Wright, Ltd.
Wright & Weaire, Ltd.
W.R.C., Ltd.

### TAPE (insulating).

Altham Radio Co.
Blue Comet, Ltd.
British Insulated Cables, Ltd.
Bromley-Langton Elec. Wire & Insulator Co., Ltd.
Callenders Cable & Construction Co., Ltd.
Concordia Electric Wire Co., Ltd.
Connollys (Blackley), Ltd.
General Electric Co., Ltd.
Hellesens, Ltd.
Ivory Electric, Ltd.
Kay, Ltd., P.
Leibovici, J.
London Electrical Co. (Sherborne Lane), Ltd.
McLeod & McLeod, Ltd.
Micanite & Insulators Co., Ltd.
Millet, J.
Moores & Co., J.
Mountford Rubber Co., Ltd.
Romac Motor Accessories, Ltd.
St. Helens Cable & Rubber Co., Ltd.
Siemens Electric Lamps & Supplies, Ltd.
Toubkin, J.
Ward & Goldstone, Ltd.

### TELEVISION APPARATUS.

Allwave International Radio & Television, Ltd.
Betterset Radio, Ltd.
Blue Comet, Ltd.
British Television Supplies, Ltd.
Burndept, Ltd.
Castagnoli, G.
Cossor, Ltd., A. C.
Edison Swan Electric Co., Ltd.
Elliott Radio Mfg. Co., Ltd.
Faraday Allwave Wireless.
Fox Industrial, Ltd.
General Electric Co., Ltd.
Grampian Reproducers, Ltd.
Hacker & Sons, H.
Ivory Electric, Ltd.
Kingsway Radio, Ltd.
London Electrical Co. (Sherborne Lane), Ltd.
Mervyn Sound & Vision Co., Ltd.
Plessey Co., Ltd.
Plew Television, Ltd.
Radiamp Co., Ltd.
Radio Reconstruction Co., Ltd.
Radiovox Wireless Services, Ltd.
Rawson (Sheffield & London), Ltd., H. C.
Reliance Mfg. Co. (Southwark), Ltd.
Reproducers & Amplifiers, Ltd.
Shalless & Evans, Ltd.
Television Instruments, Ltd.
Wilkins & Wright, Ltd.
362 Radio Valve Co., Ltd.

### TERMINALS, CONNECTORS, TAGS.

Amplifiers, Ltd.
Andrews & Co., A. E.
Barber & Coleman, Ltd.

## PRODUCTS SUPPLIED

Belling & Lee, Ltd.
Brandon & Sons, Ltd., J.
Bulgin & Co., Ltd., A. F.
Castle Fuse & Engineering Co., Ltd.
Clarkes (Redditch), Ltd.
Collett Mfg. Co., S. H.
Colvern, Ltd.
Crystalate Gramophone Record Mfg. Co., Ltd.
Eastick & Sons, J. J.
Francois, E. J.
General Electric Co., Ltd.
Gripso Co.
Harris, G. & R.
Lectro Linx, Ltd.
Leibovici, J.
Lilley & Son, Ltd., S.
Lissen, Ltd.
McLeod & McLeod, Ltd.
Muller & Co. (England), Ltd.
M.C.L. & Repetition, Ltd.
Prideaux, Junr., R.
Radiamp Co., Ltd.
Romac Motor Accessories, Ltd.
Ross, Courtney & Co., Ltd.
Siemens Electric Lamps & Supplies, Ltd.
Trix Electrical Co., Ltd.
True Screws, Ltd.
Ward & Goldstone, Ltd.
W.R.C., Ltd.

### TIME SWITCHES.

A.E.G. Electric Co., Ltd.
Everett, Edgcumbe & Co., Ltd.
General Electric Co., Ltd.
Millet, J.
Salford Electrical Instruments, Ltd.
Siemens Electric Lamps & Supplies, Ltd.
Sifam Electrical Instrument Co., Ltd.

### TINSEL (for speakers).

Altham Radio Co.
General Electric Co., Ltd.
Ivory Electric, Ltd.
Leibovici, J.
Lockwood Casework Mfg. Co.
Phœnix Telephone & Electric Works, Ltd.
Pioneer Mfg. Co.
Scott Insulated Wire Co., Ltd.
Trix Electrical Co., Ltd.
Wilkinson, L.

### TONE ARMS.

Belling & Lee, Ltd.
British Ideal Patents, Ltd.
Coppock, J. T.
General Electric Co., Ltd.
Gilbert & Co., Ltd., C.
Grosvenor Works (Holloway), Ltd.
Kay, Ltd., P.
Liebovici, J.
Limit Engineering Co., Ltd.
Lotus Radio (1933), Ltd.
Regent Fittings Co.
Rose Morris & Co., Ltd.
Thompson Diamond & Butcher.
Wendell Mfg. Co.
W.R.C., Ltd.

### TONE COMPENSATORS.

Anglo-American Industries Corporation.
British Radio Corporation, Ltd.
Castagnoli, G.
Custerson, R.
Duray.
Ferranti, Ltd.
General Electric Co., Ltd.
Goodmans (Clerkenwell), Ltd.
Lissen, Ltd.
London Electrical Co. (Sherborne Lane), Ltd.
Postlethwaite Bros.
Radiovox Wireless Services, Ltd.
Reliance Mfg. Co. (Southwark), Ltd.
Rothermel, Ltd., R. A.
Tannoy Products.
Voigt Patents, Ltd.
Whiteley Electrical Radio Co., Ltd.

### TONE CONTROLS.

Anglo-American Industries Corporation.
Bowyer-Lowe & A. E. D., Ltd.
British N.S.F. Co., Ltd.
British Pix Co., Ltd.
Bulgin & Co., Ltd., A. F.
Burne-Jones & Co., Ltd.
Castagnoli, G.
Cossor, Ltd., A. C.
Custerson, R.
Erie Resistor, Ltd.
Ferranti, Ltd.
General Electric Co., Ltd.
Goodmans (Clerkenwell), Ltd.
Lissen, Ltd.
Loewe Radio Co., Ltd.
London Electrical Co. (Sherborne Lane), Ltd.
Lotus Radio (1933), Ltd.
Lyons, Ltd., Claude.
Multitone Electric Co., Ltd.
Radio Resistor Co., Ltd.
Radiovox Wireless Services, Ltd.
Reliance Mfg. Co. (Southwark), Ltd
Rothermel, Ltd., R. A.
Standard Tels. & Cables, Ltd.
Tannoy Products.
Trix Electrical Co., Ltd.
Voigt Patents, Ltd.
Ward & Goldstone, Ltd.
Watmel Wireless Co., Ltd.
Whiteley Electrical Radio Co., Ltd.
W.R.C., Ltd.

### TOOLS.

Allen & Co., Ltd., E.
General Electric Co., Ltd.
Gordon & Co., Ltd., F. J.
Harrison & Co., A. T.
Lehmann, Archer & Lane., Ltd.
Muller & Co. (England), Ltd.
Neill & Co. (Sheffield), Ltd., J.
Partridge & Mee, Ltd.
Plessey Co., Ltd.
Radiamp Co., Ltd.
Waivis Engineering Co., Ltd.
Whiteley Electrical Radio Co., Ltd.

### TRANSFERS.

Beresford & Co., Ltd., A. W.
Eagle Transfer, Ltd.

### TRANSFORMERS (Class B).

Aerodyne Radio, Ltd.
All-Power Transformers, Ltd.
Altham Radio Co.
Amplion (1932), Ltd.
Benjamin Electric, Ltd.
British Lumophon Co.
British Rola Co., Ltd.
British Sampson Products.
British Television Supplies, Ltd.
Brown, Brew & Co., Ltd.
Bulgin & Co., Ltd., A. F.
Chorlton Metal Co., Ltd.
Cossor, Ltd., A. C.
Cranley Radio, Ltd.
Custerson, R.
Eagle Engineering Co., Ltd.
Elliott Radio Mfg. Co., Ltd.
Ferranti, Ltd.
General Electric Co., Ltd.
Goodmans (Clerkenwell), Ltd.
Graham Farish, Ltd.
Imp Radio Co.
Ivory Electric, Ltd.
Kay, Ltd., P.
Kimber, Allen & Co., B.
Kingsway Radio, Ltd.
Lissen, Ltd.
Mile End Radio Co.
Multitone Electric Co., Ltd.
Nicholls, Ltd., J. T.
Partridge & Mee, Ltd.
Plessey Co., Ltd.

Precision-Electric, Ltd.
Reproducers & Amplifiers, Ltd.
Rich & Bundy, Ltd.
Salford Electrical Instruments, Ltd.
Shearing, A. E.
Sifam Electrical Instrument Co., Ltd.
Sound Sales, Ltd.
Tannoy Products.
Trix Electrical Co., Ltd.
Varley.
Whiteley Electrical Radio Co., Ltd.
Wright & Weaire, Ltd.
362 Radio Valve Co., Ltd.

## TRANSFORMERS H.F.

Aerodyne Radio, Ltd.
Altham Radio Co.
Amplion (1932), Ltd.
Bayliss, Ltd., W.
Bedford Electrical & Radio Co., Ltd.
Berclif, Ltd.
Bird & Sons, Ltd., S. S.
British Sampson Products.
British Television Supplies, Ltd.
Bulgin & Co., Ltd., A. F.
Burne-Jones & Co., Ltd.
Castagnoli, G.
Cossor, Ltd., A. C.
Cranley Radio, Ltd.
Custerson, R.
Eagle Engineering Co., Ltd.
Elliott Radio Mfg. Co., Ltd.
Ferranti, Ltd.
General Electric Co., Ltd.
Goodmans (Clerkenwell), Ltd.
Harrison & Co., A. T.
Ivory Electric, Ltd.
Kay, Ltd., P.
Kimber, Allen & Co., B.
Kingsway Radio, Ltd.
Lotus Radio (1933), Ltd.
Mile End Radio Co.
Plessey Co., Ltd.
Precision Electric, Ltd.
Radiamp Co., Ltd.
Salford Electrical Instruments, Ltd.
Shearing, Ltd., A. E.
Tannoy Products.
Varley.
Varsity Eliminator Co., Ltd.
Ward & Goldstone, Ltd.
Whiteley Electrical Radio Co., Ltd.
Wright & Weaire, Ltd.
W.R.C., Ltd.

## TRANSFORMERS L.F.

Aerodyne Radio, Ltd.
All-Power Transformers, Ltd.
Altham Radio Co.
Bedford Electrical & Radio Co., Ltd.
Benjamin Electric, Ltd.
Birmingham Sound Reproducers, Ltd.
British Lumophon Co.
British Sampson Products.
British Television Supplies, Ltd.
Brown, Brew & Co., Ltd.
Bulgin & Co., Ltd., A. F.
Castagnoli, G.
Chorlton Metal Co., Ltd.
Concerton Radio & Electrical Co., Ltd.
Cossor, Ltd., A. C.
Cranley Radio, Ltd.
Custerson, R.
Daly, H. C.
Eagle Engineering Co., Ltd.
Elliott Radio Mfg. Co., Ltd.
Ferranti, Ltd.
General Electric Co., Ltd.
Goodmans (Clerkenwell), Ltd.
Graham Farish, Ltd.
Harrison & Co., A. T.
Hartley Turner Radio, Ltd.
Heayberd & Co., F. C.
Henry Ford Radio, Ltd.
Hewitt, Ltd., A. J.
Igranic Electric Co., Ltd.
Imp Radio Co.
Ivory Electric, Ltd.
Kay, Ltd., P.
Kimber, Allen & Co., B.
Kingsway Radio, Ltd.
Lissen, Ltd.
Lotus Radio (1933), Ltd.
McLeod & McLeod, Ltd.
Mile End Radio Co.
Multitone Electric Co., Ltd.
Nicholls, Ltd., J. T.
Northampton Plating Co.
Partridge & Mee, Ltd.
Plessey Co., Ltd.
Precision-Electric, Ltd.
Reproducers & Amplifiers, Ltd.
Salford Electrical Instruments, Ltd.
Savage, W. B.
Shearing, A. E.
Slektun Products, Ltd.
Sound Sales, Ltd.
Standard Telephones & Cables, Ltd.
Tannoy Products.
Trix Electrical Co., Ltd.
Varley.
Varsity Eliminator Co., Ltd.
Weedon Power Link Radio Co.
Whiteley Electrical Radio Co., Ltd.
W.R.C., Ltd.

## TRANSFORMERS (mains).

Aerodyne Radio, Ltd.
All-Power Transformers, Ltd.
Alpha Coil & Component Co.
Bayliss, William, Ltd.
Bedford Electrical & Radio Co., Ltd.
Birmingham Sound Reproducers, Ltd.
British Radio Corporation, Ltd.
British Sampson Products.
British Television Supplies, Ltd.
Brown, Brew & Co., Ltd.
Bryce & Co., W. A.
Bulgin & Co., Ltd., A. F.
Burnand & Son, W. E.
Castagnoli, G.
Chorlton Metal Co., Ltd.
Coates, Ltd., J. G.
Concerton Radio & Electric Co., Ltd.
Correx Amplifiers.
Cossor, Ltd., A. C.
Cranley Radio, Ltd.
Custerson, R.
Daly, H. C.
Dyson & Co. (Works), Ltd., J.
Eagle Engineering Co., Ltd.
Elliott Radio Mfg. Co., Ltd.
Emkabe Radio Co., Ltd.
Fel-Electric Radio.
Ferranti, 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.
Kay, Ltd., P.
Kingsway Radio, Ltd.
London Electrical Co. (Sherborne Lane), Ltd.
Londona, Ltd.
Lotus Radio (1933), Ltd.
Lyons, Ltd., Claude.
McLeod & McLeod, Ltd.
McMillan & Co., J.
Mains Radio Mfg. Co.
Meritus (Barnet), Ltd.
Midland Radio & Television Co.
Mile End Radio Co.
Multitone Electric Co., Ltd.
Nicholls, Ltd., J. T.
Novo Radio-Electric, Ltd.
Partridge & Mee, Ltd.
Partridge, Wilson & Co.
Peace, Ltd., Henry.
Plessey Co., Ltd.
Precision-Electric, Ltd.
Quartz Crystal Co.
Regent Radio Supply Co.
Rich & Bundy, Ltd.
Savage, W. B.
Scott Sessions & Co., G.

## PRODUCTS SUPPLIED

Sifam Electrical Instrument Co., Ltd.
Sound Sales, Ltd.
Standard Telephones & Cables, Ltd.
Sturdy Electric Co.
Supremus Specialities, Ltd.
Tannoy Products.
Tod, T. M.
Trix Electrical Co., Ltd.
Varley.
Varsity Eliminator Co., Ltd.
Walsall Electrical Co., Ltd.
Weedon Power Link Radio Co.
Whiteley Elec. Radio Co., Ltd.
Wright & Weaire, Ltd.
Zenith Electric Co., Ltd.

### TRANSFORMERS (output).

Aerodyne Radio, Ltd.
All-Power Transformers, Ltd.
Altham Radio Co.
Amplion (1932), Ltd.
Bayliss, William, Ltd.
Birmingham Sound-Reproducers, Ltd.
British Radio Corporation, Ltd.
British Rola Co., Ltd.
British Sampson Products.
British Television Supplies, Ltd.
Brown, Brew & Co., Ltd.
Bryce & Co., W. A.
Bulgin & Co., Ltd., A. F.
Castagnoli, G.
Concerton Radio & Electrical Co., Ltd.
Correx Amplifiers.
Cossor, Ltd., A. C.
Cranley Radio, Ltd.
Custerson, R.
Eagle Engineering Co., Ltd.
Elliott Radio Mfg. Co., Ltd.
Ferranti, Ltd.
General Electric Co., Ltd.
Goodmans (Clerkenwell), Ltd.
Grampian Reproducers, Ltd.
Hartley Turner Radio, Ltd.
Henry Ford Radio, Ltd.
Kay, Ltd., P.
Kingsway Radio, Ltd.
Lissen, Ltd.
London Electrical Co. (Sherborne Lane), Ltd.
Londona, Ltd.
Lotus Radio (1933), Ltd.
Lyons, Ltd., Claude.
Midland Radio & Television Co.
Mile End Radio Co.
Nicholls, Ltd., J. T.
Partridge & Mee, Ltd.
Plessey Co., Ltd.
Reproducers & Amplifiers, Ltd.
Rich & Bundy, Ltd.
Savage, W. B.
Scott Sessions & Co.. G.
Sifam Electrical Instrument Co., Ltd.
Sound Sales, Ltd.
Supremus Specialities, Ltd.
Tannoy Products.
Telsen Electric Co., Ltd.
Trix Electrical Co., Ltd.
Varley.
Volgt Patents, Ltd.
Weedon Power Link Radio Co.
Wharfedale Wireless Works.
Whiteley Elec. Radio Co., Ltd.
Wright & Weaire, Ltd.
Zenith Electric Co., Ltd.
362 Radio Valve Co., Ltd.

### TRANSFORMERS (push-pull).

Aerodyne Radio, Ltd.
All-Power Transformers, Ltd.
Amplion (1932), Ltd.
Birmingham Sound Reproducers, Ltd.
British Lumophon Co.
British Rola Co., Ltd.
British Sampson Products.
British Television Supplies, Ltd.
Bulgin & Co., Ltd., A. F.
Concerton Radio & Electric Co., Ltd.
Cossor, Ltd., A. C.
Cranley Radio, Ltd.
Custerson, R.
Elliott Radio Mfg. Co., Ltd.
Ferranti, Ltd.
General Electric Co., Ltd.
Goodmans (Clerkenwell), Ltd.
Hartley Turner Radio, Ltd.
Henry Ford Radio Ltd.
Kay, Ltd., P.
Kimber, Allen & Co., B.
Kingsway Radio, Ltd.
Lotus Radio (1933), Ltd.
Lyons, Ltd., C.
Mile End Radio Co.
Multitone Electric Co., Ltd.
Nicholls, Ltd., J. T.
Partridge & Mee, Ltd.
Plessey Co., Ltd.
Reproducers & Amplifiers, Ltd.
Rich & Bundy, Ltd.
Savage, W. B.
Sifam Electrical Instrument Co., Ltd.
Sound Sales, Ltd.
Tannoy Products.
Telsen Electric Co., Ltd.
Varley.
Weedon Power Link Radio Co.
Whiteley Elec. Radio Co., Ltd.
Wright & Weaire, Ltd.

### TRANSFORMERS (Q.P.P.).

Aerodyne Radio, Ltd.
All-Power Transformers, Ltd.
Amplion (1932), Ltd.
Birmingham Sound Reproducers, Ltd.
British Rola Co., Ltd.
British Sampson Products.
British Television Supplies, Ltd.
Bulgin & Co., Ltd., A. F.
Concerton Radio & Electric Co., Ltd.
Cossor, Ltd., A. C.
Cranley Radio, Ltd.
Custerson, R.
Elliott Radio Mfg. Co., Ltd.
Ferranti, Ltd.
General Electric Co., Ltd.
Goodmans (Clerkenwell), Ltd.
Graham Farish, Ltd.
Imp Radio Co.
Kay, Ltd., P.
Kimber, Allen & Co., B.
Kingsway Radio, Ltd.
Lissen, Ltd.
Lotus Radio (1933), Ltd.
Mile End Radio Co.
Multitone Electric Co., Ltd.
Plessey Co., Ltd.
Reproducers & Amplifiers, Ltd.
Sifam Electrical Instrument Co., Ltd.
Sound Sales, Ltd.
Tannoy Products.
Varley.
Weedon Power Link Radio Co.
Whiteley Electrical Radio Co., Ltd.
Wright & Weaire, Ltd.
Zimba Radio Co.
362 Radio Valve Co., Ltd.

### TRANSFORMER PARTS.

Adams Bros. & Burnley, Ltd.
Aerodyne Radio, Ltd.
All-Power Transformers, Ltd.
British Rola Co., Ltd.
British Sampson Products.
Brown, Brew & Co., Ltd.
Castagnoli, G.
Cranley Radio, Ltd.
Custerson, R.
Ferranti, Ltd.
General Electric Co., Ltd.
Goodmans (Clerkenwell), Ltd.
Harris, G. & R.
Harrison & Co., A. T.
Henry Ford Radio, Ltd.
Kay, Ltd., P.
Kingsway Radio, Ltd.
London Electrical (Sherborne Lane), Ltd.
Magnetic & Electrical Alloys, Ltd.

Manor Works (Aston), Ltd.
Marks & Son., Ltd., S.
Merrington Bros., Ltd.
Mile End Radio Co.
Reproducers & Amplifiers, Ltd.
Salford Electrical Instruments, Ltd.
Sankey & Sons, Ltd., Joseph.
Sound Sales, Ltd.
Standard Telephones & Cables, Ltd.
Tannoy Products.
Trix Electrical Co., Ltd.
Weedon Power Link Radio Co.
Whiteley Elec. Radio Co., Ltd.

### TRANSMITTING APPARATUS.

Allwave International Radio & Television, Ltd.
Bayliss, Ltd., W.
Blue Comet, Ltd.
Burne-Jones & Co., Ltd.
Castagnoli, G.
Cranley Radio, Ltd.
Gambrell Bros. & Co., Ltd.
Lyons, Ltd., Claude.
Marconi's Wireless Telegraph Co., Ltd.
Parkes, L. E.
Plessey Co., Ltd.
Quartz Crystal Co.,
Radio Development Co.
Sound Sales, Ltd.
Sifam Elec. Instrument Co., Ltd.
Tannoy Products.
362 Radio Valve Co., Ltd.

### TURNTABLES (gramophone).

Blue Comet, Ltd.
Collaro, Ltd.
Coppock, J. T.
Garrard Engineering & Manufacturing Co., Ltd.
General Electric Co., Ltd.
Kay, Ltd., P.
Kingsway Radio, Ltd.
Lugton & Co., Ltd.
Regent Fittings Co.
Tannoy Products.
Thompson, Diamond & Butcher.

### TURNTABLES (for portables).

Adams Bros. & Burnley, Ltd.
Coppock, J. T.
Kingsway Radio, Ltd.
Lugton & Co., Ltd.
McLeod & McLeod, Ltd.
Merrington Bros., Ltd.
Thompson, Diamond & Butcher.

### TURNTABLE BRAKES.

Blue Comet, Ltd.
Collaro, Ltd.
Coppock, J. T.
Garrard Engineering & Manufacturing Co., Ltd.
Leibovici, J.
Lugton & Co., Ltd.
Regent Fittings Co.

### VALVES (standard battery type)

Altham Radio Co.
B. and H. Valve Co.
British Pix Co., Ltd.
Clarion Radio Valve Co.
Concerton Radio & Electrical Co., Ltd.
Cossor, Ltd., A. C.
Edison Swan Electric Co., Ltd.
Ferranti, Ltd.
General Electric Co., Ltd.
High Vacuum Valve Co., Ltd.
Impex Electrical, Ltd.
Kay, Ltd., P.
Lampex Radio & Electric Co.
Lissen, Ltd.
London Radio Co. (Leeds), Ltd.
Lyons, Ltd., Claude.
Mullard Wireless Service Co., Ltd.
M.O. Valve Co., Ltd.
Octron, Ltd.
Portland Radio, Co., Ltd.
Record Radio, Ltd.
Siemens Electric Lamps & Supplies, Ltd.
Six-Sixty Radio Co., Ltd.
362 Radio Valve Co., Ltd.

### VALVES (A.C.).

Altham Radio Co.
B. and H. Valve Co.
British Pix Co., Ltd.
Clarion Radio Valve Co.
Concerton Radio & Electrical Co., Ltd.
Cossor, Ltd., A. C.
Edison Swan Electric Co., Ltd.
Ferranti, Ltd.
Forbat, E.
General Electric Co., Ltd.
High Vacuum Valve Co., Ltd.
Impex Electrical, Ltd.
Kay, Ltd., P.
Lampex Radio & Electric Co.
Lissen, Ltd.
London Radio Co. (Leeds), Ltd.
Lyons, Ltd., Claude.
Mullard Wireless Service Co., Ltd.
M.O. Valve Co., Ltd.
Octron, Ltd.
Portland Radio Co., Ltd.
Radio Development Co.
Record Radio, Ltd.
Six-Sixty Radio Co., Ltd.
362 Radio Valve Co., Ltd.

### VALVES (A.C. rectifier).

Altham Radio Co.
Bligh, S. W.
British Pix Co., Ltd.
Clarion Radio Valve Co.
Concerton Radio & Electrical Co., Ltd.
Cossor, Ltd., A. C.
Edison Swan Electric Co., Ltd.
Ferranti, Ltd.
Forbat, E.
General Electric Co., Ltd.
High Vacuum Valve Co., Ltd.
Impex Electrical, Ltd.
Kay, Ltd., P.
Lampex Radio & Electric Co.
Lissen, Ltd.
London Radio Co (Leeds), Ltd.
Lyons, Ltd., Claude.
Mullard Wireless Service Co., Ltd.
M.O. Valve Co., Ltd.
Octron. Ltd.
Philips Industrial (Philips Lamps, Ltd.).
Philips Lamps, Ltd.
Portland Radio Co., Ltd.
Radio Development Co.
Record Radio, Ltd.
Siemens Schuckert (Gt. Britain), Ltd.
Six-Sixty Radio Co., Ltd.
362 Radio Valve Co., Ltd.

### VALVES (multiple).

Bligh, S. W.
Cossor, Ltd., A. C.
Edison Swan Electric Co., Ltd.
Ferranti, Ltd.
Forbat, E.
General Electric Co., Ltd.
High Vacuum Valve Co., Ltd.
Kay, Ltd., P.
Lampex Radio & Electric Co.
Loewe Radio Co., Ltd.
Lyons, Ltd., Claude.
Mullard Wireless Service Co., Ltd.
M.O. Valve Co., Ltd.
Portland Radio Co., Ltd.
Radio Development Co.
Six-Sixty Radio Co., Ltd.
Standard Telephones & Cables, Ltd.
362 Radio Valve Co., Ltd.

### VALVES (Universal).

Bligh, S. W.
Clarion Radio Valve Co.
Concerton Radio & Electrical Co., Ltd.

## PRODUCTS SUPPLIED

Cossor, Ltd., A. C.
Edison Swan Electric Co., Ltd.
Ferranti, Ltd.
Forbat, E.
General Electric Co., Ltd.
Halson Radio Co., Ltd.
High Vacuum Valve Co., Ltd.
Impex Electrical Ltd.
Kay Ltd., P.
Lampex Radio & Electric Co.
Lyons, Ltd., Claude.
Mullard Wireless Service Co., Ltd.
M.O. Valve Co., Ltd.
Octron, Ltd.
Portland Radio Co., Ltd.
Radio Development Co.
Six-Sixty Radio Co., Ltd.
362 Radio Valve Co., Ltd.

### VALVE-HOLDERS.

Advance Components, Ltd.
Aerodyne Radio, Ltd.
Bedford Electrical & Radio Co., Ltd.
Belling & Lee, Ltd.
Benjamin Electric, Ltd.
Bligh, S. W.
Castagnoli G.
Christie & Sons, Ltd., Jas.
Crystalate Gramophone Record Mfg. Co. Ltd.
Ferranti, Ltd.
General Electric Co., Ltd.
Graham & Co., R. F.
Graham Farish, Ltd.
Gripso Co.
Harrison & Co., A. T.
Kay, Ltd., P.
Lectro Linx, Ltd.
Lissen, Ltd.
Loewe Radio Co., Ltd.
London Electrical Co. (Sherborne Lane), Ltd.
London & Provincial Factors, Ltd.
Lyons, Ltd., Claude.
McLeod & McLeod, Ltd.
Marks & Sons, S.
Person & Son, L.
Plessey Co., Ltd.
Radiamp Co., Ltd.
Stratton & Co., Ltd.
Telsen Electric Co., Ltd.
Toubkin, J.
Ward & Goldstone, Ltd.
Whiteley Elec. Radio Co., Ltd.
Wright & Weaire, Ltd.
W.R.C., Ltd.
362 Radio Valve Co., Ltd.

### VALVE TESTERS.

Aerodyne Radio, Ltd.
Automobile Accessories (Bristol), Ltd.
Castagnoli, G.
Custerson, R.
Ferranti, Ltd.
General Electric Co., Ltd.
London Electrical Co. (Sherborne Lane), Ltd.
McLeod & McLeod, Ltd.
McMillan & Co., J.
Millet, J.
Pifco, Ltd.
Pye Radio, Ltd.
Radio Development Co.
Salford Electrical Instruments, Ltd.
Siemens Schuckert (Gt. Britain), Ltd.
Tannoy Products.
Weston Electrical Instrument Co., Ltd.
Wood, L. R.

### VARNISHES, INSULATING.

Bakelite, Ltd.
Bligh, S. W.
British Insulated Cables, Ltd.
Ellison Insulations, Ltd.
Enfield Cable Works, Ltd.
General Electric Co., Ltd.
Grampian Reproducers, Ltd.
Micanite & Insulators Co., Ltd.
Nobel Chemical Finishes, Ltd.
Westinghouse Electric International Co.

### VOLUME CONTROLS.

Anglo American Industries Corpn.
Automobile Accessories (Bristol), Ltd.
Bowyer, Lowe & A. E. D., Ltd.
British Blue Spot Co., Ltd.
British Goldring Products, Ltd.
British N.S.F. Co., Ltd.
British Pix Co., Ltd.
British Radio Mfg. Co. (Liverpool), Ltd.
British Radiophone, Ltd.
Bulgin & Co., Ltd., A. F.
Burne-Jones & Co., Ltd.
Castagnoli, G.
Chorlton Metal Co., Ltd.
Colvern, Ltd.
Cosmocord, Ltd.
Cossor, Ltd., A. C.
Earl Mfg. Co., Ltd.
Edison Swan Electric Co., Ltd.
Erie Resistor, Ltd.
Ferranti, Ltd.
General Electric Co., Ltd.
Goodmans (Clerkenwell), Ltd.
Graham Farish, Ltd.
Harrison & Co., A. T.
Igranic Electric Co., Ltd.
Ivory Electric, Ltd.
Kay, Ltd., P.
Lechner & Co., F. W.
Lissen, Ltd.
Loewe Radio Co., Ltd.
London Electrical Co. (Sherborne Lane), Ltd.
Lyons, Ltd., Claude.
McLeod & McLeod, Ltd.
Partridge & Mee, Ltd.

Plessey Co., Ltd.
Radio Resistor Co.
Rawson (Sheffield & London), Ltd., H. C.
Reliance Mfg. Co. (Southwark), Ltd.
Reproducers & Amplifiers, Ltd.
Rothermel, Ltd., R. A.
Salford Electrical Instruments, Ltd.
Standard Telephones & Cables, Ltd.
Tannoy Products.
Telsen Electric Co., Ltd.
Varley.
Watmel Wireless Co., Ltd.
Whiteley Electrical Radio Co., Ltd.
Wingrove & Rogers, Ltd.
Wright & Weaire, Ltd.
W.R.C., Ltd.

## WANDER PLUGS.

Amplifiers, Ltd.
Andrews & Co., A. E.
Belling & Lee, Ltd.
Bulgin & Co., Ltd., A. F.
Castle Fuse & Engineering Co., Ltd.
Colvern, Ltd.
Eastick & Sons, J. J.
Francois, E. J.
General Electric Co., Ltd.
Graham & Co., R. F.
Gripso Co.
Harris, G. & R.
Igranic Electric Co., Ltd.
Ivory Electric, Ltd.
Joseph, H.
Lectro Linx, Ltd.
Leibovici, J.
Lilley & Son, Ltd., S.
Lisenin Wireless Co.
Lissen, Ltd.
McLeod & McLeod, Ltd.
Millet, J.
Radiamp Co., Ltd.
Siemens Electric Lamps & Supplies, Ltd.
Toubkin, J.
True Screws, Ltd.
Ward & Goldstone, Ltd.
W.R.C.. Ltd.

## WASHERS.

Amplifiers, Ltd.
Austin & Hayes.
Barber & Colman, Ltd.
Bligh, S. W.
Clarkes (Redditch), Ltd.
Cossor, Ltd., A. C.
Francois, E. J.
Gee (Birmingham), Ltd.
General Electric Co., Ltd.
Harris, G. & R.
Ivory Electric, Ltd.
McLeod & McLeod, Ltd.
Manor Works (Aston), Ltd.
Mica Mfg. Co., Ltd.
Money Hicks, Ltd.
Muller & Co. (England), Ltd.
Prideaux, Junr., R.
Radiamp Co., Ltd.
Regent Fittings Co.
Romac Motor Accessories, Ltd.
Ross, Courtney & Co., Ltd.
True Screws, Ltd.
Wilkins & Wright, Ltd.
W.R.C., Ltd.

## WAVEMETERS.

Allwave International Radio & Television, Ltd.
Brown Brew & Co., Ltd.
Brown Radio Co., W. F.
Burne-Jones & Co., Ltd.
Castagnoli, G.
Custerson, R.
Ferranti, Ltd.
General Electric Co., Ltd.
Ivory Electric, Ltd.
London Electrical Co. (Sherborne Lane), Ltd.
Lyons, Ltd., Claude.
Quartz Crystal Co.
Siemens-Schuckert (Gt. Britain), Ltd.
Tannoy Products.

## WAVE TRAPS.

Automobile Accessories (Bristol), Ltd.
Berclif, Ltd.
Bligh, S. W.
Brown, Brew & Co., Ltd.
Burne-Jones & Co., Ltd.
Chalkley, C. G.
Custerson, R.
Elliott Radio Mfg. Co., Ltd.
Eon Vacuum Wireless Co.
Ferranti, Ltd.
Graham Farish, Ltd.
Ivory Electric, Ltd.
Kingsway Radio, Ltd.
London Electrical Co. (Sherborne Lane), Ltd.
Lotus Radio (1933), Ltd.
Postlethwaite Bros.
Radiamp Co. Ltd.
Shearing, A. E.
Tannoy Products.
Ward & Goldstone, Ltd.
Watmel Wireless Co., Ltd.
Wood, L. R.
362 Radio Valve Co., Ltd.

## WIRE (aerial).

Aerialite, Ltd.
Altham Radio Co.
Bligh, S. W.
Blue Comet, Ltd.
British Aluminium Co., Ltd.
British Insulated Cables, Ltd.
British Ropes, Ltd.
Bromley-Langton Electric Wire & Insulator Co., Ltd.
Callenders Cable & Construction Co., Ltd.
Concordia Electric Wire Co., Ltd.
Connollys (Blackley), Ltd.
Dennis & Co., W. F.

## PRODUCTS SUPPLIED

Enfield Cable Works, Ltd.
General Electric Co., Ltd.
Hart Bros. Electrical Mfg. Co., Ltd.
Henry Ford Radio, Ltd.
Ivory Electric, Ltd.
Laker Co., Ltd., J. & J.
Lamplugh Radio, Ltd.
London Electric Wire Co., & Smiths, Ltd.
London Radio Co. (Leeds), Ltd.
McLeod & McLeod, Ltd.
Midland Electric Wire Co., Ltd.
Millet, J.
New London Electron Works, Ltd.
Sanger & Son, M.
Siemens Electric Lamps & Supplies, Ltd.
Toubkin, J.
Trent Electric Wire Works, Ltd.
Trix Electrical Co., Ltd.
Ward and Goldstone, Ltd.
Wood, L. R.

### WIRE (connecting).

Altham Radio Co.
Bligh, S. W.
Blue Comet, Ltd.
British Insulated Cables, Ltd.
British Ropes, Ltd.
Bromley-Langton Electric Wire & Insulator Co., Ltd.
Callenders Cable & Construction Co., Ltd.
Concordia Electric Wire Co., Ltd.
Enfield Cable Works, Ltd.
General Electric Co., Ltd.
Hart Bros. Electrical Mfg. Co., Ltd.
Ivory Electric, Ltd.
Leibovici, J.
McLeod & McLeod, Ltd.
Millet, J.
Reliance Electrical Wire Co., Ltd.
Sanger & Son, M.
Scott Insulated Wire Co., Ltd.
Siemens Electric Lamps & Supplies, Ltd.
Telsen Electric Co., Ltd.
Trix Electrical Co., Ltd.
Ward & Goldstone, Ltd.
Wood, L. R.

### WIRE (galvanised stay).

Braby & Co., Ltd., F.
British Ropes, Ltd.
Bruntons (Musselburgh), Ltd.
Dennis & Co., W. F.
General Electric Co., Ltd.
Ivory Electric Ltd.
Laker Co., Ltd., J. & J.

### WIRE (instrument).

British Insulated Cables, Ltd.
British Ropes, Ltd.
Bromley-Langton Electric Wire & Insulator Co. Ltd.
Concordia Electric Wire Co., Ltd.
Connollys (Blackley), Ltd.
Cranley Radio, Ltd.
Elvy, C. L.
Enfield Cable Works, Ltd.
General Electric Co., Ltd.
Hart Bros. Electrical Mfg. Co., Ltd.
Ivory Electric Ltd.
Kent Bros. Electric Wire Co. & E. H. Phillips, Ltd.
London Electric Wire Co., & Smiths, Ltd.
McLeod & McLeod, Ltd.
Midland Electric Wire Co., Ltd.
Scott Insulated Wire Co., Ltd.
Ward & Goldstone, Ltd.

### WIRE (Litz).

Blue Comet, Ltd.
British Insulated Cables, Ltd.
Bromley-Langton Electric Wire & Insulator Co., Ltd.
Concordia Electrical Wire Co., Ltd.
Connollys (Blackley), Ltd.
Cranley Radio, Ltd.
Hart Bros. Electrical Mfg. Co., Ltd.
Ivory Electric, Ltd.
London Electric Wire Co., & Smiths, Ltd.
McLeod & McLeod, Ltd.
Scott Insulated Wire Co., Ltd.
Ward & Goldstone, Ltd.

### WIRE (resistance).

Blue Comet, Ltd.
British Insulated Cables, Ltd.
British Ropes, Ltd.
Bromley-Langton Electric Wire & Insulator Co., Ltd.
Concordia Electric Wire Co., Ltd.
Cranley Radio Ltd.
General Electric Co., Ltd.
Harrison & Co., A. T.
Hart Bros. Electrical Mfg. Co., Ltd.
Imp Radio Co.
Ivory Electric, Ltd.
Kent Bros. Electric Wire Co. & E. H. Phillips, Ltd.
London Electric Wire Co. & Smiths, Ltd.
McLeod & McLeod, Ltd.
Maul & Murphy, Ltd.
Scott Insulated Wire Co., Ltd.
Siemens Schuckert (Gt. Britain), Ltd.
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### D.



### E.



### F.



### G.

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S.



T.



U.

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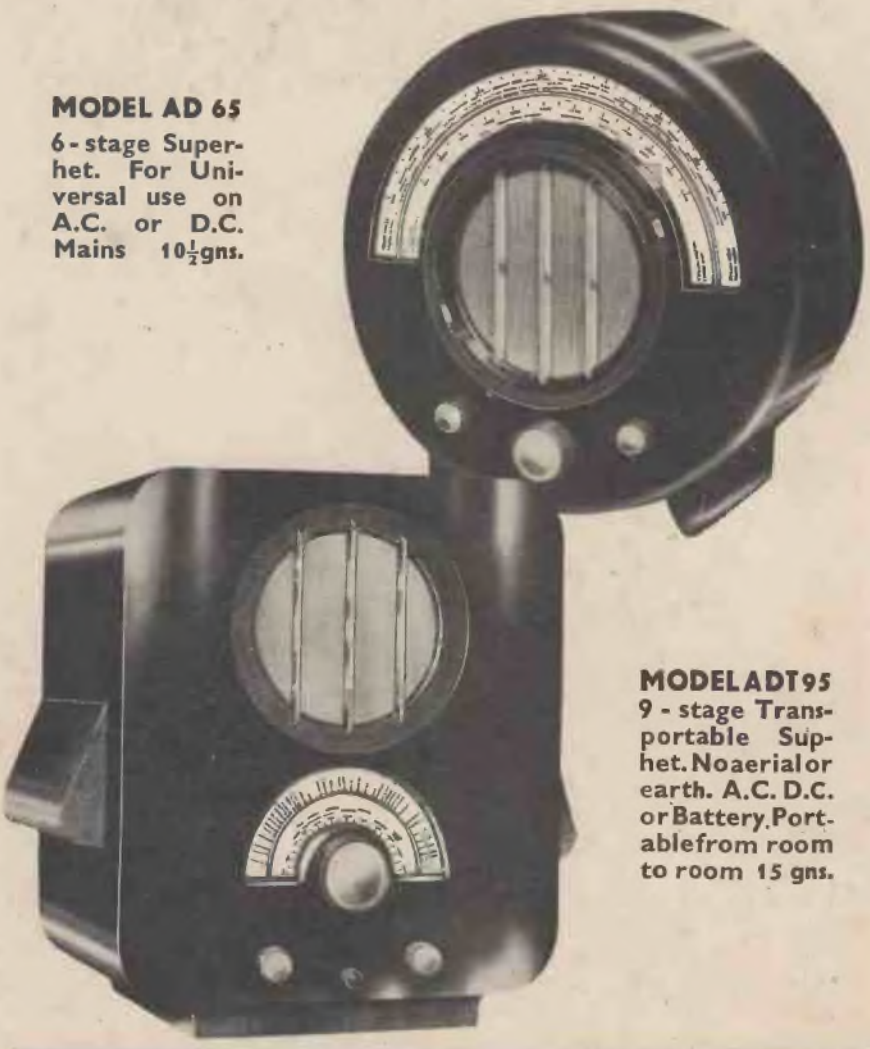

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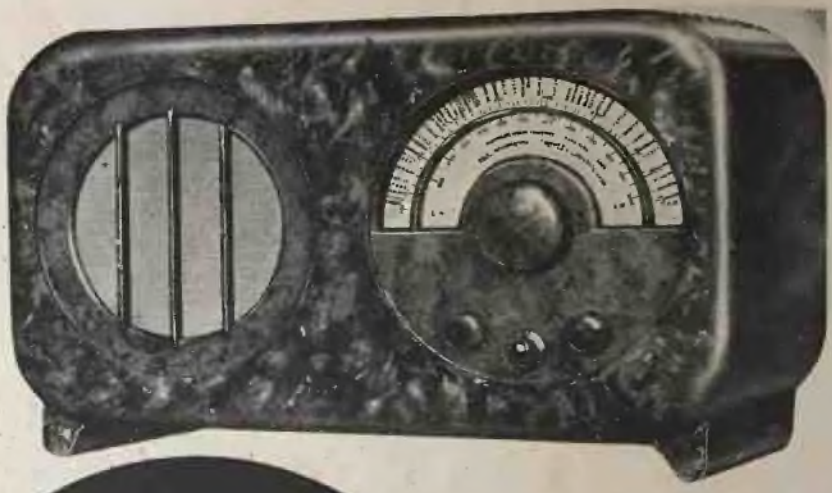

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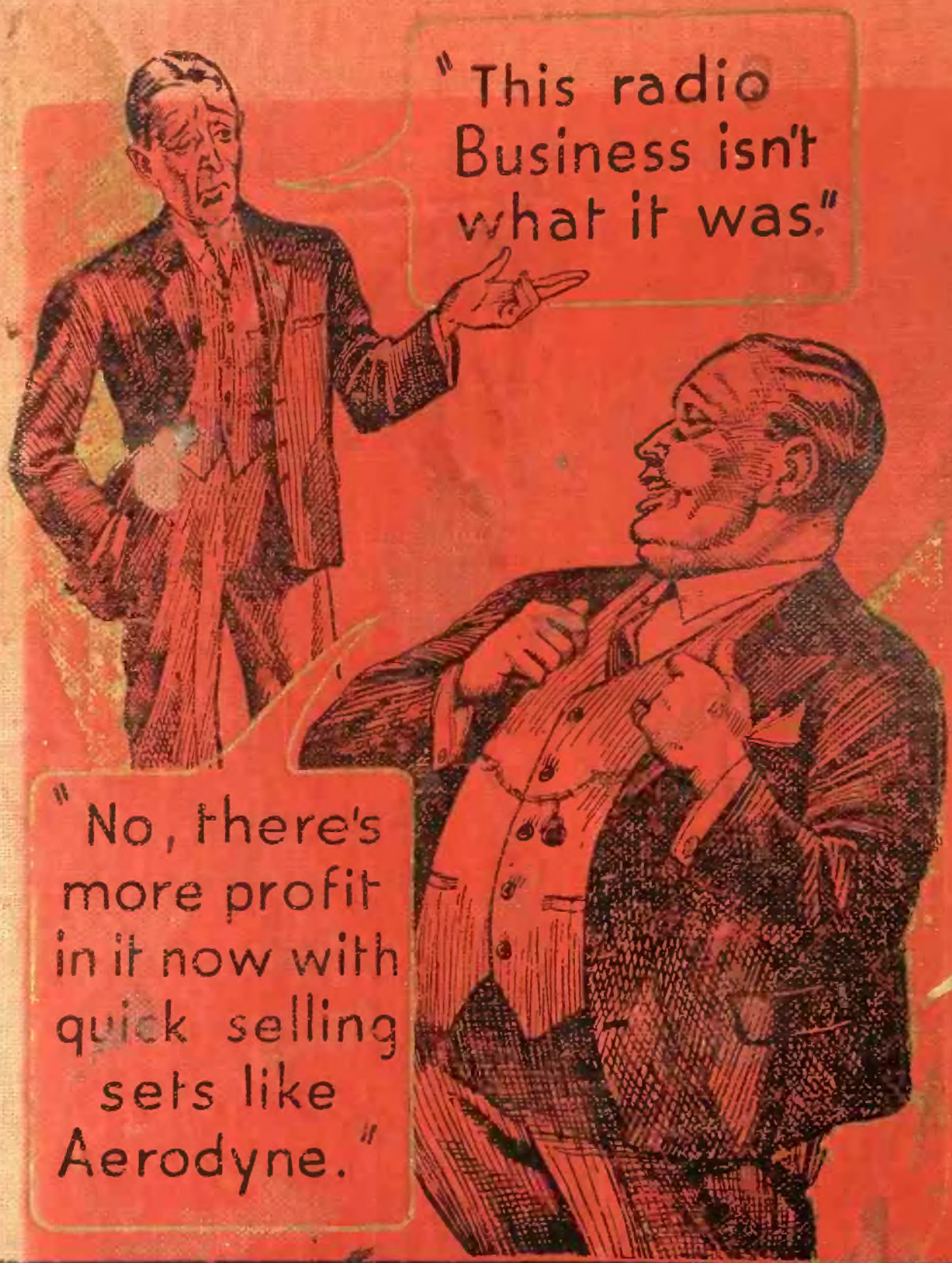


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