

3<sup>D</sup>

# The Wireless World

## AND RADIO REVIEW

### *The Paper for Every Wireless Amateur*

Wednesday, October 2nd, 1929.



MANUFACTURED BY  
C. F. & H. BurTon

PROGRESS WORKS  
WALSALL, ENG.

### Precision Condensers



### POWER for your Valves from the Mains

ATLAS  
Battery Eliminator  
Prices from  
WRITE FOR

H. CLARKE & CO. (Mcr.) LTD., OLD TRAFFORD, MANCHESTER

## SEE THE AMAZING

# MAZDA

VALVES

at OLYMPIA

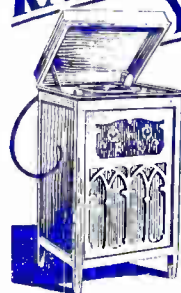
on the Ediswan stand

## NEW 1929 RANGE

V.14

LOW IN PRICE—EFFICIENT IN PERFORMANCE

## THE RADIO-GRAMOPHONE YOU HAVE WAITED FOR



GIVES PERFECT RADIO & GRAMOPHONE MUSIC ON ONE INSTRUMENT FOR BATTERY OR MAINS OPERATION

## The CRAIGWELL RADIO-GRAMOPHONE

Write for Particulars The British Radio Gramophone Co Ltd, 77, City Road, London E.C.1

# SOME BATTERIES

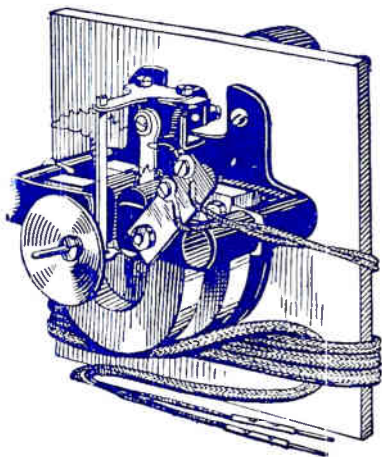
may be good, others may be better, but the best is undoubtedly

## "BEAM"



position of "Beam" batteries consists of roughly reliable elements which combine a perfectly steady flow of current over periods thereby enabling you to listen to stations without the disturbing effects of ground noises.

If your dealer cannot supply, order direct.



### NEW AND IMPROVED BEAM CONE UNIT

The Unit which reproduces without loss of tonal quality and with extra purity and volume all that your set receives. Every "Beam" Unit carries a 12 months' guarantee. **21/-**

"Beam" components and accessories are of first-class technical design and construction.

**Beam Ltd.** 35, Farringdon Road, London, E.C.1.  
Telephone: Holborn 7048.

PRICE

30/-



## A GOOD INVESTMENT

Quickly pays for itself in saving of records. The only carrier which ensures true radial tracking.

Write for full particulars to

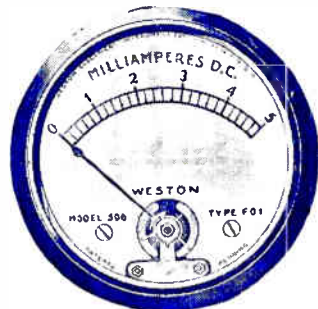
**ROBINSON & HANDS ELEC. CO., LTD.,**  
BARWICK STREET, BIRMINGHAM.

# Weston sets the world's standard

**MODEL 506 Panel Voltmeter** ensures permanent accuracy on your radio receivers. Experimenters and radio enthusiasts find it necessary for checking the electrical operation of their sets.

Having a high internal resistance of 125 ohms per volt, it makes practically no load on the batteries. It is compact and neat in appearance.

The Weston booklet "Radio Control," which explains the uses of this and other Weston Radio Instruments, is free. Write for your copy now.



MODEL 506 PANEL VOLTMETER.

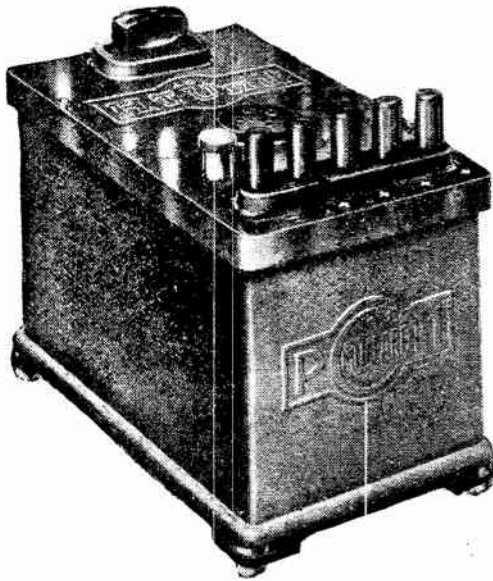
Prices: £1-15-0—£2-15-0

# WESTON

STANDARD THE WORLD OVER

Pioneers since 1888  
**WESTON ELECTRICAL INSTRUMENT CO., LTD.,**  
15, Great Saffron Hill, London, E.C.1.

Mention of "The Wireless World," when writing to advertisers, will ensure prompt attention.



# HIGH TENSION

current must be steady and un-failing. To this end there has been designed the Mullard P.M. H.T. Supply Unit—a component that effectively dispenses with batteries for ever. Here is a performance table that puts down what you are buying in black and white:

Total Current from all tapplings.	Approx. Voltage available of tapping 4.
10 milliamperes.	180 v.
20     "	150 v.
30     "	125 v.
40     "	100 v.

Tapping recommended for	Approx. Voltage available.
1. Detector Valve.	40-60 v.
2. H.F. Valves.	60-90 v.
3. L.F. Valves (other than last valve).	90-100 v.
4. Last Valve (Super power type).	150 v.

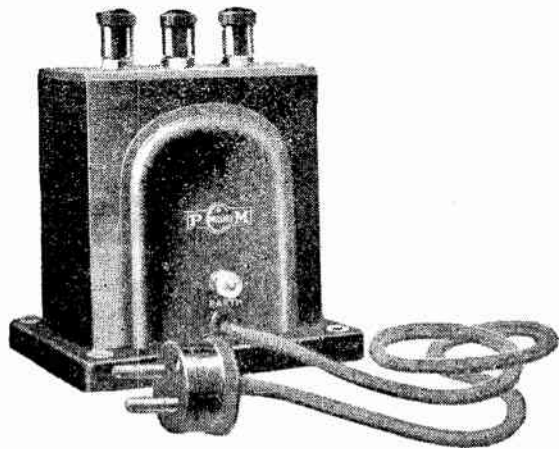
# LOW TENSION

supply from the mains is achieved with the Mullard P.M. Filament Transformer. Use it with the Mullard indirectly heated A.C. valves and be dependent no longer on batteries as a foundation for your radio entertainment.

Below are suitable types for varying voltages :

Type.	Suitable for A.C. Mains.
103	100-106
111	107-114
210	200-214
222	215-228
240	229-245
253	246-260

PRICE £5 5s. 0d.



PRICE 32s. 6d.

# Mullard MASTER • RADIO



Regd. Design

BY THE  
WONDERFUL  
NEW

IN THREE MODELS:  
Mahogany or Oak.  
Design as illustrated.  
Model V10 - £5 10 0  
Model V12 - £7 10 0  
Model V15 - £12 10 0  
Also obtainable by easy  
payments, ask your Dealer  
for particulars.

**H**ERE is one of the greatest achievements in the history of the Radio—a loud speaker that reproduces the broadcast in your home *exactly as it is played in the studio*. It omits nothing! It invents nothing! It finds notes that other loud speakers miss. It reveals instruments you've never heard by Radio before. It is the new Brown Duplex Loud Speaker.

The greatest of many Brown triumphs, this wonderful new loud speaker owes its superior performance to two entirely new features of design—the new "Vee" Movement and the new Duplex Cone. In no other loud speaker will you find them. That is why from no other loud speaker will you get a tone so sweet and so mellow—a volume so rich and so full. Only the Brown Duplex Loud Speaker "re-creates the *living* artiste." Ask any Wireless Dealer.

# Brown

## DUPLEX LOUD SPEAKER

Advt. S. G. Brown, Ltd., Western Ave., N. Acton, London, W.3.

Mention of "The Wireless World," when writing to advertisers, will ensure prompt attention.

GA 686



# WITH MELODY OUT OF THE MEDLEY

**FIT**

The rich mellow tones of an aged violin—the delicate touch of a master violinist can be reproduced with amazing fidelity if your set includes Telsen Transformers, the Transformers that cover the whole of the musical range.

Entirely British and the right jobs at the right price.

"Radiogrand" Model "Ace" Model

12/6

8/6

Ratios 5-1  
and 3-1

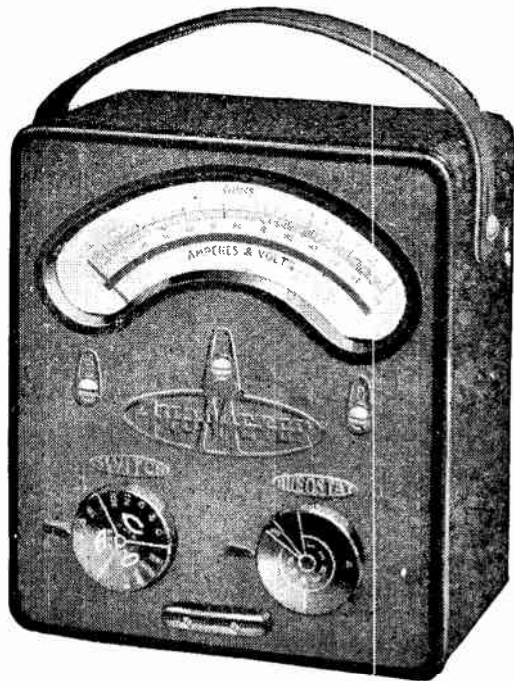
Ratios 5-1  
and 3-1



# TRANSFORMERS

TELSEN ELECTRIC CO., LTD.

MILLER STREET, BIRMINGHAM.



13 ELECTRICAL INSTRUMENTS IN 1  
**The "AVOMETER"**

MEASURES

**AMPS, VOLTS and OHMS**

without calculation of any kind.

**NO EXTERNAL SHUNTS OR MULTIPLIERS.**

The 13 ranges of the  
**"AVOMETER"**

are as follows:

0-12 Milliamps  
 0-120 Milliamps  
 0-12 Amperes  
 0-12 Amperes } Amperes.

0-120 Millivolts  
 0-12 Volts  
 0-12 Volts  
 0-120 Volts  
 0-1200 Volts } Volts.

0-1000 Ohms  
 0-10,000 Ohms  
 0-100,000 Ohms  
 0-1 Megohm } Ohms.

**BRITISH THROUGHOUT.**

No printing matter can possibly convey the numerous uses to which this Instrument can be put. One of the largest firms in the world informs us that "THE VALUE OF THE 'AVOMETER' CANNOT POSSIBLY BE APPRECIATED UNTIL IT IS IN ACTUAL USE." This concern has purchased over 80 "AVOMETERS", and is still ordering.

**Price - - £8 8 0**

*Deferred Payments Arranged.*

**The "DOUGLAS"**  
**Automatic Coil Winder**

PATENTED IN ALL COUNTRIES:

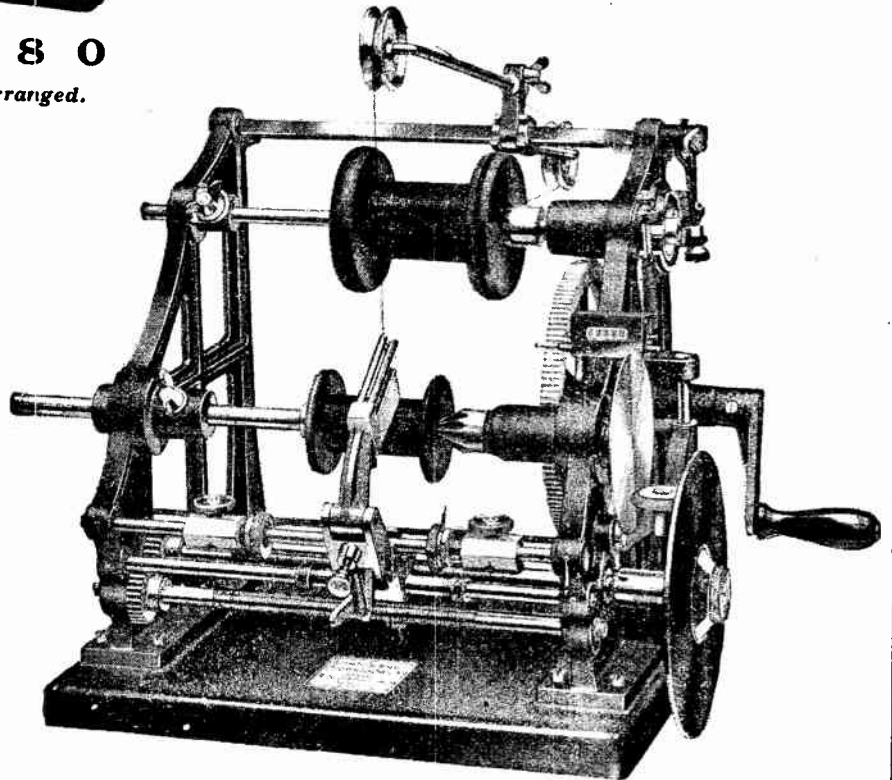
(Hand-driven).

It is a high class Machine designed to meet the requirements of small Manufacturers, Repairers, etc.

It winds perfect coils of any shape from  $\frac{3}{16}$ " to 5" in length and up to 4" in diameter, with any gauge wire from 48 to 22 s.w.g., at a maximum speed of 3,000 r.p.m.

The setting or changing over from one job to another, irrespective of the size of wire or shape of bobbin, occupies less than half a minute.

SEE A DEMONSTRATION  
 STAND No. 220 GALLERY  
 (Opposite Exhibitors' Club).



**The Automatic Coil Winder & Electrical Equipment Co., Ltd.,**  
**WINDER HOUSE, ROCHESTER ROW, S.W.1.**

Phone: VICTORIA 4350.

# The BLUE SPOT chassis for the BLUE SPOT unit



It is logical to assume that you get the finest results from your set when your loudspeaker is made up from a Blue Spot unit and chassis . . . .

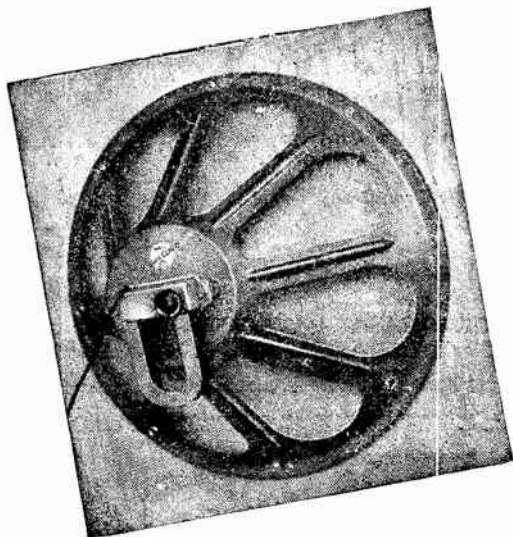
The Blue Spot unit is acknowledged to be the finest speaker unit produced, while the Blue Spot chassis has been specially designed for the unit.

The two working in conjunction represent loudspeaker performance of the highest order.

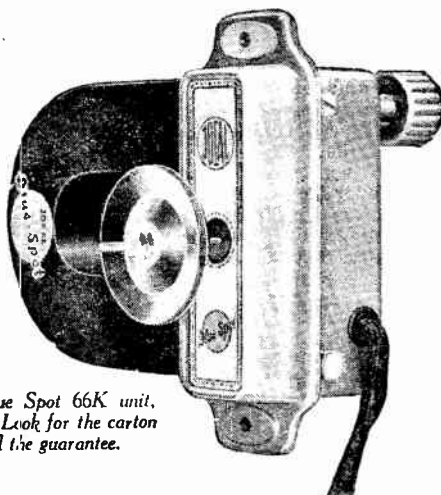
Price of the Blue Spot Major Chassis complete with 13" cone - - 15/-

Price of the Blue Spot Minor Chassis complete with 9½" cone - 12/6

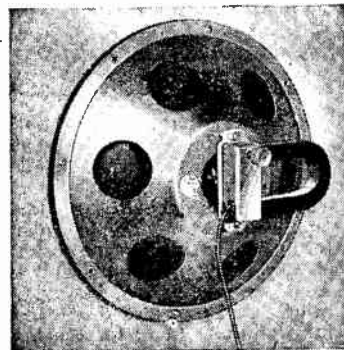
Obtainable from all wireless retailers. Five minutes to fix unit to chassis, no constructional difficulties.



*If you have a large set and like plenty of volume, the Major Chassis is what you require. It will handle an enormous input without chatter or distortion.*



*The Blue Spot 66K unit, 25/- . Look for the carton and the guarantee.*



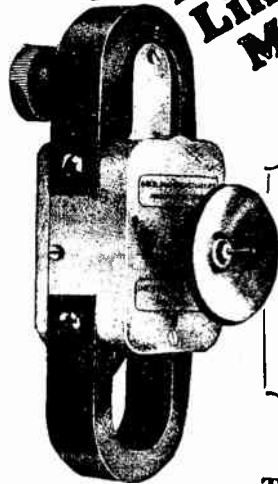
*If space for your loudspeaker is limited then the Minor Chassis will meet the case.*

**F. A. HUGHES & CO., LIMITED, 204-6, Great Portland Street, London, W.1**

Phone: Museum 8630 (4 lines).

Distributors for Northern England, Scotland and North Wales:  
H. C. RAWSON (SHEFFIELD & LONDON) LTD. 100, LONDON ROAD, SHEFFIELD. Phone: Sheffield 26006.  
25, ST. MARY'S PARSONAGE, MANCHESTER. Phone: Manchester City 3329.

After  
Many  
Months of  
Toil—  
Music-Speech  
Like  
Moving  
Coil



Weight  
2 pounds.

BRITISH  
MADE

THE  
**KUKOO**  
GIVES MOVING COIL RESULTS

COBALT  
UNIT

THIS AMAZING FOUR POLE UNIT  
STANDS SUPREME

For faithful reproduction over all transmitted frequencies

**SECRETS of SUCCESS**

The KUKOO incor-  
porates two Cobalt Steel  
magnets of high magnetic  
efficiency which provide  
Enormous flux density  
across the ends of  
Uniquely suspended arm-  
ature which has  
Sensitive and "stayput"  
adjustments.  
The KUKOO is robust  
and will last a lifetime.  
Best quality British made  
materials only used.

Even the most expensive MOVING COIL LOUD  
SPEAKERS do not excel this most excellent  
4 pole unit in quality of reproduction.

Designed to reach the extreme frequencies, the  
KUKOO fully merits the unstinted and un-  
solicited praise bestowed upon it by numerous  
radio experts and music critics. Their trained  
ears have fully grasped its outstanding tonal  
qualities.

With each unit detailed instructions are given for making cones  
of diameters varying from 6 ins. to 12 ins., so that a novice can  
produce a complete Speaker in an hour.

Kukoo Chassis complete with Cone shortly available.  
Write for particulars.



Sole Manufacturers and Patentees:

**THE SHEFFIELD MAGNET CO., SHEFFIELD, ENGLAND**

Cables and Telegrams: Magnet 20866 Sheffield.

Telephone: 20866 Sheffield.

(Postage extra).

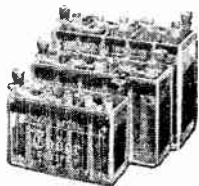
**A WIRELESS BATTERY THAT  
LEAVES NOTHING TO BE DESIRED!**

The battery that gives real satisfaction to its owner is the one that gives consistent efficiency in service. The Tudor Battery has every claim to such a reputation—it has everything that a good wireless battery should have.

There are charge indicators, for convenience and safety—thick plates and wood separators, for long life and robustness—non-corrosive terminals with vaseline chambers—clear glass containers—big ebonite filling plugs—and now an all-metal carrier.

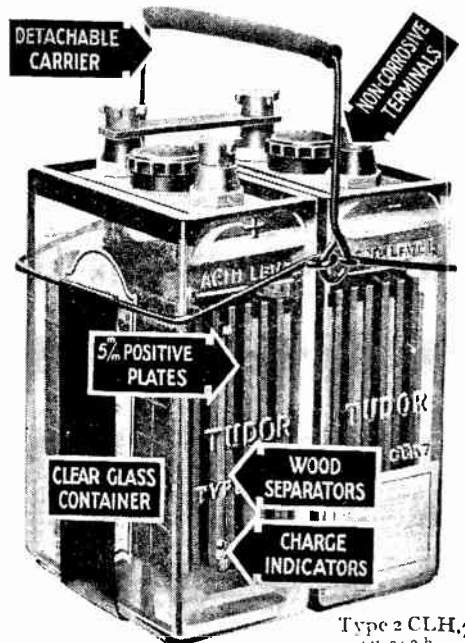
All these advantages, however, mean only a very slight increase in price. Ask your local dealer to show you a Tudor Battery and examine it carefully. Look for the ingenious indicators which tell you how much current you have left and when recharging becomes necessary.

You can take a Tudor Battery home and realise that you have in it, a perfect piece of workmanship—a compliment to your set.



**10 Volt HIGH TENSION UNITS.**

	Capacity.	Price.
5 H.T. 1	2,750 Milliamps.	6/9
5 H.T. 2	5,500 "	10/-
5 H.T. 4	11,000 "	17/6



Type 2 CLH.7  
4V. 34 a.h.

**Tudor**  
ACCUMULATORS

**27'9**  
Complete.

**COUPON.**  
Please send me full particulars of Tudor Wireless Accumulators.  
Name .....  
Address .....

Tudor Accumulator Co., Ltd.,  
2, Norfolk Street, Strand, W.C.2.





## PUSH-PULL AMPLIFICATION

Push-Pull amplification, with moderate H.T. Voltages enables you to handle considerable volume in the output stage without distortion.

In this system the output of the receiver is divided between two valves, or a multiple of two. The product is combined by means of a Push-Pull output transformer and fed to the speaker. A greatly enhanced grid swing is thus permissible and a correspondingly louder signal can be handled without the harshness or "chatter" due to overloaded valves.

A descriptive leaflet, Wb 412, gives full particulars, Transformer details and circuit. It should be in the hands of everyone interested in the combination of ample volume and quality reproduction. Ask your dealer or write direct.

# FERRANTI

FERRANTI LTD.

HOLLINWOOD

LANCASHIRE

**WE ARE AT  
OLYMPIA  
STAND 93**

# The Ready Radio Review & Buyers Guide

**PAY US  
A  
VISIT**

No. W.W.2.

IT PAYS TO BUY EFFICIENCY.

2nd OCTOBER, 1929.

### KIT SET

2 Polar No. 2 .0003 mfd. Variable Condensers. ....	11/-	1 Polar fixed Potentiometer 400 ohms .....	2/-
1 Utility Mite .0003 mfd. Variable Condenser .....	7/-	1 Igranite rheostat 50 ohms ..	2/6
1 Utility Mite .0005 mfd. Variable Condenser .....	7/6	1 Igranite type J transformer 3:1 ratio .....	17/6
2 Condenser dials 5 1/2" dia. and escutcheon plates .....	8/6	1 Siemens Special Cell .....	9
2 T.C.C. 2 mfd. 400 v. test fixed condensers .....	7/8	1 Siemens 15 volt G.B. battery ..	3/8
2 T.C.C. 1 mfd. 400 v. test fixed condensers .....	4/8	1 Utility on/off switch type W188 .....	1/8
1 T.C.C. .0001 mfd. condenser ..	1/6	1 McMichael Binocular HF choke .....	4/-
1 T.C.C. .0002 mfd. " ..	1/6	9 Belling Lee Terminals .....	4/3
1 T.C.C. .0003 mfd. " ..	1/6	1 Special metal cabinet complete with Base .....	60/-
2 Valve Holders .....	2/6	1 Complete set of special coils with switches and coupling lever .....	45/-
1 S.G. Valve Holder .....	2/-	3 Valves as specified .....	23/8
1 Ferranti 20,000 ohm resistance with holder .....	4/-	Glazite, Screws Etc. ....	2/-
1 Dubilier 2 Meg Grid Leak ..	2/6		
1 Grid leak holder .....	6		
2 Wearite 600 ohm resistances ..	3/-		
			<b>£11 11 11</b>

### CATALOGUE INFORMATION

#### READY RADIO PRODUCTS OF PROVEN PERFORMANCE

H.F. CHOKE.....	2 s. d	6 6
H.T. FUSE and BULB.....		1 6
NON-INDUCTIVE WIRE-WOUND RESISTANCE (with holders) 500, 600, 1,000.....		2 9
2,000, 3,000, 4,000, 5,000, 10,000.....		4 6
20,000, 30,000, 40,000, 50,000.....		6 6
100,000, 150,000, 200,000, 250,000.....		8 6
SELECTIVITY UNIT (High and Low Wave Models) each .....	1 0 0	
DYNAMIC REPRODUCER .....	6 0 0	

### SERVICE AND SATISFACTION

We have customers all over the world who have taken advantage of the Ready Radio Service. We receive every day testimonials and letters of appreciation. It pays to advertise good products and it pays to tell you about ourselves because we know it will pay you to avail yourself of our service.

#### TO HOME CUSTOMERS.

Your goods are despatched post free in sealed cartons or carriage paid by rail. A nominal charge of 2/- is made on orders, and this amount is credited if the case is returned within 7 days. **NOTE.**—You can if you desire avail yourself of the C.O.D. system.

#### TO OVERSEAS CUSTOMERS.

All your goods are very carefully packed for export and insured; all charges forward.

#### WRITE, WIRE OR 'PHONE

If you require any goods not shown in our lists, send your order and they will be despatched promptly at list prices C.O.D.

Telephone No.  
Hop 5555  
Private Exchange.

**Ready Radio**  
159, BOROUGH HIGH STREET, LONDON BRIDGE, S.E.1.  
(Three minutes from London Bridge Stations.)

Telegrams:  
Ready Hop 5555  
London.

# Get the Best from your Set— only the **GROSVENOR** can do it



The wonderful new Vitalising Element ensures continuous and satisfactory service. No other battery can give you the same service. It's the new Vitalising Element unique to Grosvenor that does it. Fitted by all the Leading Set Makers after the most exhaustive comparative tests, and PROVED to be the best.

66 v. from 7/6      99 v. from 11/6

THE GROSVENOR BATTERY Co., Ltd.,  
2/3, White Street, Moorgate, LONDON, E.C.2.

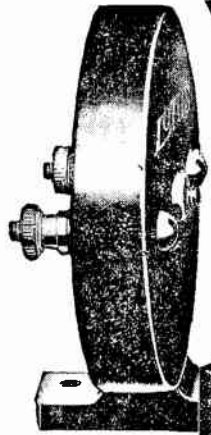
**GROSVENOR BRITISH MADE BATTERIES**

Mention of "The Wireless World," when writing to advertisers, will ensure prompt attention.

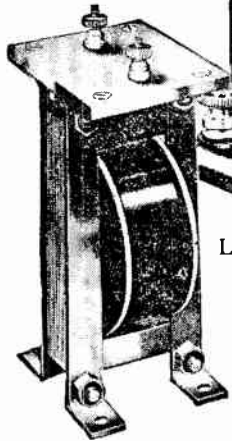
# SET BUILDERS!

**use Lotus components  
for easy assembling!**

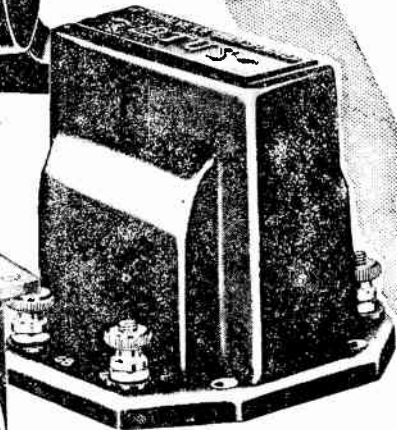
**D**RAW the curtains and gather round the table. Now's the time to try your hand at building some of the new radio sets with Lotus components. You'll enjoy the trouble-free building, the easy slipping together of these well-made units. Each is a masterpiece of mechanical perfection, strong, neat and accurate. Instead of buying a number of varying makes of components, choose all yours from the Lotus range. Lotus components are made to work together in harmony, and they ensure easy assembling and the achievement of all that the designer claims.



Lotus H.F. Choke, 5/6d.



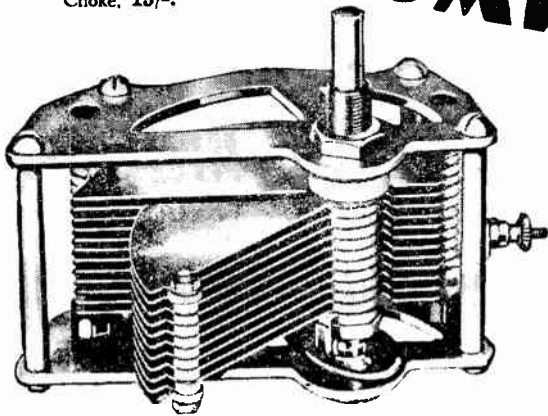
Lotus L.F. Power Choke, 15/-.



Lotus L.F. Intervalve transformer, 12/6d.

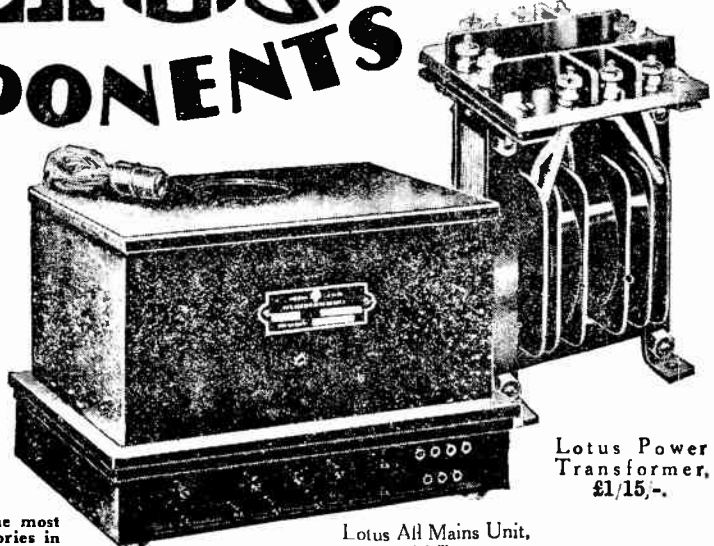
**ASK YOUR RADIO  
DEALER  
TO GIVE YOU A  
COPY OF THE NEW  
LOTUS CATALOGUE  
OR SEND DIRECT  
TO THE MAKERS  
AND IT WILL COME  
POST FREE**

## LOTUS COMPONENTS



Lotus Logarithmic condensers in all capacities from 5/-.

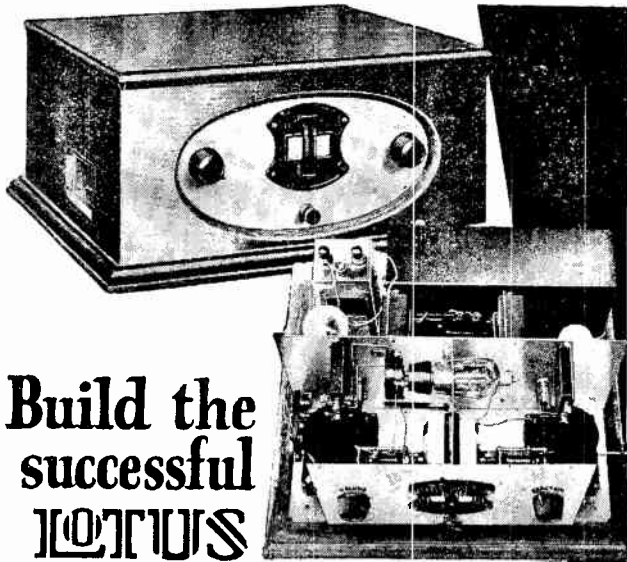
Made in one of the most modern radio factories in Great Britain.



Lotus Power Transformer, £1/15/-.

Lotus All Mains Unit, £7/7/-.

**GARNETT, WHITELEY & CO., LTD., LOTUS WORKS, LIVERPOOL.**



# Build the successful LOTUS S.G.P. Set yourself!

Here's a chance to secure the best set of the season—the new Lotus S.G.P. For tone, range and selectivity the new Lotus S.G.P. 3-valve set is voted by press and public to be the most outstanding set of the season, and in order that home constructors may enjoy its possession and also enjoy building it, Lotus are supplying it in kit form for home assembling. The kit is complete without valves, batteries and cabinet, and the main components are already mounted. Follow the simple diagrams and instructions, given free, and you can have a new Lotus S.G.P. in a few hours.

**Do you want an All Mains Model?**  
Then get the Lotus S.G.P. Kit for all mains operation. It is just as easy to build.

# LOTUS S.G.P. Kit Set

*Supplied with main components already mounted and with full instructions for building. Every component is thoroughly efficient. Prepared by the makers of Lotus components.*

GARNETT, WHITELEY & CO., LTD.,  
LOTUS WORKS, MILL LANE, LIVERPOOL.

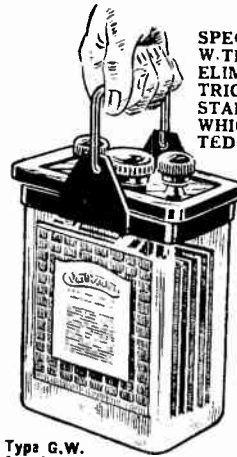
Send this Coupon Now!

To Garnett, Whiteley & Co., Ltd.,  
Lotus Works, Mill Lane, Liverpool.  
Please send me, free, copies of the new Lotus booklets and instructions how to build the Lotus S.G.P. Set.

Name .....  
Address .....

W.W. 2,9 29.

# BUY BATTERIES THAT ELIMINATE WASTE!



SPECIAL PRECAUTIONS ARE TAKEN WITH ALL VAN RADEN BATTERIES TO ELIMINATE EVERY SOURCE OF ELECTRICAL LEAKAGE—THIS IS A LONG STANDING VAN RADEN FEATURE WHICH WILL BE READILY APPRECIATED BY EVERY RADIO ENTHUSIAST.

Van Raden Batteries mean resistance to all the forces that tend to hammer the life out of a battery. Here is a novel glass container having protruding edges. Metal carrying handles are provided without extra cost. Fitted with rubber glands to prevent corrosion of terminals.

- G.W.3 - 9/-
- G.W.4 - 11/-
- G.W.5 - 13/-

Type G.W. 2-volt

40-, 60- and 80-hour inter-capacities.

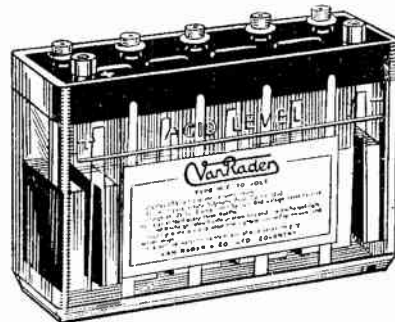


**N.W. Type.** A light, compact celluloid container, of a definite hard-wearing pattern, specially selected grooved wood separators, non-corrosive acid-proof terminals, fitted with grease caps filled with vaseline, a long-standing Van Raden practice.

- N.W.22 - 9/-
- N.W.23 - 11/-
- N.W.24 - 13/-
- N.W.25 - 15/-
- N.W.26 - 17/-

Type N.W. 2-volt

40-, 60-, 80-, 100- and 120-hour intercapacities.



A remarkable H.T. Battery, specially recommended for sets with more than 10 milliamps consumption.

W.Z.10 6/3

5,000 capacity in milliampere hours (on slow discharge).

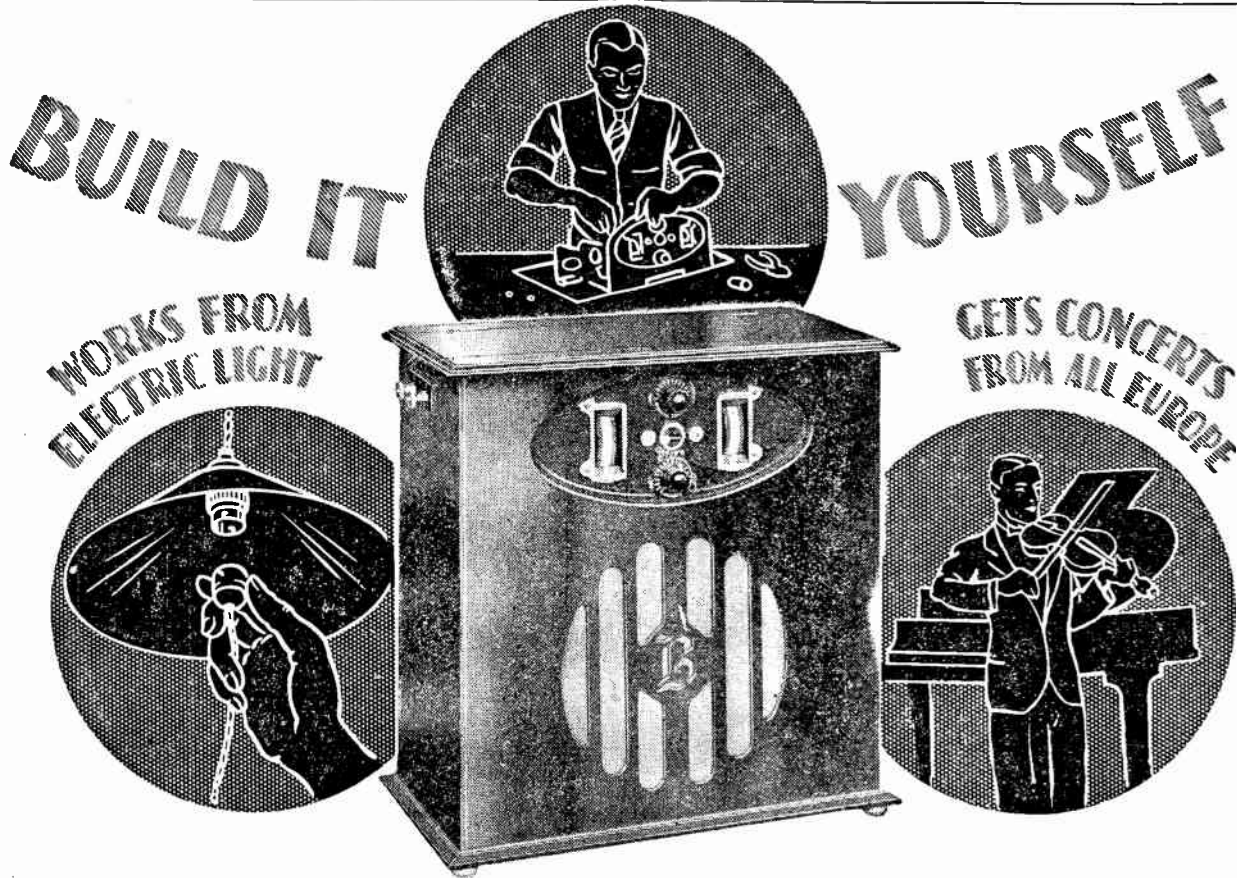
Type W.Z.10. 10-volt



THE BATTERY OF REPUTE  
VAN RADEN & Co., Ltd.  
GREAT HEATH, COVENTRY

TRADERS.—If your district is not already represented will you write for full details?

Mention of "The Wireless World," when writing to advertisers, will ensure prompt attention.



## The Receiver for the new B.B.C. Regional Scheme . . . which will put old Sets out-of-date

### Entirely Self-Contained

Everything is contained within the handsome oak cabinet—set, loud speaker, batteries and accumulator, away out of sight! Or, if you prefer it, you can build the **BROWN** Receiver without the loud speaker. Either model is a Set far ahead of previous home-built Receivers.

### Pay as you listen!

Any of the types of the **BROWN** Receiver can be obtained for a small first payment—and the balance in easy monthly instalments while you listen. Ask your Wireless Dealer for folder, "Why you should build the **BROWN** Receiver," which gives full details of our simple "pay as you listen" system.

**S**ELLECTIVITY is the great Radio need of to-day. The forthcoming B.B.C. Regional Scheme will soon put old Sets out-of-date. Higher powered British Stations will make reception of foreign programmes more difficult than ever. That is why you need the **BROWN** Receiver—a wonderful new Set that smashes all previous ideas of Radio home construction. The **BROWN** Receiver sets new standards in selectivity. With it you can cut out your local station at will and take your choice of at least twenty foreign programmes any evening. And you can build it yourself—even if you've never made a Set before—a handsome Receiver, in rich oak cabinet—one that you'll be proud to own! Finally the **BROWN** Receiver has a purer tone and a greater volume than any previous home-built Set. Prove our claims for yourself—at your Wireless Dealer's!

# The NEW **Brown** RECEIVER

*The famous Polar Condensers, made by Wingrove & Rogers, Ltd., of Liverpool, are used throughout Brown Receivers.*

### For Battery Operation

Type A, as illustrated above, includes loud speaker already assembled and tested in cabinet. Type B is similar to type A, but without loud speaker. Each model has space for batteries and accumulator. Kit of parts, less valves, batteries and accumulator, but including coils for 200-550 metres:—Type A—£12; Type B—£9.

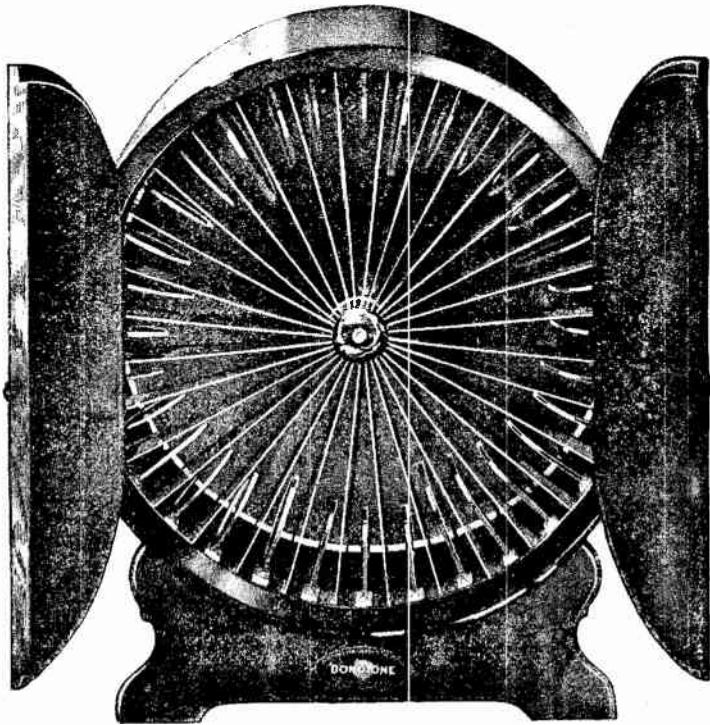
### All-Electric Models

Either model of the **BROWN** Receiver can be built for operation from either A.C. or D.C. electric light mains. Type A.M. includes loud speaker; Type B.M. has no speaker. Kit of parts, less valves, batteries and accumulator, but including coils for 200-550 metres:—Type A.M.—£20; Type B.M.—£17.

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The unanimous opinion of all who visited our Stands at the Radio Show was that the Donotone with its tuned gongs was the most wonderful reproducer that they had ever heard.

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**Purity! Volume!**

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### EDISWAN GLASS-ENCLOSED VACUUM RESISTANCES.

(Grid Leak or Anode)

Ediswan are the only British made resistances of this type on the market. All resistances are thoroughly tested before leaving our works, and are absolutely accurate and noiseless in operation. Obtainable in values from 5,000 ohms to 5 megohms. Overall length, 45 mm.

### CARTRIDGE CONDENSERS.

These condensers are ideal for the man who likes to experiment. In a second, you can pull one out of the clips and put in another of a different value. They are made in values from .0001 mfd. to .001 mfd. Overall length, 45 mm.

*For the best results*

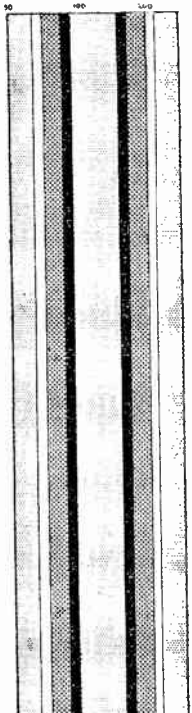
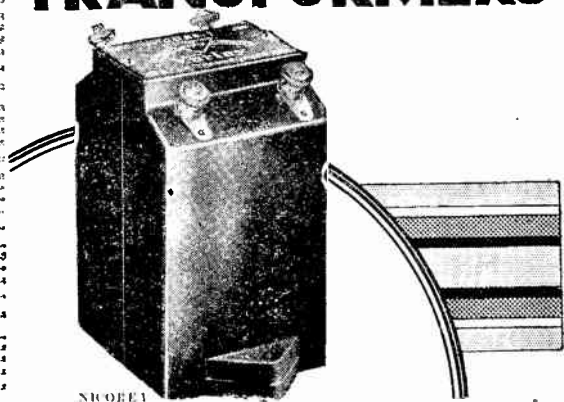
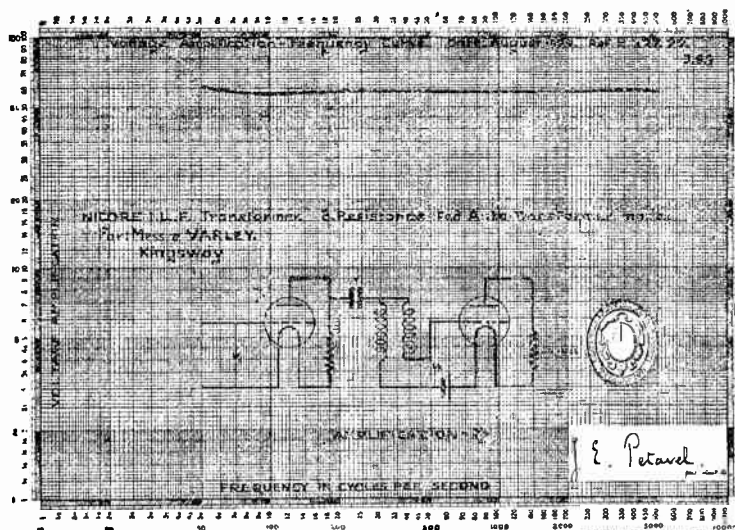
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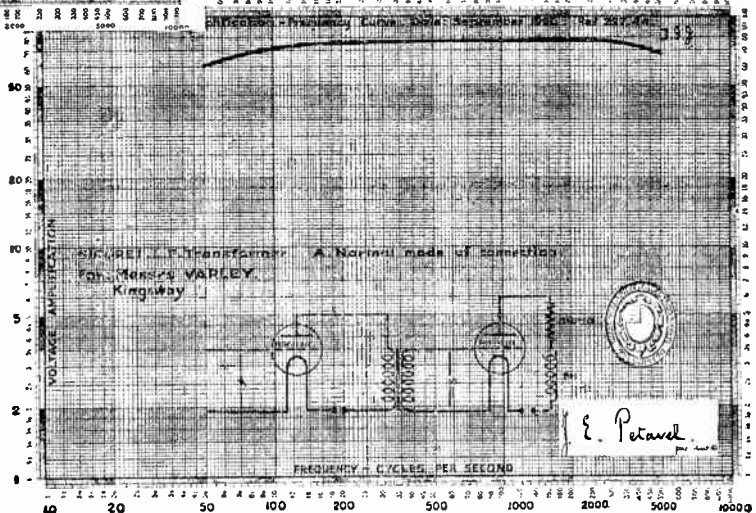
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You have only to look at these curves to see that for yourself. They show what the curves of no other transformer can show—perfect amplification of the deep bass notes, together with constant response at all frequencies from 50 to 5,000 cycles. After all it was only to be expected, for in the early days of broadcasting the coils for most of the well-known transformers were wound by Varley. Then after months of research came our success with the nickel iron alloy core, and to-day we are able to market at an amazingly low price two L.F. Intervalve Transformers whose performance is second to none.

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**MADE TO A STANDARD THAT SETS A STANDARD!**

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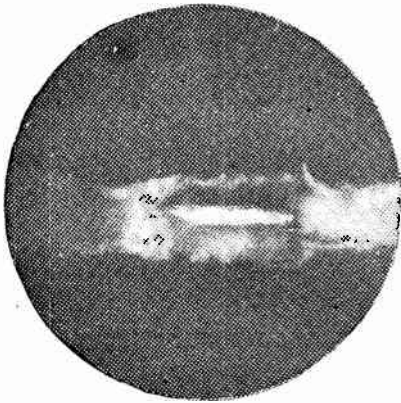
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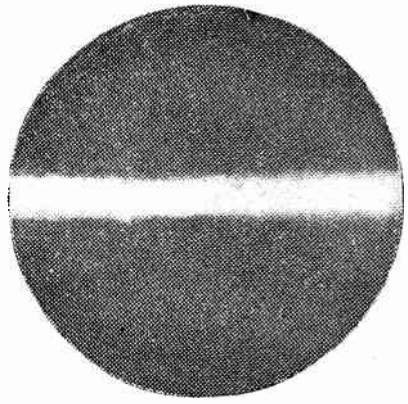
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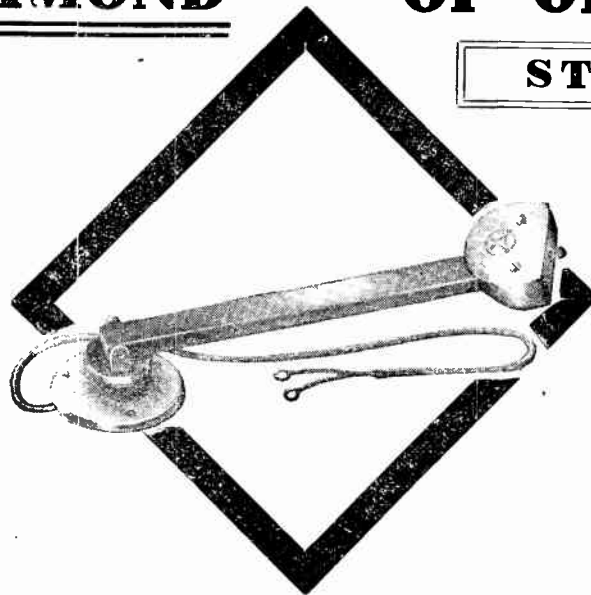
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*Literature on application*

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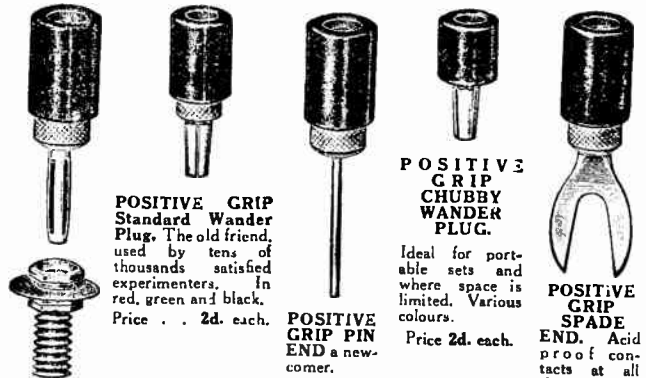


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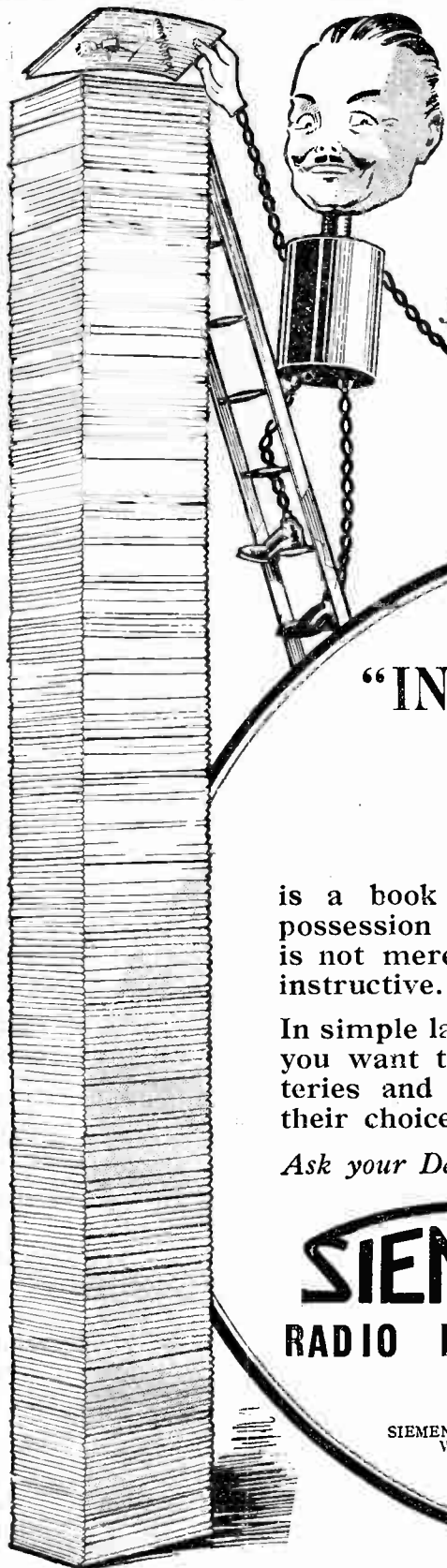
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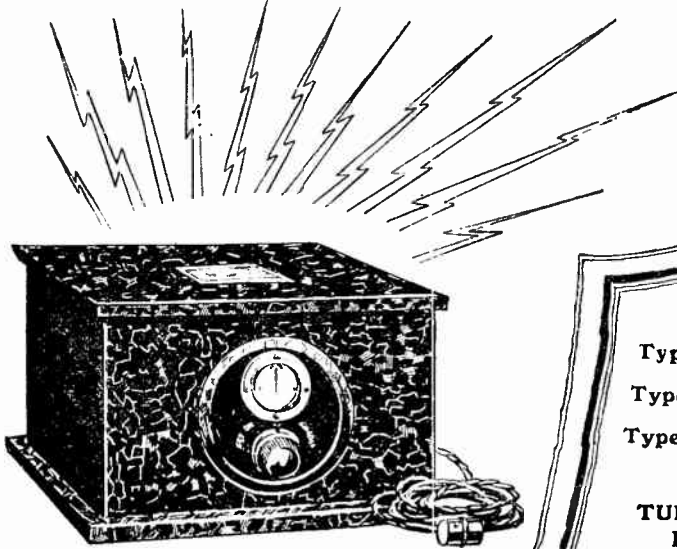


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SUPPLY UNITS  
FOR H.T. and L.T.  
FROM £2.7.6**



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L.T.—2, 4 or 6 volts @ 5 amp. max. **£5.12.6**
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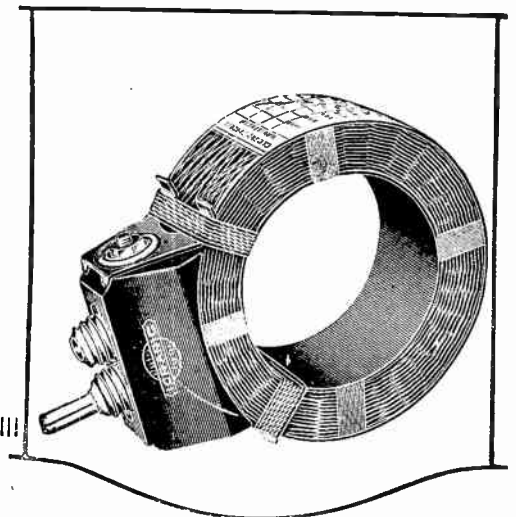
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£6  
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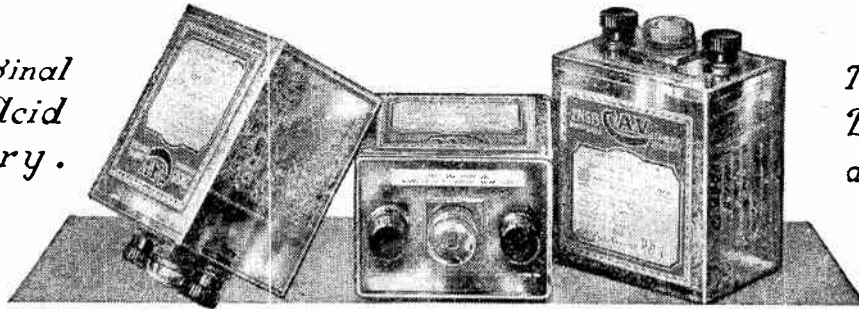
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We are exhibiting at  
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OLYMPIA (NEW HALL)  
Stand No. 120



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Jelly Acid  
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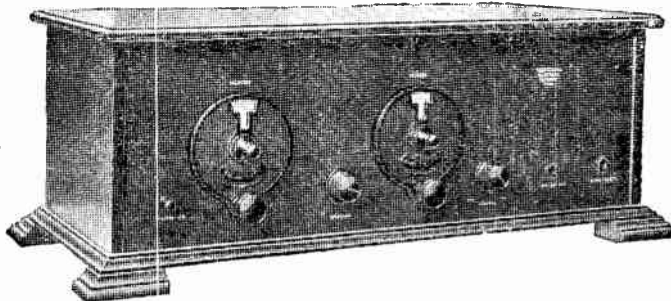
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**NATIONAL  
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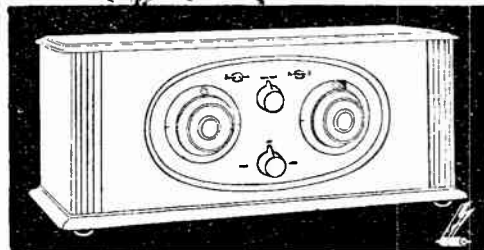
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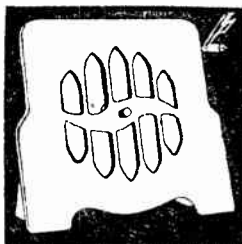


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**TEN POUNDS**  
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**THE JUNIOR CONE REPRODUCER** is a thoroughly efficient speaker, giving clear and faithful reproduction. A new Bowyer-Lowe model at a popular price.

**35/-**

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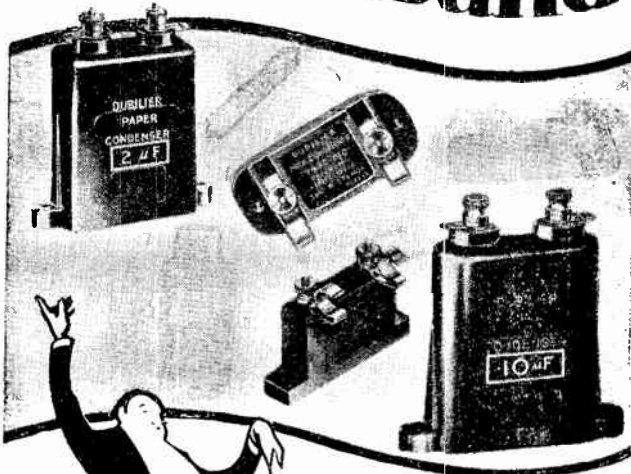
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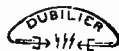
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## FIXED CONDENSERS

Free for the asking—"A Bit about a Battery." There's a copy for you at your dealer's.



Dubilier Condenser Co. (1925) Ltd., Ducon Works, Victoria Road, N. Acton, London, W.3.

Dr. 205, F

**NOW** Put it on your Panel!



Introducing

## WATES

three in one

## VOLT-AMP

### RADIO TEST METER

### PANEL MOUNTING MODEL

The meter fits on to the panel, below which is placed a bakelite disc fitted with sockets and plugs. A neat Ivorine instruction plate fits above this, detailing the exact location of the plugs, which are merely re-arranged in the coloured sockets to obtain the various readings on the three scales. This model is extremely ingenious and presents unrivalled possibilities to all set owners who have long felt the need of a "3 in 1" meter for panel mounting purposes. Meter finished in highly polished nickel. Supplied complete with plugs, sockets and discs, drilling dimensions and fitting instructions. Obtainable direct or from Halfords Stores, Currys Stores and all Radio dealers.

Illustration shows meter and discs in position on piece of ebonite. Note pleasing appearance of fitting.

- READINGS.
- 0-150 Volts.
  - 0-30 milliamps.
  - 0-6 Volts.
  - Res. 5,000 Ohms.
  - Fully guaranteed.
  - Price 13/9.

THE STANDARD WET BATTERY CO., (Dept. W.W.), 184-188, Shaftesbury Avenue, W.C.2.



M.B.

B10

Mention of "The Wireless World," when writing to advertisers, will ensure prompt attention.



**£180 IN £3 NOTES  
GIVENAWAY  
NEXT WEEK**

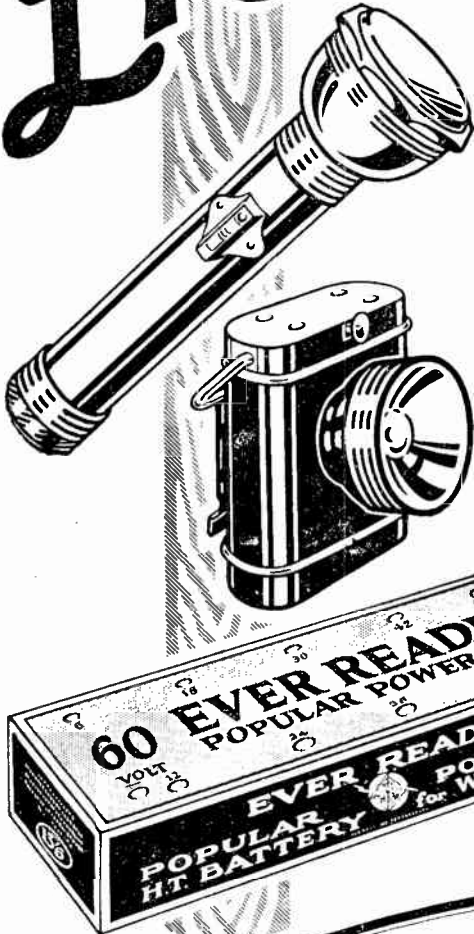
**OCTOBER 7th-12th.**

to purchasers of EVER READY Lamps and Batteries. The Ever Ready man will visit Hardware, Electrical, Photographic Stores and Garages, etc., where special displays of Ever Ready goods are made.

Brilliant illumination at the touch of a switch is provided by an EVER READY SPOT-LIGHT, ready for every emergency in the dark Winter nights.

EVER READY WIRELESS BATTERIES ensure clear, powerful reception, and give the best service at least cost.

Buy an EVER READY Lamp or Battery, you may be one of the lucky ones and receive £3 notes.



**PORTABLE SPOTLIGHTS**

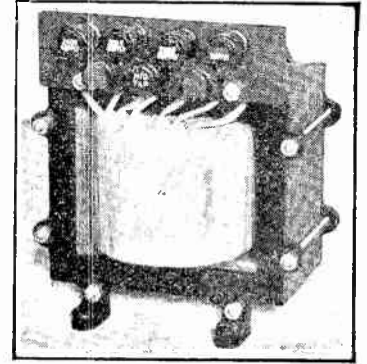
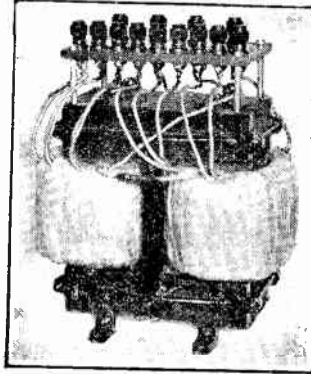
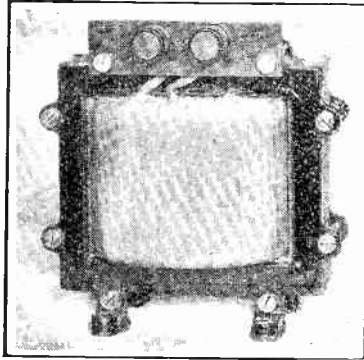
**EVER READY**

REGD TRADE MARK

**BRITAIN'S BEST BATTERIES**

**Superior A.C. POWER TRANSFORMERS**  
 and **CHOKES** for the **MAINS** from **35/-** each  
 for **ALL INPUTS** and **OUTPUTS.**

**ON VIEW STAND 292**



**SPECIAL INTERVALVE TRANSFORMERS 15/- EACH.**

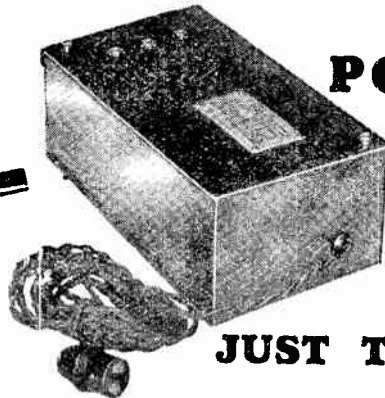
*Special Quotations for Gramophone Radio and Public Address Smoothing Chokes on application.*

**WILLIAM BAYLISS LTD.,** Sheepcote Street, **BIRMINGHAM.**  
 Telephone : Mid. 1409.      Telegrams : "Drawbench, B'ham."

**THE ELIMINATOR**

**FOR USE IN PORTABLE SETS**

**30 M/A AT 120 VOLTS**  
**20 M/A AT 150 VOLTS**



**ELLISON**  
**GUARANTEED ELIMINATOR**

**JUST THE SIZE OF AN H.T. BATTERY**

SEE THIS ELIMINATOR AT OLYMPIA, STANDS 250, 251, 274, 275, G242-245.

A.C. MODEL any voltage from 100-230v.  
 2 Tappings . . . . . £6-0-0  
 D.C. MODEL any voltage from 100-230v.  
 2 Tappings . . . . . £2-10-0

'Phone **ELLISON MANUFACTURING CO. LTD.** 4680  
**DRAGON WORKS** - - - **HARROGATE**  
 TRADE ENQUIRIES INVITED

*Mention of "The Wireless World," when writing to advertisers, will ensure prompt attention.*

What!  
 not seen them?  
 try to get through  
 the crowd on Stand 31



**5-PIN VALVEHOLDER**  
 Designed for use with the new 5-pin A<sub>C</sub> valve with centre leg. The well-known Benjamin anti-microphonic feature is incorporated, and also patented contact, which ensures perfect contact when using either solid pin or split pin valves.  
 Price 1/9d. each.

1/9 Each.



**ROTARY BATTERY SWITCH**  
 An attractive alternative to the usual Push and Pull type of Switch. All insulated, with indicating "On" and "Off" dial, pointer knob, double contact and suitable for use with panels up to 3 in. thickness.  
 Price 1/9d. each.

1/9 Each.

The continued popularity of Benjamin Valveholders, Vibroliders and Switches is proved by the past year's sales, which have exceeded all expectations, and these will be again actively sold this season.

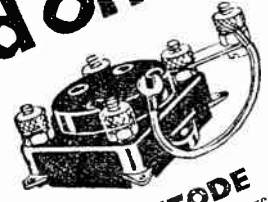
**YOU ALREADY KNOW THESE THREE**

The original CLEARER-TONE VALVEHOLDER in face of considerable low price competition has more than held its own, and will be continued at 2/- each.

The BENJAMIN VIBROLIDER was last season's most successful accessory, the self-aligning feature ensuring positive contact with all types of English 4-pin valves. Price 1/6d. each.

The popular Push and Pull double-contact Battery Switch. It's off when it's in. Price, with terminals 1/3d. each, without terminals 1s. each.

Leaflets giving full details of all the above lines will shortly be ready and will be sent on request.



**PENTODE**  
 The famous Benjamin Clearer-Tone Valveholder equipped with small attachment enabling same to be used with the pentode valve. Flexible connection is provided for attaching to the terminal on the cap of the pentode valve. Price 2/3d. each.  
 Pentode attachment only for use with existing Clearer-Tone Valveholders or Vibroliders, 3d. each.

2/3 Each.



**TURNTABLE**  
 Ball-bearing Turntable, 9 in. in diameter, brown crystalline finish. Fitted with hinged and folding legs which enable the set to be used on uneven ground, while maintaining perfect level. For indoor use, the legs can be folded up, being equipped underneath with rubber buffers, to prevent damage to furniture, etc. Price 7/6d. each.

7/6 Each.

**BENJAMIN RADIO PRODUCTS**  
 THE BENJAMIN ELECTRIC, LIMITED,  
 Brantwood Works, Tottenham, LONDON, N. 17

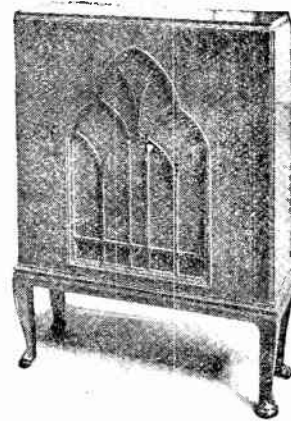


**The R.G.D. Radiogramophone.**  
 An entirely new six-valve instrument giving the highest possible quality for both radio and record, with ample volume, incorporating the latest design of moving coil speaker, operates entirely from electric mains, A.C. any voltage, or D.C. 200 volts or over. £75.0.0 in oak. £80 Mahogany.

The R.G.D. Moving Coil Loudspeaker finished in Walnut, Oak or Mahogany 2 ft. 6 ins. high 3 ft. 6 ins. wide—an exceptionally High-class Instrument for D.C. mains

£20  
 Can be supplied with equipment for A.C. mains.

Hear it at Olympia before the end of the Show, Stand 292.



**Stand 292**

**Wireless Exhibition, Olympia.**

*Literature on application.*

**The RADIO GRAMOPHONE DEVELOPMENT Co.,**  
**ST. PETER'S PLACE, BROAD ST., BIRMINGHAM.**

**YOUR "D.C.," SIR,**  
**IS ON STAND 13/14—**  
**Important developments in**



**METAL RECTIFIERS**

The construction of high-tension eliminators is now greatly simplified and cheapened by the introduction of the new units H.T.3 and H.T.4.

The prices of the H.T.1 and H.T.2 models are reduced.

Complete range of units suitable for any type of eliminator or charger will be on view.

For those who intend to buy a ready-made mains unit, we have a selection on show of those made by the leading radio manufacturers.



The Westinghouse Brake & Saxby Signal Co., Ltd.,  
 82, York Road,  
 King's Cross, London, N.1

**SEE THEM ON**  
**STAND 13/14**

and don't forget  
 to ask for your  
 copy of the new

**"All Metal Way 1930"**

32 pages of circuits and  
 indispensable notes on A.C.  
 Mains Units of all kinds.

*Mention of "The Wireless World," when writing to advertisers, will ensure prompt attention.*

EVERYTHING **The G.E.C.** ELECTRICAL  
*your guarantee*

**The VERDICT of Olympia**

**GECOPHONE**  
REGISTERED TRADE MARK

**A great Success!**

**1929-30 MODELS**  
ALL-ELECTRIC RECEIVERS  
ALL-ELECTRIC & BATTERY PORTABLES  
BATTERY RECEIVERS - LOUD SPEAKERS  
H.T. POWER UNITS - ALL-ELECTRIC AMPLIFIERS

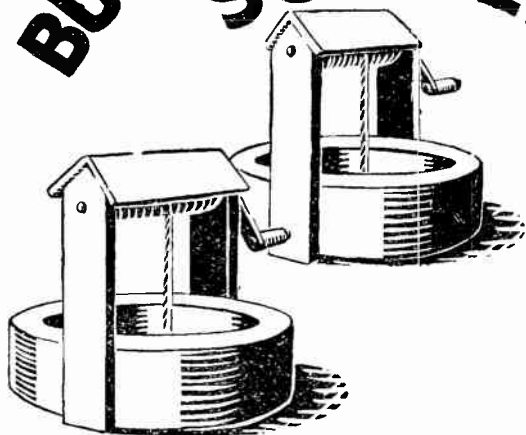
Made in England.  
Sold by all  
Wireless Dealers

**WRITE for Brochure B.C. 5201 which gives full particulars of all GECOPHONE Receivers, Loud Speakers, etc. SENT POST FREE on REQUEST**

Advt. of The General Electric Co. Ltd., Magnet House, Kingsway, London, W.C.2

B15 Advertisements for "The Wireless World" are only accepted from firms we believe to be thoroughly reliable.

**BOTH LOOK  
ALIKE  
BUT ONE DRIES  
SOONER**



Two wells, equal in diameter, their water content at the same level . . . but one is deeper. One could still be drawn upon long after the other had been exhausted.

So the new Dubilier H.T. Battery differs from all the good makes in having a materially longer working life. No other battery of equal size lasts so long. Prove this for yourself. Use a Dubilier H.T. Battery in your set now.

"A Bit about a Batter" is an interesting booklet which you can obtain free from your dealer.



**SUPERIOR (Single Capacity)**

9 v. - 1/6	66 v. (with G. B. Tappings)	7/11
63 v. - 7/6	99 v. . . . .	11/9
66 v. - 7/3	108 v. . . . .	12/9

**SUPREME (Treble Capacity)**

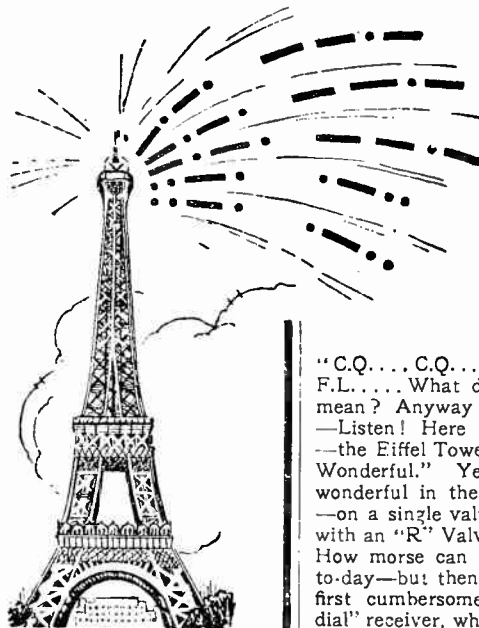
60 v. - 13/6	63 v. . . . .	14/3
	100 v. . . . .	22/-

**THE DUBILIER BATTERY**

LONGER LIFE AT LOWER COST.  
Dubilier Condenser Co. (1925) Ltd., Euscon Works, North Acton, London, W.3.

B3

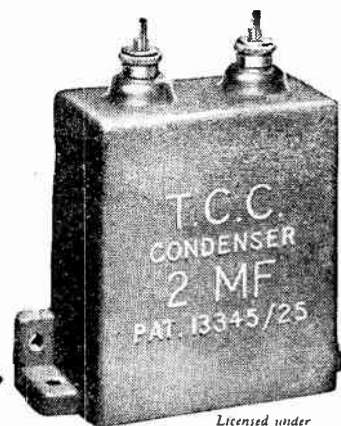
**DO YOU REMEMBER?**



"C.Q. . . . C.Q. . . . C.Q. . . . F.L. . . . What does it all mean? Anyway it's morse—Listen! Here it is again—the Eiffel Tower—Paris! Wonderful." Yes, it was wonderful in the old days—on a single valver too—with an "R" Valve at that. How morse can worry us to-day—but then, with our first cumbersome "multidial" receiver, what a thrill that splutter of sound gave us. Couldn't understand it, but still it was "wireless."

Even then T.C.C. Condensers were used in the truly wonderful gear of that time. T.C.C. Condensers have *always* been used where precision and accuracy matter. Take the tip of the old hands in radio—use T.C.C. and be safe.

Here is illustrated one of the many patterns, it is the 2 mfd. Paper Condenser, Price 3s. 10d. Other capacities from .005 to 10 mfd.



Licensed under Design Reg. No. 723,271

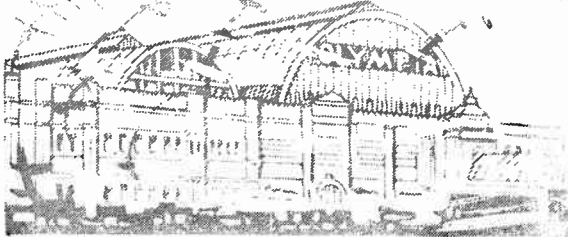
**T.C.C. CONDENSERS WERE USED THEN**

Advt. Telegraph Condenser Co., Ltd., Wales Farm Rd., N. Acton, London, W.3



Mention of "The Wireless World," when writing to advertisers, will ensure prompt attention.

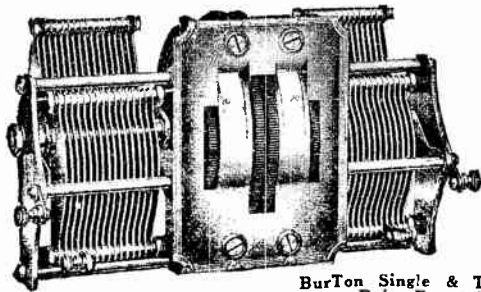
# A PHENOMENAL SUCCESS INSTANTANEOUS APPROVAL OF



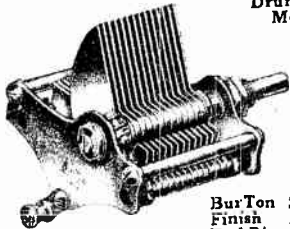
# BurTON 1929

## INTRODUCTIONS

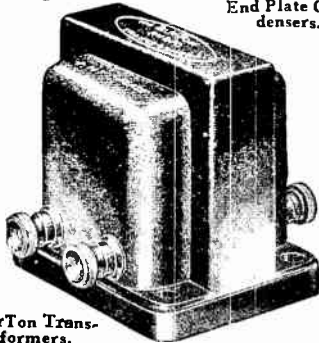
## THE ECLIPSE OF OLYMPIA



BurTON Single & Twin  
Drum Drive Fast & Slow  
Motion Condensers.



BurTON Super  
Finish Metal  
End Plate Con-  
densers.



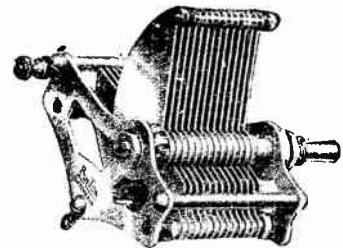
BurTON Trans-  
formers.



BurTON  
Anti-Capacity  
Switches.



BurTON Single and Binocular  
H.F. Chokes.



BurTON Mid-Log Condensers.  
Metal End Plates.

If you were unable to visit Olympia—visit your Dealer now—ask him to show you the complete range of BurTON Components, that took Olympia by storm! You will marvel at the standard of perfection attained in BurTON Components. Compare the prices with others—you will then instantly agree that others are rare that can possibly compare with BurTON Components.

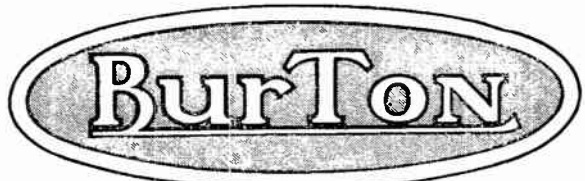
SEE THE

**BurTON EMPIRE 3-VALVE SETS!**

Battery and All Mains Models Built by BurTON.

## WITH FULL DETAILS OF

the complete range of BurTON Components, including H.F. Chokes, Transformers, Drum Drive Condensers, Anti-Capacity Switches, a new range of Metal End Plate Condensers, Six Pin Cases, Indicating Terminals, Vernier Dials, Reaction Condensers, Base Board Resistors, Panel Rheostats, Valve Holders, Metal Cabinets, Contact Switches, etc.



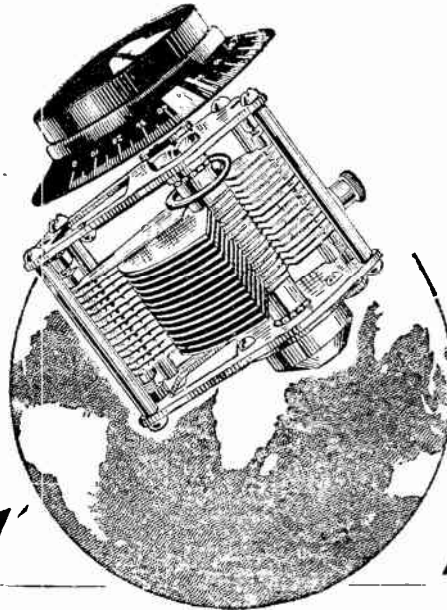
C. F. & H. BurTON, PROGRESS WORKS, WALSALL, ENG.

**SEND  
FOR OUR  
1929  
LIST**

# Turn the world your way!

The effect of placing Polar Condensers behind your panel is equivalent to turning the world round the way you want it.

The combination of Slow Motion and Direct Drive, as fitted to Polar Condensers, is the surest method of quickly bringing in those evasive stations.



## PRICES OF THE POLAR "IDEAL"

·0005	-	-	12/6
·00035	-	-	12/3
·0003	-	-	12/-

The Polar Range includes a condenser for every purpose.

Write for the New Polar Catalogue (W), in which the full range is illustrated and described.

## Polar 'Ideal'

## Condensers

WINGROVE & ROGERS, LTD.,

188-189, STRAND, LONDON, W.C.2.

Works: Polar Works, Old Swan, Liverpool.

# **B.T.H.** Tungal BATTERY CHARGER



## NEW MODELS LOWER PRICES

- New 12 amp. 75 volt Public Garage type.
- 5 amp. Full Wave type for charging Car Starter Batteries and large Radio Accumulators.
- New High and Low Tension Radio type.
- New Trickle Charger Radio type.

Write for Illustrated Folder giving full particulars and prices of complete range

THE EDISON SWAN ELECTRIC CO., LTD.,  
 Incorporating the Wiring Supplies, Lighting Engineering, Refrigeration and Radio Business of The British Thomson-Houston Co., Ltd.,  
 TUNGAR DEPT., 1a, NEWMAN ST., OXFORD ST., W.1.



# The Wireless World OLYMPIA SHOW COMPETITION

**DIRECTIONS AND RULES.**

1. Enter on the form, in the spaces provided, the names of the manufacturers and the official description of what you consider the best apparatus at the Show, based on a consideration of value at the price asked.
2. Write your name and address clearly and in ink on the entry form in the space provided, and post the completed entry form not later than Monday, October 7th, to: The Competition Editor, The Wireless World, Dorset House, Tudor Street, E.C.4.\*
3. The prizes will be awarded to the competitors who correctly forecast the outstanding single exhibit (No. 8 below), as decided by the majority of votes, and have also the largest number of correct forecasts in the other classes of apparatus.
4. No correspondence can be entered into in connection with the Competition, and the Editor will not be responsible for any entries lost in the post or otherwise. Only one entry form to be sent in by each competitor.
5. The decision of the Editor must be accepted as final on all questions arising out of this Competition

## A FIRST PRIZE OF FIFTY POUNDS IN CASH

2nd.—A voucher for the purchase of apparatus to the value of £20 from firms exhibiting at the Olympia Show.

**FREE  
ENTRY FORM**

- 3rd.—A similar voucher to the value of £15.  
4th.—A similar voucher to the value of £10.  
5th.—A similar voucher to the value of £5.

Enter your choice of the best apparatus at the Show in each of the following classes:—

DEFINITION OF CLASS.	NAME OF MANUFACTURER.	OFFICIAL DESCRIPTION OF APPARATUS.
1 Complete receiver of 5 valves or more, that is to say, receivers exclusive of loud speaker and batteries—unless these should happen to be incorporated as part of the receiver.		
2 Complete receivers of 4 valves or less, similarly defined.		
3 Batteries of all kinds, including accumulators for both high tension and low tension.		
4 Mains supply units, both D.C. and A.C., and including those which provide filament heating circuits.		
5 Loud speakers of all types.		
6 Valves.		
7 Other apparatus not classified above, also amplifiers, component parts such as transformers, condensers, tuning coils, resistances, etc., etc.		
<sup>and</sup> 8 The outstanding single exhibit at the Show, irrespective of the class to which it belongs.		

I agree to accept the rules and declare that this is the only entry form that I have completed.

NAME (In Block Letters).....

FULL ADDRESS.....

\* Visitors to Olympia may place the completed form in one of the boxes provided at the Wireless World stands Nos. 38-39.

B19 Advertisements for "The Wireless World" are only accepted from firms we believe to be thoroughly reliable.

## Wonderful Response!

A recent advertiser in "The Wireless World" writes:—

"I should like to inform you of the wonderful response to my advertisement in 'The Wireless World.' I have received no less than 20 applications for the Ferranti and Marconi Transformers and most of the other goods have been sold."

W. H. Trevett,  
60, High Street,  
Erith, Kent.

W.W.82.

## "Astounding!"

The following extract is from the letter of a recent advertiser in the Miscellaneous Columns of "The Wireless World."

"My loud-speaker was sold on the evening of the same day on which the advertisement appeared.

Many thanks to your paper: it is wonderful. The number of replies to my advertisement was *astounding.*"

Clarke Wood,  
Common Side,  
Selston,  
NOTTS.

W.W. 81.



The YOUNG ENTHUSIAST. By Mrs. Steed.  
(From the Beginners' Competition.)

## Use your camera!

NOW is the time of year when you can take pictures out-of-doors. If you would learn how to get the best results from your exposures and the greatest pleasure from your hobby—read "The Amateur Photographer" every week. It contains a mass of helpful and interesting information, together with art reproductions of pictorial photographs and free criticism of readers' prints.

EVERY WEDNESDAY 3d.

**The AMATEUR PHOTOGRAPHER**  
& CINEMATOPHIL  
Incorporating "The New Photographer."

ILIFFE & SONS LIMITED,  
Dorset House, Tudor Street,  
LONDON, E.C.4.

W.W.37.

## How to sell a Portable!

For the sale or purchase of Portable or other Receivers use the Miscellaneous Columns of "The Wireless World." A recent advertiser writes as follows:

"I am very satisfied with the results obtained. The Portable set was sold the same day, and I had over twenty other replies, including prepaid Telegrams. I also had a large number of callers, and altogether am very pleased with the pulling powers of your valuable paper."

M. A. Frost,  
54, Clerkenwell Road,  
London, E.C.1.

W.W.81.

EGYPT  
NATAL  
SOUTH AFRICA  
MALTA

## High Value!

"You will be pleased to learn that from my last advertisement in 'The Wireless World,' letters reached me from EGYPT, NATAL, SOUTH AFRICA, and goods were sold to a person residing in MALTA.

This undoubtedly proves the high value of your paper."

WILLIAM WINFIELD,  
4, ARTHUR ST.,  
HULL ROAD,  
YORK.

W.W.83

# An Entirely New M-L



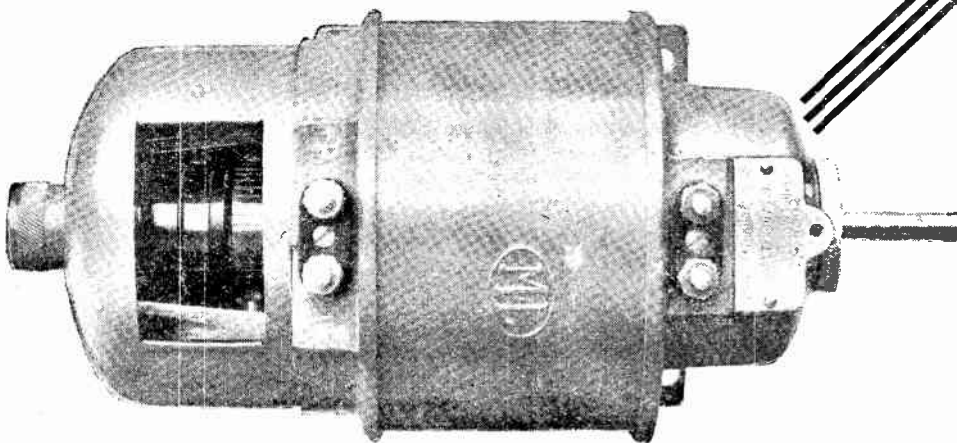
## Production :=====

For the ALL ELECTRIC RECEIVER

THE

# D.C. to A.C. Converter

Stand 292 OLYMPIA



40 WATT Model  
£13-0-0

85 WATT Model  
£19-0-0

IF YOU ARE ON D.C. MAINS  
employ the above machine  
for running your all  
**ELECTRIC RECEIVER.**

The only safe way to operate receivers  
from D.C. Mains. Suitable for well-  
known makes of Receivers.

**POWER SUPPLY UNITS our Speciality.**

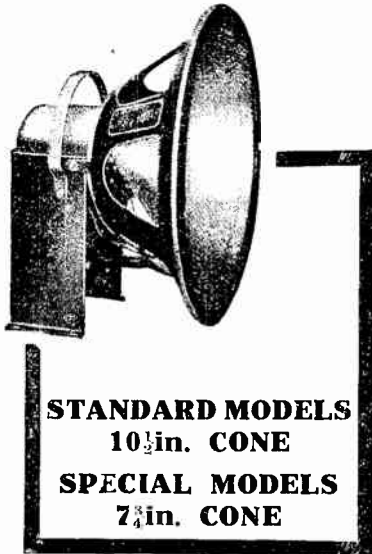


**MAGNETO SYND. Ltd., Radio Dept.,  
COVENTRY.**

Telephone: 5001.

# X-CORE The World's greatest development in Dynamic Speaker Construction

## AGAIN **MAGNAVOX** LEADS THE WAY



### Standard Models 10½ in. Cones

No. 107	110/180v. D.C.	£8.5.0
.. 103	180/300v. D.C.	£8.5.0
.. 201	6/12v. D.C.	£8
.. 401	110v.50cy A.C.	£11
.. 405	200/240v.50cy A.C.	£11

### Special Models 7½ in. Cones

No. 105	110/180v. D.C.	£6
.. 108	180/300v. D.C.	£6.7.6
.. 200	6/12v. D.C.	£6
.. 400	110v.50cy A.C.	£8.5.0
.. 404	200/240v.50cy A.C.	£8.5.0

Again leads the way with the new X-CORE dynamics. The X-CORE insures perfect alignment of the inner and outer poles and a true concentric gap in which the moving coil may vibrate. The X-CORE is secured in engagement with the main core by means of a belt running directly through its centre. The new special model with 7½ in. "LEXIDE" Cone is the World's finest Moving Coil Speaker, while the Standard model with 10½ in. "LEXIDE" Core heralds the greatest advance in dynamic power speaker construction.

Write for new right-page folder

**THE ROTHERMEL CORPORATION, Ltd.**  
24 Maddox Street, London, W.1

Phone, MAYFAIR 0578/9

# "RITHO" METAL CABINETS

The illustration above is the Metal Cabinet of the "W.W. Kit Set" described in "The Wireless World" of Sept. 18th.

WE INVITE YOU TO GET IN TOUCH WITH US.

Let Ritherdon's supply the cabinet for your set. "RITHO" Metal Cabinets are made by the most efficient metal working establishment in the country. Modern plant and modern methods enable Ritherdon's to supply the highest class of work at moderate prices.

"Ritho" Eliminator Cases and High Grade Metal Cabinets of every description in a variety of artistic finishes. Screening boxes with single or multiple compartments, containers, etc., etc.

**RITHERDON & CO., LTD.,**  
METAL WORKERS,  
NORTH BRIDGE MILLS,  
**BOLTON.**  
Tel. 1024.

### The Appearance of Your Wireless Set.

Now you have finished building that set and are proud of it why not carry your pride a step further and enclose it in a "KABILOK" cabinet?

There is a "KABILOK" cabinet to suit every receiver Radio Gramophones, also cone and moving coil loud speaker cabinets in oak or mahogany, beautifully finished in an extensive range of designs to suit your particular needs. "KABILOK" cabinets are specified for the Mullard Master Three and Master Five Portable.

A RECOGNITION OF EFFICIENCY  
Illustrated list sent free on request.

**W. & T. LOCK, Ltd.,**  
St. Peter's Works,  
BATH.  
London Showrooms: 11, Red Lion Square, High Holborn, W.C.1.

**STANDS 202 - 203 OLYMPIA**

## WIRELESS VALVE TRANSMITTERS

Price By W. James.

**9/-** net  
By Post 9/6.

A book that deals very thoroughly with the design and operation of small power apparatus.

**ILIFFE & SONS LTD.,**  
Dorset House, Tudor Street, London, E.C.4



# THE NEW H.C. CELL

*means*  
**BETTER  
 H.T.  
 SERVICE**

An entirely NEW MANUFACTURING PROCESS is employed in the construction of MAGNET Wireless Batteries. It gives a standard of battery performance hitherto non-existent and maintains smooth, effortless power for a greater length of time.

All MAGNET Batteries are fitted with super grip screw terminals.



# Magnet

## WIRELESS BATTERIES

MADE IN ENGLAND

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# The Wireless World

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Assistant Editor: F. H. HAYNES.

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## THE BATTLE OF THE GIANTS.

THE "Plan de Prague," which came into operation at the end of June last, based on decisions previously taken at the Washington Conference, made the best of a bad job, namely, an attempt to fit into a narrow broadcasting band an innumerable list of European transmitters. Many exclusive wavelengths were cut down, more common waves were created, and others were shared by two or more countries; in fact, every effort was made to satisfy most of the claimants whilst still adhering to a co-ordinated plan with a view to securing a degree of order in the ether.

From the date it was carried out the "Plan de Prague" in turn has been highly praised or ruthlessly condemned, and it would be difficult for the average listener to distant stations to express his opinion regarding the success or failure of the scheme. Are general conditions better or worse than they were a year ago? An evening spent with a highly selective wireless receiver will demonstrate that, like the proverbial curate's egg, the broadcasting band is good in parts; but the

small separation between frequencies necessitated by the narrowness of the band and the number of wavelengths to be allocated does not give sufficient elbow room, especially as on most nights some stations stray from their official positions.

For close on three months the authorities have been given an opportunity of studying the working of the scheme, and at The Hague, where a conference is being held, the matter again comes up for general discussion. For the present it is difficult to see how any improvement can be made so long as the broadcasting band remains within such narrow boundaries, and stations are as numerous as at present. The Prague Plan, in its foundation, is based on the aerial energy of the respective transmitters, at the time it was prepared. This important factor is changing rapidly and is likely to annihilate the entire scheme.

Gradually, with the evolution and development of the wireless programmes, most authorities have put forward schemes either for an increase in the number of stations to supply an extended service or, alternatively, an increase in the power of the transmissions, thus obtaining greater range. With the centralisation of activities in the respective capitals, the latter scheme has been mostly favoured, and if a short study be made of the developments which are taking place in a number of European countries, it will be found that within the last year many additional high-power transmitters have come into operation. Moreover, the constructional programmes of most foreign broadcasting concerns call for a further increase. Taking Great Britain alone, the new Brookmans Park dual transmitter will work with an energy of 30 kilowatts in the aerial; and we are promised in the future four more similar installations.

On the Continent we find proposals to endow Strasbourg with a 12-kilowatt station, and to erect a 30-kilowatt transmitter at Bordeaux. Madrid intends to use 20 kilowatts, Barcelona 10, Rome 50, Milan 20, Naples 7, Prague 60, and so on.

If it is assumed that certain individual countries will look to an increased transmitting energy as a means to rid themselves of interference both local and distant, and thus ensure a better service to their licence-holders, we may be sure this example will be followed generally, with the inevitable result that the "Plan de Prague" must fail.

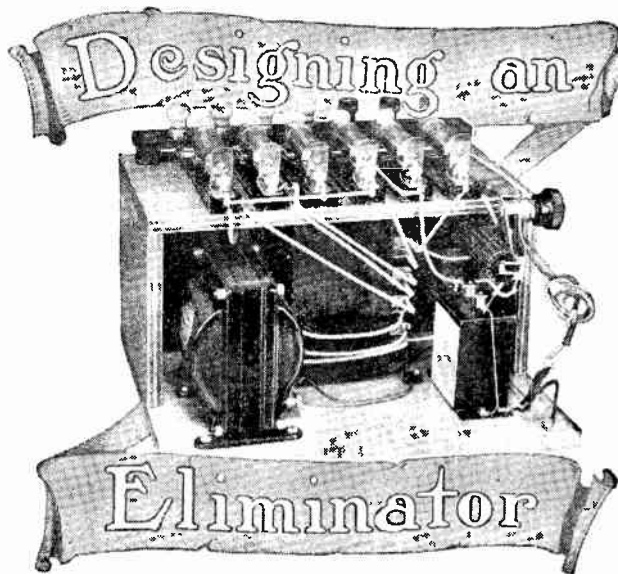
So far as can be foreseen, the near future will bring with it a Battle of Giants, an event which will benefit no individual country, but which, on the other hand, in the present limitations of the wave band, will sadly hamper broadcasting developments in Europe.

PROBABLY the largest item in the upkeep of a simple radio receiver is the high-tension battery. Notwithstanding this, there are many listeners who have electric light in their houses and who refrain from constructing an H.T. battery substitute because they fear that the calculation of the resistance values and the design of the filter to suit their sets is too complicated for them. Let it be said at once that the science of decoupling or the process for preventing unwanted couplings when two or more A.C. potentials are common to one circuit has been so thoroughly developed during the last year that H.T. eliminators can now be designed either for A.C. or D.C. in which there is no trace of motor boating, hum, distortion, or loss of amplification.

Besides the obvious advantage conferred by a mains unit of a trouble-free anode supply, there is the question of economy. It should be pointed out that a unit of electricity can be purchased from a lighting company for, say, 5d., whilst the cost of a unit obtained from high-tension batteries would be about 30s. to 40s. Thus an A.C. eliminator costing, perhaps, £5 to £6 would soon pay for itself. Another advantage is the constancy, within small limits, of the voltage of the supply mains and the fact that power valves with a more liberal anode current than that usually to be extracted from batteries can be included in a mains set without producing any noticeable increase in the quarterly lighting bill.

#### Voltage Regulation.

There are several fundamental differences between battery and mains supply. First, a change in current in the feed to any valve, when a battery is used, is not accompanied by any serious change in voltage, whereas with an eliminator, owing to the common resistance network which is always present, the voltage-current relationship is a steep slope known as the voltage-regulation curve. If, for instance, the power valve of a mains receiver is exchanged for another having double the anode current, the plate voltages on all the other valves will drop. Our aim, therefore, is to design an eliminator with the minimum common internal resistance. Secondly, if, when using a battery, we desire a voltage below the maximum (perhaps for the screen of an S.G. valve), we simply make connection to the necessary tapping, but we cannot obtain a lesser voltage than that of the mains unless we use a resistance. Here, again, a change in feed current results in a change in applied voltage. This difficulty



### Notes on Current Practice in Home-constructed H.T. Mains Units.

By W. I. G. PAGE, B.Sc.

the circuit being tuned to a frequency above about 25 cycles, otherwise hum will be heard in the loud speaker. A high-tension battery is devoid of ripple troubles, but with age will develop an appreciable internal resistance which, however, will be independent of frequency.

#### Filter Circuits.

In brief, by comparison with a battery, an eliminator has a high internal resistance producing a sloped voltage-current regulation curve, a resonant frequency, no direct means of providing a lower voltage than the mains except by voltage-dropping resistances, and sufficient common impedance to necessitate the deflection of speech currents which would otherwise cause low-frequency reaction and various forms of interruption. The filter in Fig. 2 for A.C. or D.C., used with or without one of the rectifiers of Fig. 1, is designed to be a fair compromise between cost and the ideal condition where the various difficulties are avoided. It should be noted that no potentiometer is included that is common to two or more circuits (except in the case of the feeds to two S.G. valves).

We can now discuss the relative merits of the various forms of rectifier available for H.T. mains units for A.C. The valve rectifier is cheap, but has a filament of limited life, and where the full-wave type is used a tapped transformer of rather elaborate design must be employed, having a voltage of, perhaps, 500 across the outers of the secondary. The dry copper-oxide metal rectifier, being electronic in action, has a practically everlasting life, its efficiency is about 70 per cent., and its internal resistance is lower than that of the valve, so that the voltage regulation curve is less steep. Full-wave metal oxide rectification is effected by a bridge circuit, and the transformer secondary is

is partially overcome by using separate potentiometers for all feeds of, say, 2 mA. and under, the resistance values being so chosen that the constant current passing through the potentiometer is over four times that of the feed to the valve.

Where a power valve is concerned it would be uneconomical to use a separate potentiometer; a series resistance is used in its place. Thirdly, to smooth out the ripple which is always superimposed on D.C. mains and is present in rectified A.C., it is necessary to make unstinted use of inductance and capacity, the association of which will inevitably mean resonance at some low frequency. There are certain minimum inductance and capacity values which must be exceeded to prevent



**Designing an Eliminator.—**

untapped and need have a voltage little in excess of that across the primary. The metal rectifier is rather sensitive to overload, and should always have a flash lamp fuse incorporated (fusing point between 100 and 200 mA.), and not more than 4 mfd. shunted immediately across the output, otherwise the A.C. load may be too heavy.

All rectifiers, except the voltage-doubling condenser bridge circuit, should have a reservoir condenser immediately across the output to charge up during the rise in voltage and to discharge into the load circuit during the voltage decline. With regard to the merits of half-wave and full-wave rectification, it should be stated that the former is rather cheaper where small outputs are desired, and although the rectified output is 50 cycles from a 50-cycle supply, the ear can tolerate from the average loud speaker without annoyance quite a large amplitude of ripple at this frequency. Full-wave rectification gives an output of 100 cycles from a 50-cycle supply, and less smoothing equipment is required to give the same freedom from ripple as compared with the half-wave method, but 100-cycle ripple is more audible from the loud speaker. It is thus rather a question of swings and roundabouts. For

large outputs full-wave rectification has the greatest application.

In Fig. 1 (a) and (b) full-wave and half-wave valve rectification is shown. In (c) a metal-oxide full-wave bridge is illustrated. A Westinghouse unit of this type,

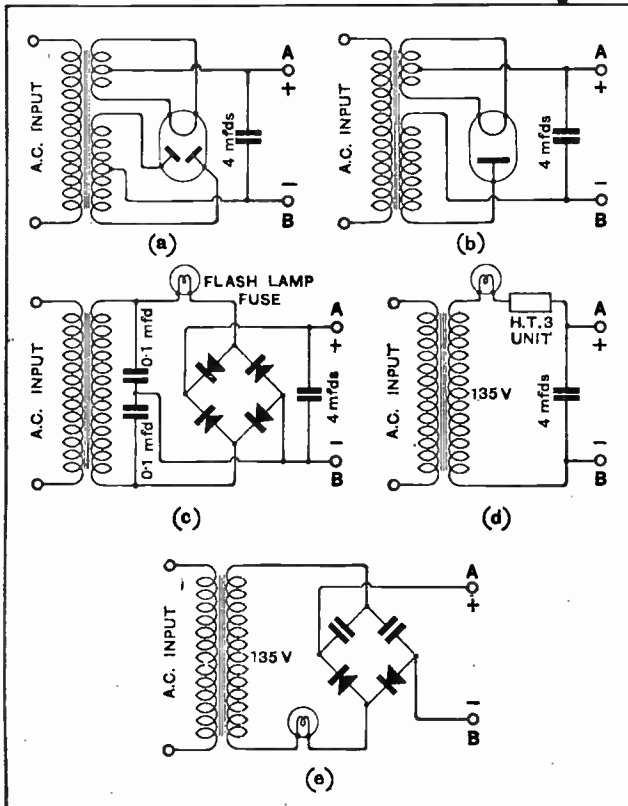


Fig. 1.—Five methods of rectification at present in use. In each case the terminals A and B are connected to a smoothing circuit such as that shown in Fig. 2. (a) Circuit for full-wave valve rectifier. (b) Half-wave valve rectifier. (c) Full-wave bridge with metal-oxide rectifier. Note the double 0.1 mfd. condenser across the transformer secondary. (d) Half-wave Westinghouse metal rectifier (H.T.3). (e) Condenser-rectifier bridge giving full-wave rectification and a voltage step-up irrespective of the transformer.

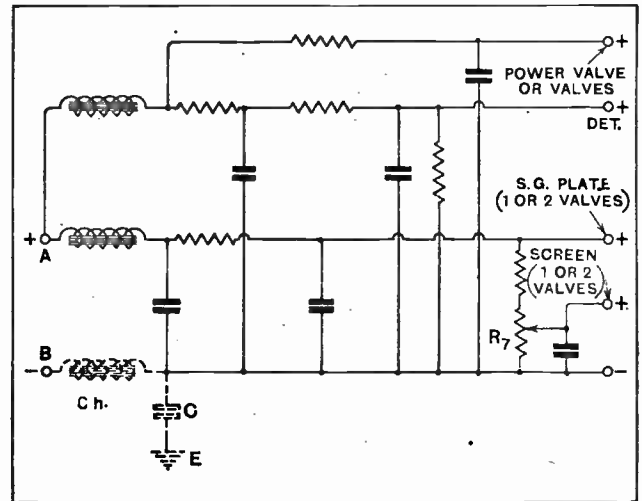


Fig. 2.—A comprehensive smoothing and voltage-dropping circuit for modern 3-, 4- and 5-valve receivers. The terminals A and B can be connected to any of the five rectifiers in Fig. 1. If a choke Ch and an earth condenser C (shown in dotted lines) be added, the above circuit becomes an efficient H.T. eliminator for D.C. mains.

known as the H.T.I., is manufactured giving the large output of 100 mA. at 200 volts, thus being suitable for moving coil speakers; note should be made of the flash lamp fuse and the centre-tapped double 0.1 mfd. condenser which will remove the last traces of hum. In (d) a Westinghouse H.T.3 half-wave unit is shown; the transformer secondary should give 135 volts and the smoothed voltage output will be 120 when the load is 20 mA.—a sufficient anode supply for most 3-valve kit sets. An interesting condenser-rectifier bridge, known as the H.T.4, is shown in (e) which gives a step-up irrespective of the transformer. With a load of 30 mA. the voltage developed is 180; with 50 mA. (the maximum permissible) the voltage is 150, both these outputs being obtained with 135 volts across the transformer secondary. This "voltage-doubling" device functions by virtue of the fact that the peak voltage charges in the condensers and the secondary voltage are additive. As explained in the inscription, the circuit of Fig. 2 can be used as a complete D.C. eliminator, while for A.C. it can be connected to any of the rectifiers of Fig. 1. Potentiometers are included where the valve current does not exceed 2 mA., and a desirable refinement for critical screen voltage control is used wherein one limb of a potentiometer consists of a continuously variable wire-wound potential divider.

The various 2 mfd. condensers can conveniently consist of a single tapped condenser block which confers the benefit of compactness, easy wiring and, last but not least, cheapness. Interchangeable clip-in resistances are used except for R, so that the anode feed may easily be changed to suit any valve.



### Our Impressions of Olympia, 1929.

THE outstanding impression carried away after a visit to Olympia has been that real progress is in evidence in almost every section of the Exhibition, and in the pages which follow we endeavour to present to the reader our views on what are the principal indications of progress made during the past year in the design and production of apparatus of all kinds. Something should also be said for the Exhibition itself, for therein, too, we have an illustration of the growing importance of the wireless industry of this country and a definite indication of its increasing stability.

The days appear to have passed when firms of mushroom growth came into the wireless industry with no experience of technical ability, but merely with the intention of making capital out of the ignorance of the general public in technical matters. To-day it is almost impossible to sell "junk" to the public, and we take considerable credit to ourselves because we believe that our efforts to distribute technical information amongst the public have contributed very largely to bring about that happy state of affairs so much in evidence at Olympia this year, where the bulk of the apparatus is above criticism technically and every stand impresses the visitor with confidence that the firm represented is a *bona fide* unit of the industry.

The Exhibition itself is larger than any Wireless Exhibition that has previously been held in this country, and the stands are more numerous; yet it is pleasing to observe that by the careful planning of the stands the organisers have been able to eliminate any impression of overcrowding in the hall. A specially constructed staircase leading from the main hall to the

gallery is an innovation which has proved a most happy addition, not only from the point of view of the general appearance but because it has tended to attract the attention of the public to the gallery.

The most important innovation this year, and one on which we heartily congratulate the Radio Manufacturers' Association, is the provision which has been made in the gallery of soundproof demonstration rooms available to exhibitors. This has given the public opportunities to hear reproduction on the spot, and we hope that if in future Exhibitions space can be provided this feature may be extended so that every exhibitor can demonstrate. But we realise that with the number of exhibitors to be accommodated it was not possible for more demonstration rooms to be provided this year at Olympia. Whilst congratulating the organisers on this arrangement, we do not feel that we can be equally enthusiastic regarding the facilities arranged and the permission granted for loud speaker demonstrations in the open on every stand. There were times when in visiting the stands and conversing with the exhibitors one felt the need for a megaphone to carry on a conversation at all. We do not want to suggest that demonstration of this kind should be cut out altogether, but perhaps some arrangement could be made next year whereby a limited number of stands are permitted to demonstrate at one time.

Before passing on to our observations on the trend of technical progress we take this opportunity of extending our congratulations to the Radio Manufacturers' Association as the organisers of what is undoubtedly the finest Radio Exhibition which has yet been held.

## TYPES OF NEW RECEIVERS

THIS has been a year of consolidation rather than of innovation. The critical visitor to Olympia finds little that is radically new, but is confirmed in the opinion that manufacturers have now completely mastered the practical application of technical developments introduced during the two preceding years—which, after all, is far more important than the adoption of novelties merely for their own sake. There has been a definite all-round improvement in quality of reproduction, sensitivity and selectivity; further, sets have been “tidied up” to such an extent that, almost without a single exception, the exhibits are entirely capable of meeting the needs of the particular type of user for whom they are designed.

It would be idle and inopportune to indulge in vain conjecture as to the developments likely to be introduced in the immediate future, and, indeed, one gains the impression that no very sweeping modification of generally accepted standard practice is anticipated. This has had an important bearing on design, as many firms have deemed it safe to embark on an extensive manufac-

turing programme; in consequence, a large number of sets, instead of being mere assemblies of components, are designed as units, or, where it is found to simplify and cheapen the production of several models, as an arrangement of two or more units. This procedure—provided that production is large enough in the matter of quantity—makes for economy, the saving being passed on to the consumer either in the form of cheaper sets or better sets at the same price.

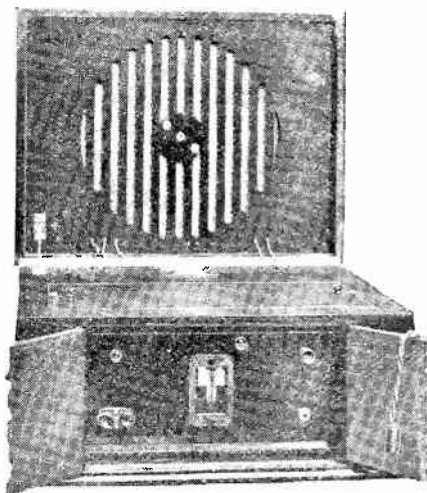
Metal lends itself admirably for use in these modern manufacturing schemes, and we find that it is applied extensively; it is almost the exception to find a receiver without a metal chassis, which generally forms part of the screening system—which, by the way, is in almost every case infinitely more thorough and effective than that of last year. From this it may be concluded that much better use is being made of the properties of the screen-grid valve.

In the matter of externals it is clear that polished wood is still the most generally used material for containers. Examples of other

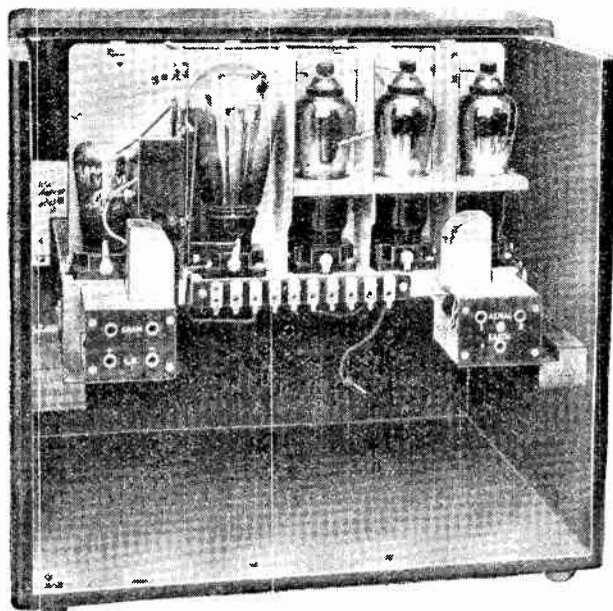
methods of construction are not lacking; the new Amplion, Cossor, and Marconiphone (type 47) sets are typical of those housed in metal cabinets, and show the wide scope in the finish that can be given. Another method is exemplified in the Ediswan and Philips (three-valve model) sets, where a leathrette covering is applied to the metal.

Tuning control is nowadays largely effected through edgewise drums, and the conventional circular dial is seldom seen.

One guesses that this is because the thumb-operated discs are considered to be more attractive to the eye and more likely to appeal to the non-technical potential user. This form



Gambrell mains transportable receiver, with frame aerial and loud speaker in lid.



Marconiphone "3-H.F." receiver, with back cover removed. Space for batteries or mains unit is provided in the base.

of control has another important advantage: we still find that complete “ganging” of condensers is but rarely attempted (the Burndopt “A.C.7” is one of the outstanding exceptions), but that the side-by-side mounting of two edgewise dials affords in a large measure the advantages of single-knob tuning. This feature is included in perhaps the majority of sets having H.F. amplification. In the Marconiphone Model 56 receiver we find an elaboration of this scheme; its four tuned circuits are permanently ganged in pairs and the two dials are mounted side by side. The Columbia five-valve set includes a similar method, but here the two sets of condensers are coupled through a slipping clutch so that they may be operated together or individually as required; this is a promising line of development.

Another minor improvement in control, found in a number of sets, is the provision of a scale arranged at a convenient angle for reading the figures.

There is a definite increase in the

**The Trend of Progress.—**

practice of calibrating directly in wavelengths, instead of on an arbitrary scale. Naturally, this feature adds appreciably to the cost of production, but it is found in some quite inexpensive sets, and seems likely to be adopted to a still greater extent in the future.

Volume control methods have not undergone any radical changes, although the provision of means whereby the aperiodic aerial coupling may be critically and continuously adjusted has points of novelty; it is included in Amplion and Marconiphone sets. With regard to devices for inclusion in the L.F. side of the set, it is observed that the anode potentiometer method is widely used.

A third form of control—that of tone—is coming into use; it is embodied in the Columbia radio-gramophone, while the "Novotone" device is built into the Gambrell instrument.

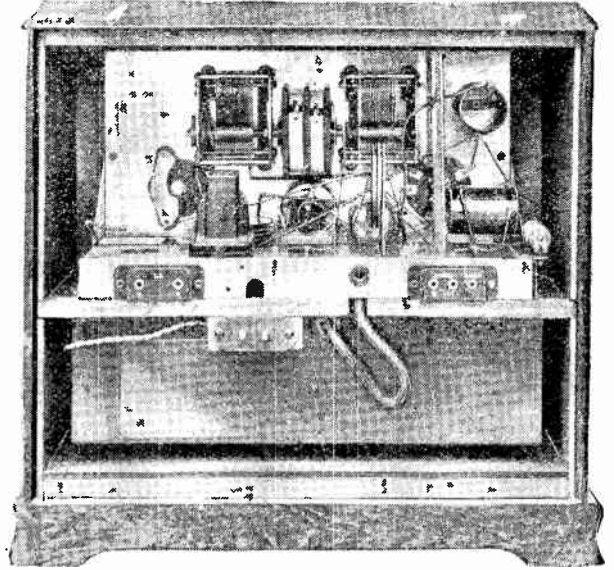
It is seldom that provision is not made for the use of a gramophone pick-up, except in the case of the simplest and least expensive type of set. As was to be expected, the radio-gramophone, complete with turntable, is one of the outstanding features of the show; each form of

reproduction is, in a sense, complementary to the other, and the many excellent examples exhibited go to prove that it is not a difficult matter to combine the best features of both in a single instrument. No attempt has been made to take a census, but it is not likely to be wide of the mark to say that the majority of radio-gramophones include a built-in frame aerial which, thanks to the ample room available in the containing cabinet, is generally of sufficiently large dimensions to be reasonably effective. In several instances frames are built into flaps hinged to the sides of the cabinet, so that they may be orientated (this method is adopted by the British Radio Gramophone Company), while it is usual to provide an external knob for rotating built-in loops. A third course is exemplified in the Igranic "A.C.3" bureau models and radio gramophones, in which non-directional frames are used.

**Mains Transportable Sets.**

It is not an exaggeration to say that the average buyer of a portable set does not choose that particular type of receiver solely on the score of its portability, but because he wishes for a completely self-contained piece of apparatus that can be moved from room to room—and very seldom, if ever, farther afield. The truth of this seems to be generally realised, and several firms have produced mains transportable receivers, complete in themselves except for a connection to the electric supply mains. One of the first examples of this type was

the R.I. All-Electric Three, which, thanks to a circuit arrangement of high efficiency, has sufficient sensitivity (though including but three valves) for average requirements without the use of any aerial. Among other interesting sets in this

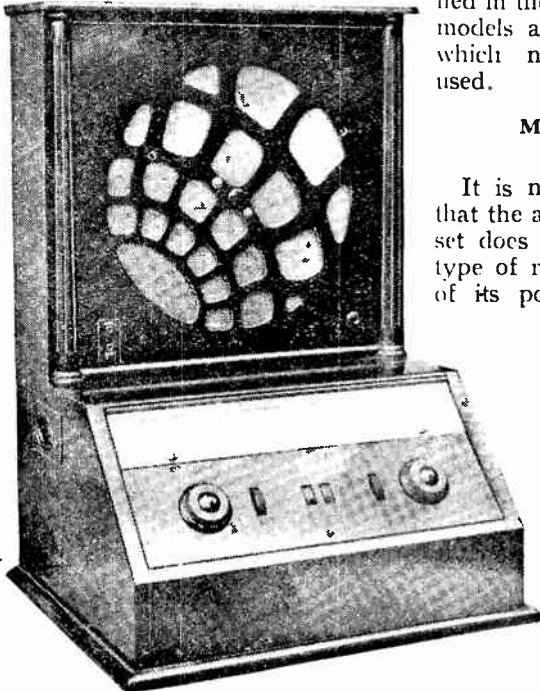


Interior of the Kolster-Brandes 3-valve mains set.

category are the Gambrell, Ediswan, and Lotus mains transportable models. The Burndept "A.C.7" and Igranic "A.C.3" (the latter in the bureau model) are representative in their two spheres of a different line of attack in designing self-contained sets; like the transportables they are complete in themselves (except for a mains connection), but are mounted in larger pedestal cabinets.

**Table Portables.**

The general tendency towards the avoidance of a number of interconnected accessories is illustrated in other directions; battery-operated self-contained sets are now being made in a form in which portability is not the first aim of the designer, who has been more concerned in evolving a set for home use. Examples of this procedure are to be seen in the G.E.C. and McMichael table models, the latter being a "home" version of the long-range portable recently reviewed in these columns. There is also a tendency towards enclosing loud-speaker and set in the same cabinet;



The evolution of the portable: the McMichael Table Model.

**The Trend of Progress.—**

for instance, the new Cossor two-valve mains receiver is supplied in this form as well as in the conventional table pattern.

It is almost certainly correct to say that the present-day "standard" receiver is an H.F.-det.-L.F. three-valve combination with a pentode either definitely specified or optional in the last position. There are but few firms who do not produce something on these lines, but there is infinite variety in details of design. Grid-circuit detection is almost exclusively used in this class of set, but anode bend is adopted in several cases, notably in the Pye No. 350 A.C. set, which includes low-loss circuits specially suitable for working in conjunction with this type of rectifier.

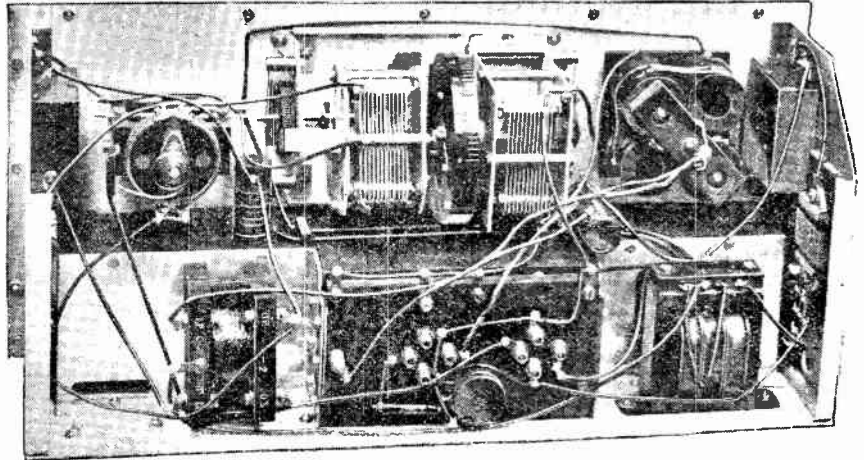
The basic three-valve circuit of the type discussed in the preceding paragraph is as popular for mains operation as for battery feed, and, thanks to the increased efficiency of indirectly heated valves, is generally quite as effective—indeed, much more effective—than the average four-valve set of a year or two ago.

Reverting to the question of detection, it is clear that the anode bend method has gained ground, but only in sets having an exceptionally efficient single H.F. stage (as the Pye No. 460), or in those with two or more H.F. stages.

There has been no great change

in the L.F. amplifier except that there seems to be an ever-increasing number of sets with a single stage. In these sets there is a tendency to increase magnification by using a high-ratio L.F. transformer, such

well as its accessories—batteries or mains unit, loud speaker, and even frame aerial—in a single container. In quite inexpensive battery sets, space for batteries is often included in the cabinet.



A modern portable set chassis: the McMichael portable.

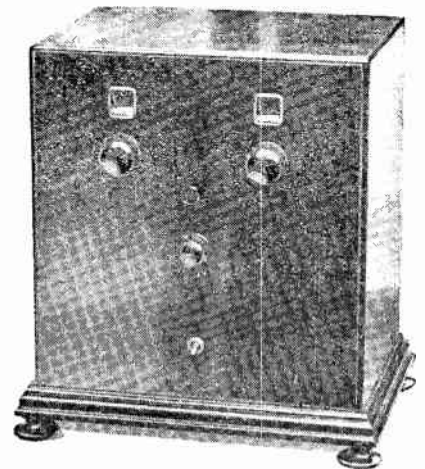
as in the new Ferranti A.C. receiver.

It is found that practically all sets of the more ambitious type include at least some measure of decoupling, and in many cases, particularly where mains feed is provided, this refinement is included in every circuit that might conceivably give rise to interaction troubles.

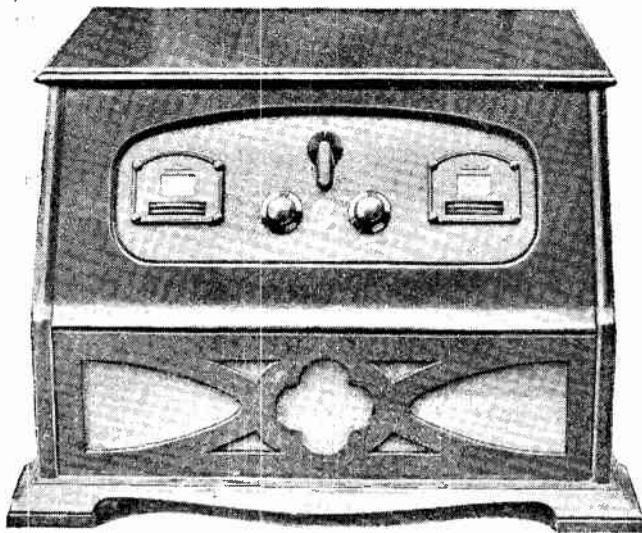
In mechanical details there has been a general all-round improvement since last year; variable condensers with inadequate bearings or switches likely to develop faulty contacts after a few months' use are hardly ever seen, and almost every set should work for years without failure of its moving parts.

It has already been suggested that the outstanding feature of present-day set design is tidiness, and to this end the tendency is to include the set proper, as

Although the general average of selectivity has been improved to such an extent that the requirements of the average user are adequately satisfied, there seems to be no determined attempt to cater for the poten-



The new Ferranti all-mains receiver.



A good example of British design and construction: the Pye No. 350 three-valve A.C. set.

tial purchaser whose letter-paper is headed, say, "Potters Bar." He is, of course, in a minority, and, commercially, can hardly be considered, although from the technical point of view it would be interesting to see what sort of comparatively simple arrangement could be devised for him.

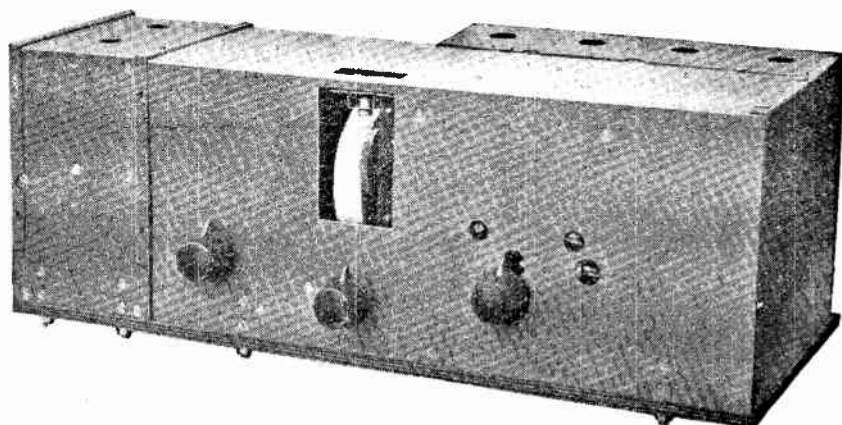
## H.F. AMPLIFICATION IN MODERN RECEIVERS

THE imminence of the regional scheme, with its twin-wave high - power transmitters, seems to have exercised a premonitory influence on the design of the high-frequency portion of this year's receivers. The need for greater selectivity that will be manifested under the new conditions is probably responsible for a general tendency to amplify more at high-frequency and less at low. Of modern

stages are substituted for one have the further great advantage of permitting less perfect screening without danger to stability, and of making it possible to gang at least two of the three tuning controls without loss of amplification. In this way the extra selectivity and the additional amplification of the second stage are made available while keeping a maximum of two tuning controls and avoiding all danger of

separate tuning control for the frame. It is interesting to note that for the complete screening of the H.F. stages tin-plate boxes are used, this material being chosen, we understand, because the seams of the boxes can readily be soldered up to provide the thorough screening that is so essential in a set of this type.

An interesting contrast in two H.F. receivers is presented by considering together a Burndept and a Philips set. In the former the whole of the amplifier is enclosed in a compact aluminium container which appears to provide almost perfect screening between successive stages. In the latter the use of toroidal coils has made possible the construction of an effective two-stage amplifier in which screening is practically non-existent, metal only being used in the form of a skeleton framework upon which the receiver is built. It seems probable that in this case any small stray couplings that may exist have been deliberately pressed into service to prevent oscillation instead of provoking it. If this guess is correct we have here an excellent example of the way in which the very limitations of factory production can be used as a help instead of a hindrance in the design of an efficient receiver. Both these receivers are completely ganged, there

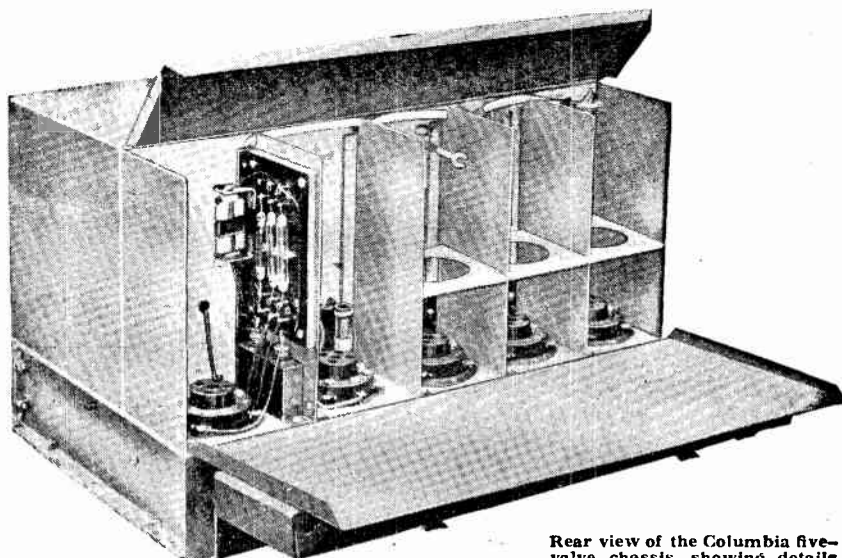


The Burndept "A.C.7" chassis removed from its cabinet. This "2-H.F." set exemplifies modern tendencies in construction and screening.

four-valve receivers, quite a fair percentage have two H.F. stages followed by an anode-bend detector feeding directly to the output valve, whereas a couple of years ago one was certain to find a single H.F. stage, of very dubious efficiency, preceding a grid detector and two L.F. stages, reaction being relied upon almost entirely for all long-range reception.

Those who hope to find receivers in which the high possibilities of the modern screen-grid valve are exploited to the utmost extent will be disappointed, for a stage-gain of two or three hundred times cannot at present be attained in any design suitable for factory production. Instead of one high-gain stage many manufacturers have wisely preferred to offer two stages of moderate gain, and have thereby provided a greater degree of amplification and better selectivity than can be had, even in the laboratory, from a single stage. The higher coil losses permissible when two

losing the side-bands of the received telephony. One of the Rees-Mace portable receivers, for example, employs two tuned stages, the two intervalve transformers being tuned by a single knob, while there is a



Rear view of the Columbia five-valve chassis, showing details of the screening system.

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being but one control knob for all three tuned circuits.

In place of the two-position wave-band switch to change over from the medium to the long waves, the Burndept receiver employs a three-way switch. By this means the range of 200-550 metres is divided into two parts, and the variation in stage gain so often noticed in passing from one end of the medium wave-band to the other is very materially lessened by avoiding the large change in L/C ratio that is otherwise inevitable in tuning over this wide range.

**Screening Materials.**

Apart from the Philips receiver just mentioned, there is noticeable a distinct tendency to use a greater amount of screening than has been customary in the past. The favourite material for the purpose is aluminium, partly owing to its lightness, and partly owing to the ease with which it can be worked. As aluminium cannot be soldered, the general custom is to make the boxes or other containers in separate sections and to build up the sections into the finished article by means of bolts. Only in cases where the compactness of the receiver, the high overall amplification, or the high efficiency of each individual stage is such as to make the most perfect screening essential are other materials preferred.

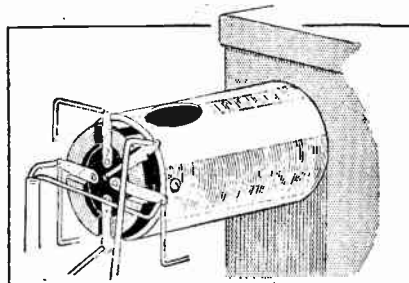
The only two receivers employing three H.F. stages both make use of what appears to be nickel-plated brass for the very perfect screening that their very high amplification demands, even in a single-stage receiver seen on the Varley stand, in which single-layer coils of thick wire are used throughout, a copper screening-box surrounds the detector grid circuit. This receiver shows a further refinement of screening, which consists of a brass tube surrounding the screen-grid valve and protecting it, as shown in the sketch, from the field of the coils. The tinfole boxes of the Rees-Mace portable have been mentioned on the previous page.

In general one may say that screening, which a few years ago bore a shame-faced air of being a last-minute addition to stabilise an

unruly set, is now so generally recognised as the prime essential of a successful high-frequency amplifier that it tends to the opposite extreme of controlling the whole lay-out of the receiver. One of the happiest examples of simultaneous design of set and screening system is undoubtedly found in the McMichael portable receiver.

The Marconiphone Co. and the Columbia Graphophone Co., the latter a newcomer to the wireless trade, both offer receivers embodying three stages of tuned high-frequency amplification. With three stages available, there is no need to make any attempt to extract the maximum amplification from each stage, so that very compact construction has been made possible. The result is a receiver in which overall selectivity should be very high indeed without danger of any loss of side-bands due to over-sharp tuning, while the overall amplification is probably better than the theoretical maximum which two stages ought, on paper, to provide. The use of astatic coils in combination with very thorough screening ensures stability, while the comparatively high losses of the coils have made it possible to reduce the tuning controls to two edgewise drums which can be rotated together with one hand. This method of attaining high amplification, though not cheap, offers a luxurious simplicity in use that cannot be surpassed by any other type of design.

The widest choice of receivers is offered in the "1-H.F." class, of

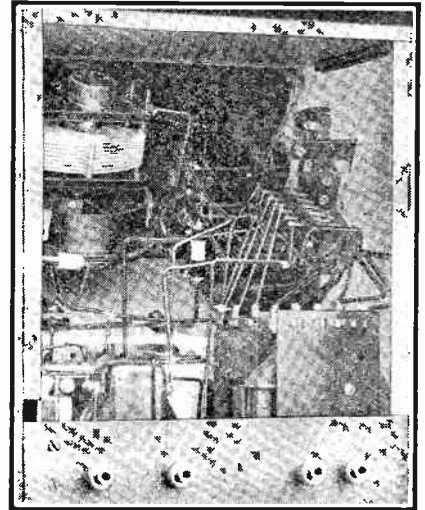


The H.F. valve of the Varley set is enclosed in a brass tube projecting from the main screening box.

which there are very many examples. The design of the coils varies very widely from set to set, but it is interesting to note that even where coils of quite high efficiency

are employed it is still considered necessary, in almost all cases, to use a grid detector aided by the use of reaction.

This suggests that the makers of



Interior of the "H.F." end of the Pye No. 350.

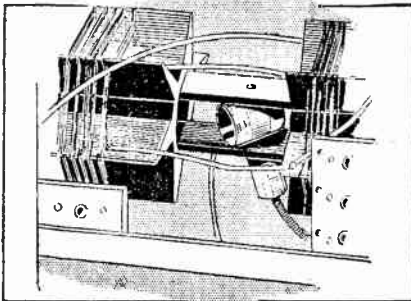
the sets are doubtful of the ability of their receivers to provide, with only two tuned circuits, the selectivity that will be needed when the Regional Scheme comes fully into operation, and may perhaps be taken to indicate that they expect their clients to follow the advice of the B.B.C. and reduce their aerials to quite small dimensions. With small aerials the selectivity of two tuned circuits may be expected to be reasonably adequate, while the incorporation of reaction will enable stations at long distances still to be received.

The Ediswan receiver contains single-layer coils for both aerial and intervalve tuning on the medium wave-band. The fact that the aerial coil is wound with stranded wire suggests that the receiver is intended either for use with quite a small aerial, or with a very loose aerial coupling, as otherwise the benefits conferred by this expensive form of winding would not be evident. It was difficult to follow out the switch wiring, but it appeared that a loading coil was used for the long waves, being shorted out on the medium wave-band. In the Pye three-valve set, on the other hand, two entirely separate high-frequency

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transformers, with a complete switch-over of all connections, have been preferred. A photograph indicates the extreme neatness of the arrangement, and shows the arm that goes through the screening-box to gang the aerial-circuit switch with the intervalve-circuit switch that is actually shown. The only definite data for stage-gain that was offered us, on any stand, referred to this receiver. The amplification for the medium-wave band is given as 96 times, with 160 times on the long-waves.

In the Ferranti three-valve receiver the coils used are wound in slots in a ribbed ebonite former as shown clearly in the sketch.

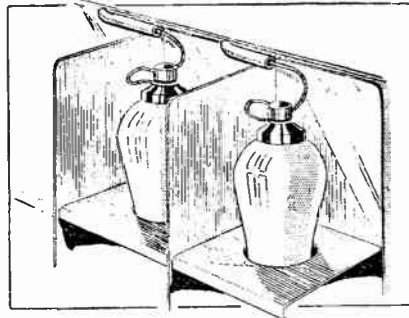


H.F. transformers in the Ferranti set, showing mounting of the reaction coil.

Readers of *The Wireless World* will hardly need to be reminded that high-frequency transformers constructed on these lines offer many valuable advantages when used with screen-grid valves.

Binocular coils do not appear to have received much attention, though they are in evidence in a

McMichael set which, with only one high-frequency stage, is recommended for use with a frame aerial. The ingenious method in which one pair of reaction coils (one coil being coupled to each half of the binocular



H.F. valve mountings in Marconiphone Model 56 set. Screening tubes are provided for the anode leads.

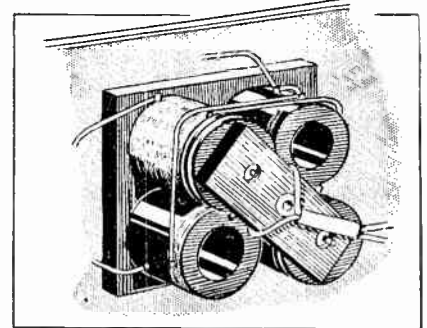
pair) is made to do duty on both wave-ranges is indicated in the accompanying sketch.

The comments so far made have been applied impartially to all sets, whether tuned anode, tuned grid, or tuned transformer circuits have been adopted. The simple tuned anode is giving place, by degrees, to its more elaborate rivals, both of which offer advantages in lessening inter-stage coupling. In the cases where transformer coupling has been adopted, it has usually been preferred for the sake of the extra selectivity that, at the cost of a small decrease on amplification, it can be made to yield. Tuned anode circuits are, on the whole, mainly to be found in receivers with but one stage of high-frequency amplification, while the decoupling advantages offered by the other two

circuits have made them the favourites where more than one stage is employed.

Untuned couplings are chiefly to be found in the portable receivers, where the use of a frame makes up for an extreme lack of selectivity in the amplifier itself. A very useful compromise, offering an increase both in signal strength and in selectivity, is found in many portables which have one tuned and one untuned stage.

Even the briefest survey of the receivers offered at this year's Show makes it very clear indeed that the bad old days when the high-frequency stages were included



Assembly of medium and long-wave binocular anode coils in the McMichael portable. Swinging reaction coils are mounted on a pivoted block.

merely as a selling point, with no real hope that they would contribute anything to the amplification of the receiver, are past and over. Though one could not say that every amplifier comes up to the standard of the best on view, there is certainly none that fails to contribute a very considerable share to the performance of the set into which it is built.

## OPERATING FROM THE MAINS

THE majority of the listening public have yet to appreciate the success which attends both long range and quality reception which has been brought about by the remarkable progress revealed during the past few months in valve manufacture. Makers of sets are emphasising the outstanding quality of reception combined with an ability to receive distant stations, coupling with these claims the merits of "all-mains" working. It is this

last observation which is responsible for the improved performance, first by the use of the new indirectly heated valves, and secondly by the facility with which the comparatively heavy H.T. demands of a generous output stage are obtained from the mains.

To the statement "mains operated" so freely announced at the stands must be added the initial letters "A.C." Whereas at last year's exhibition there were more D.C.

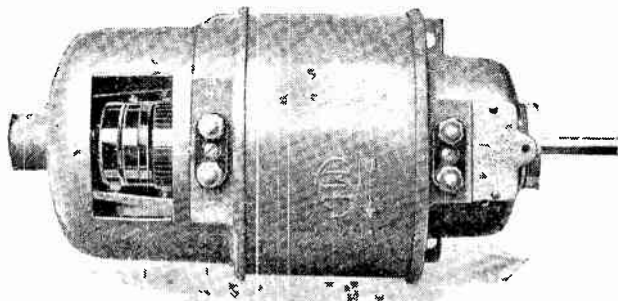
than A.C. mains-operated sets there are now comparatively few D.C. models.

With the comforting remark that the D.C. supply is shortly to be substituted by A.C. the manufacturers have shunned the problem of the D.C. mains-operated set and at the moment are congratulating themselves on having achieved the almost unexpected and outstanding results given by the A.C. equipment.



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There are exceptions among the exhibits of the mains-operated set manufacturers of previous years, where D.C. as well as A.C. sets are still to be found. On the other hand, the majority of the exhibitors of "all-mains" operated sets, such as Philips, Ferranti, Colvern, Cossor and many others, provide exclusively for A.C. supply. With the fairly reliable estimate of three to five representing the ratio of D.C. to A.C. mains supply the scarcity of D.C. equipments is significant. Had there been a mains valve taking a current appreciably less than 0.1 amp. and a potential approaching that of the normal D.C. supply voltage there is no doubt that D.C. mains equipments would have equalled in numbers those designed for A.C. supply. The listener who has D.C. supply is disappointed. Any of the A.C. mains-operated sets can, however, be used with D.C. supply with the aid of a small D.C. to A.C. rotary converter. Such a machine has been developed by the M-L Magneto Syndicate, Ltd. This machine is of the double-wound armature type and, like M-L generators, has a permanent magnet field. The A.C. output is 40 watts.



Small M-L alternating current generator, permitting the use of A.C. mains receivers with D.C. supply.

Another machine of interest to those with D.C. supply is one arranged to step-up the mains voltage to 500, thus affording a solution to the problem of operating generous output valves with a modest mains potential.

In design, the A.C. mains-operated sets possess little novelty. A transformer produces the potentials required for a metal or valve rectifier, heater current for the indirectly heated valves, as well as A.C. filament current for an output valve;

while in some instances an additional potential is provided for a grid biasing rectifier. It is the exception rather than the rule to fix the available anode potential at a maximum of 150 volts, as was the case last season. Rectified potentials of 250 volts are common, brought about by the use of such output valves as the P.625, P.625A, and the P.T.625, while in more than one receiver of the popular class the anode potential approaches 300 volts to suit the new pentode valve, the P.M.24A. An even division roughly exists in the sets shown between the use of metal and valve rectifiers.

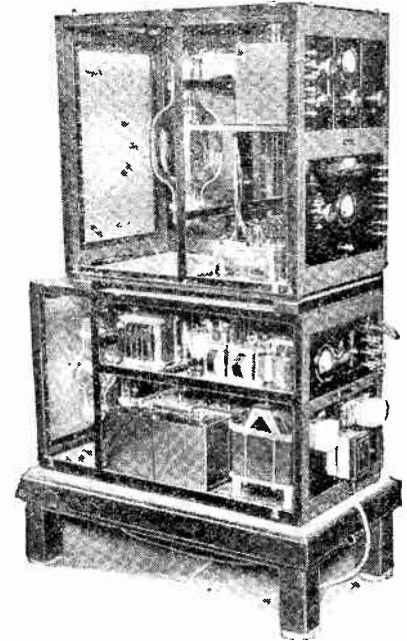
**Grid Biasing Methods.**

Examples of the three common methods of obtaining grid biasing in the A.C. mains-operated set are to be found. In order of popularity these are: (1) "free" grid bias produced by a voltage across a resistance which is traversed by the anode current; (2) a separate rectifier, and (3) the use of a potential divider across the H.T. supply. The first is favoured because of its small cost and its freedom from the complications of unwanted couplings. Like the potentiometer arrangement, this method results in a reduction of the maxi-

imum anode voltage, grid bias being obtained by robbing the H.T. potential. The potential thus taken is not accompanied by the drawing of a supply of current that is made available by the high voltage rectifier. Method (2) is in-

variably carried into effect by the use of the special Westinghouse rectifier produced for the purpose. The merit of this arrangement is complete separation of grid and anode circuits. The potential divided method (3) is only adopted when the various anode potentials required in the receiver are produced by means of a potentiometer. This third method is, where necessary, associated with the use of feed resistances to avoid couplings between the several valve stages. Several of the A.C.

mains-operated sets are fitted with grid biasing cells. It is the low cost of the grid cell as compared with other biasing devices that accounts for its continued use. The inclusion of cells in mains-operated receivers is to be deprecated, on the grounds that a loss of voltage is only discovered in consequence of a falling-



Complete mains-operated speech amplifier for public address purposes developed by Partridge and Mee.

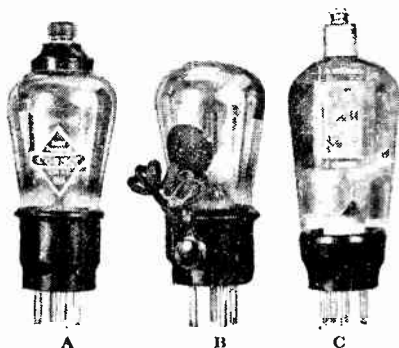
off in performance. When this point is reached the valves will almost certainly have suffered damage by being operated at the full anode potential maintained by the eliminator.

A departure from the established practice of last season, when manufacturers were opposed to the use in home equipments of voltages much in excess of 200, is the provision in several sets in the radio-gramophone class of anode potentials of the order of 500 volts. These outfits are, of course, essentially designed for hotel and cinema work. A notable change among the large mains-operated installations for public address purposes is the substitution of a single high-powered valve in the place of a parallel-connected group. It is invariably the practice to build a high voltage rectifier associated exclusively with the output stage when the speech output exceeds more than a few watts.

## VALVES OF TO-DAY

PROGRESS in receiver design is almost entirely dependent upon valve development, as witness the abundance of all-mains receivers at Olympia this year—an advance following close on the heels of the A.C. valve which has only lately been generally obtainable from the group of well-known valve makers. Valves with indirectly heated cathodes have suffered from a serious defect—namely, grid emission—but a cure has been found and applied, with the result that this year is being known as an “all-mains year,” so quickly does receiver technique respond to the influence of the valve.

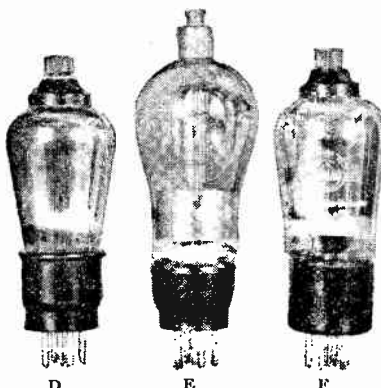
Last year saw the introduction of the pentode, which has now consolidated its position and is to be found fitted as standard in many sets, especially portables, where space considerations demand the minimum number of valves and couplings. There are many new pentodes available, amongst them a type capable of enormous output when using 300 volts H.T. and having a filament suitable for direct A.C. heating. Hitherto the low maximum permissible anode voltage somewhat restricted the output, and incidentally the input of the pentode.



Three typical battery-fed screen-grid valves. (A) Mazda 215 S.G. The anode-grid capacity is  $0.005\mu\text{F}$ ; a stage gain of about 150 is possible (unneutralised). (B) Cleartron S.G. valve with anode terminal in base and press-button connection. (C) Cossor 220 S.G.

Screen-grid valves for battery heating have been improved to such a degree that it is now possible to make the definite statement that, with a simple coupling, a stable amplification is obtainable up to four

times that possible with the best neutralised three-electrode valve. The demise of the latter is, therefore, complete. The universal adoption of the screened valve where H.F. amplification is used not only makes for considerably greater stage gain, but there is also the advantage of simple waveband switching and the application of reaction without aerial radiation.



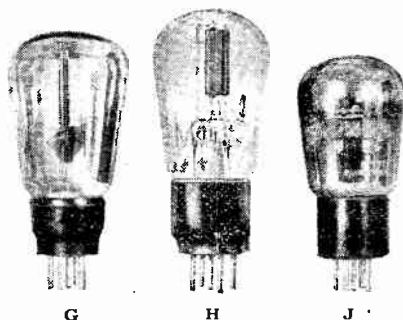
Indirectly heated screen-grid valves for A.C. mains. (D) Cossor MSG41 with a slope of 2 mA./volt. (E) Mazda AC/SG with which the remarkable stage amplification of about 250 (unneutralised) can be attained. The inter-electrode capacity is  $0.0045\mu\text{F}$ . (F) Mullard S4V with an amplification factor of 1000.

Perhaps the most striking addition to the enormous range of valves now available is the series of indirectly heated screen-grid valves with remarkable constants. There are four such valves at the moment on the market with which a simple coupling coil can be used and stable amplifications up to nearly 250 times, or about six times that of the best possible neutralised triode, are possible. Before discussing specific cases of valve design, tribute must be paid to those manufacturers who have developed the 2-volt three-electrode valve, so that its characteristics for a given filament wattage are as good as, and in some cases better than, those of similar 6-volt valves. Reference is here made to the new 2-volt battery valves with mutual conductances approaching 4 mA. per volt—a great achievement.

It is understood that the popularity of 2-volt valves in general is such that their output from at least one well-known factory is consider-

ably greater than all other types put together. This can be accounted for by the big demand for such valves for portable receivers and for home sets where the L.T. accumulator has to be carried to the charging station. Little advance appears to have been made with directly heated A.C. valves with fat, short filaments for A.C. potentials below 1 volt. They may confer the slight advantage of easier wiring, but there appears to be no directly heated model which has not got an indirectly heated counterpart with substantially better characteristics, and there is no advantage in price. There is a welcome standardisation of valve bases and holders for all A.C. valves, the fifth contact being centrally disposed on the base. It is understood that all pentodes will fall into line with this arrangement in due course; at present there are only one or two to be found without a side terminal.

Referring again to A.C. valves with independently heated cathodes, it has apparently needed a great deal of research to combat the evil of emission taking place from the control grid—a condition which is worse in its effect in a receiver than the copious flow of grid current. It is almost impossible to prevent the



Indirectly heated triodes. (G) Mazda AC/11L with a slope of 2.6 mA./volt. (H) Marconi MH4 valve. (J) Mullard 354V with an amplification factor of 35 and a slope of 2.5 mA./volt.

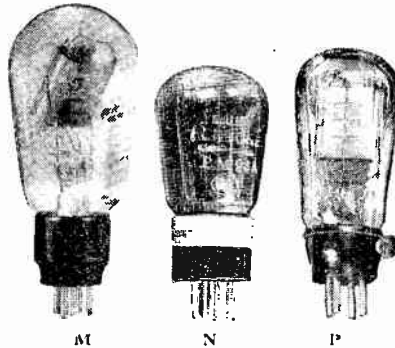
coating of the cathode from finding its way to the grid, but the problem of avoiding a sufficient temperature rise to prevent the grid from emitting has been tackled particularly by the Metro-Vick research department, and the fruits of their labour are

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evident in the present range of Mazda A.C. valves. In the first place, instead of a separate heater and insulator, the heater is dipped into porcelain "slip" so as to be coated with an adherent insulator. This produces a cathode of small diameter and considerable length, resulting in the watts dissipation per cm. being small, thus maintaining a cool grid. To allow for any small heat radiation from the grid, a number of A.C. valves also have open or ventilated anodes.

Where lighting mains are available, there is a great advantage in using A.C. valves, not only because of the cheaper and constant voltage supply, but also for the reason that, compared with battery valves, a

necessary characteristics for an anode bend detector, and will accept up to about 25 volts grid swing



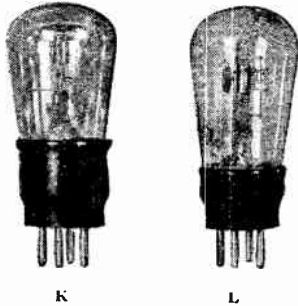
Typical pentodes. (M) Osram PT 625 for anode voltages up to 250. (N) Mullard PM24A for 300 volts H.T. (P) Mazda 230-Pen. The outer grid is connected to the control grid as a safeguard.

when the high-tension voltage is 200. With an A.C. resistance of 8,000 ohms and an amplification factor of 16 it would be permissible to link such a detector to an L.F. transformer of high primary inductance. The ML4 is a power output valve with a slope of 2 capable of accepting about 45 volts grid swing with 200 volts H.T.

Of the Mullard A.C. valves, mention should be made of the 164V, which has the characteristics of the well-known steep slope "D" valves, but an even better mutual conductance of 2.4 mA./volt. The

power output valve of this series—the 104V—has the remarkable slope of 3.5 and an A.C. resistance of 2,850 ohms. There are no fewer than five Cossor A.C. valves (other than the S.G. valve for A.C.) having A.C. resistances from 2,000 to 20,000 ohms.

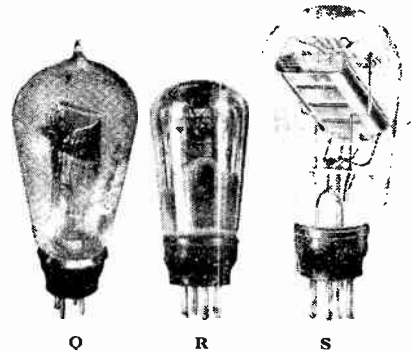
As for screen-grid valves, about a year ago it was not possible to obtain a stage amplification greater than about 80 before instability set in, however perfect the screening in the receiver might have been. By a careful investigation of the effect of two screening grids in cascade or by using a cross-mesh screen, it has been found possible during the last year to reduce the interelectrode capacity to the extremely low figure of 0.0045 micromicrofarads, allow-



Directly heated A.C. valves. (K) Osram D8. A special detector consuming 1.6 amps. at 0.8 volt. (L) Cossor 82.MD.

better mutual conductance and hence performance can be obtained. The A.C. valve does not suffer from a potential gradient down the filament, as it has an equipotential surface and there is no field around it tending to restrict electron flow.

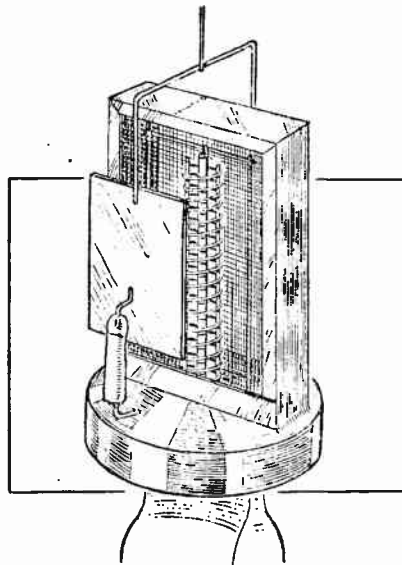
Including the four A.C. screened valves already referred to, there are at present about nineteen indirectly heated valves marketed. The Mazda AC/HL is an improved AC/G with an A.C. resistance of 13,500 ohms and an amplification factor of 35; the AC/P has a mutual conductance of 3.75 mA./volt and an A.C. resistance of 2,650 ohms, while the AC/P1 is a super-power output valve having the high amplification factor of 5 and an A.C. resistance of 2,000 ohms, and is capable of delivering at 200 volts H.T. 1 watt of undistorted A.C. output. This is accepted as being adequate for a moving-coil loud speaker for any ordinary domestic purpose. The Marconi and Osram MHL4 has the



Power output valves. (Q) Osram LS6A giving a very large power output. (R) Mazda P.240; a 2-volt battery valve with the remarkable slope of 3.7 mA./volt. (S) Marconi PX4; a new 4-volt power valve.

ing single-stage amplifications up to 250 with stability and without neutralisation. The Mazda 215 S.G., the AC/SG, and the Marconi and Osram MS4, have capacities of about the figure mentioned. With low-loss circuits it is the valve capacity which limits the amplification possible before oscillation commences. As an example let us take the Mazda 215 S.G. with a capacity of 0.005  $\mu\mu\text{F}$ ; the maximum attainable amplification (unneutralised) is about 150; if the capacity had been 0.05  $\mu\mu\text{F}$ —a figure not unknown quite a short time ago—the maximum amplification would be 60, or hardly any more than that of the much cheaper triode.

A very controversial point now arises. With such meticulous care to avoid the very minutest loss due to valve capacity, it would seem incongruous with valves for H.F. cir-



The electrode disposition in the Marconi M.S.4—the S.G. valve for A.C. mains. The interelectrode capacity has been reduced to 0.0045  $\mu\mu\text{F}$  by the use of a cross-mesh screening grid. A stage amplification of nearly 200 with stability is possible (unneutralised).

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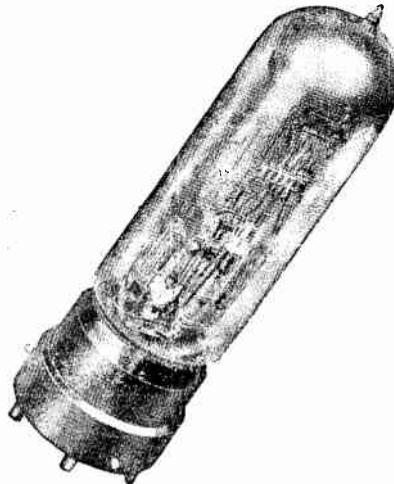
circuits to use an ordinary valve base and valve holder, which together add a minimum of about 500,000 ohms (at 300 metres) in shunt with the dynamic resistance of the tuned circuit. If the latter is of the Litz low-loss type with a dynamic resistance of possibly 300,000 ohms, as soon as the valve and holder are put in circuit the impedance drops to 188,000 ohms, or a little over half its original value. A decapped valve acts as a shunt of about 5 megohms and has a negligible effect. Will a new method of mounting valves for H.F. circuits be seen during the coming year?

With regard to special detectors, beyond the indirectly heated "D" valves there does not appear to be any newcomer. A screened valve with an A.C. resistance not above 20,000 ohms would find a large field of application for aperiodic coupling in portable sets and for anode bend detection.

Readers may have been wondering why with each new range of valves the leaky grid detector of the series becomes more sensitive. This method of detection depends upon the bend in the grid current curve, which is bound up with the question of emission velocity from the filament. In its turn this is affected by the working temperature, and herein lies the explanation. Successive oxide-coating processes have resulted in lower and lower filament temperatures, and if one of the new

valves be compared with a former type—each having the same A.C. resistance and amplification factor—the greater sensitivity of the new valve with the lower working temperature will be most marked.

There is an abundance of pentodes this season. In spite of the theoretical disadvantage of disparity



Loewe multiple valve (triple) containing detector with contact for reaction and two resistance-coupled L.F. stages.

of impedance relationship between loud speaker and valve, the results obtained without any output coupling device are often very brilliant and pleasing, this effect being probably due to the pentode and loud speaker combination having a greater response to the high notes which may have easily been sup-

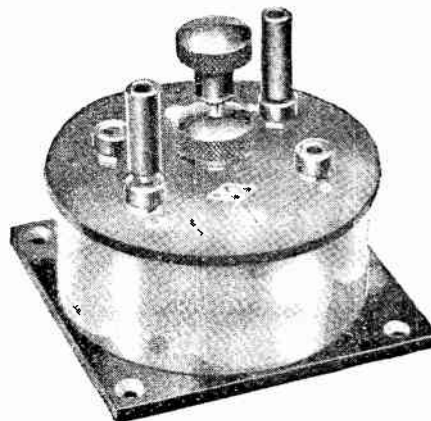
pressed earlier in the receiver. Pentodes suffer from the disadvantage of running into anode distortion before the available grid base is used; in this connection a welcome addition to the range is the Mullard P.M.24A for use with 300 volts on the anode and 200 volts on the auxiliary grid. Very large power outputs are possible before anode curvature distortion starts. The new Mazda pentodes (230-Pen and 425-Pen) contain an outer third grid which is connected to the control grid and not to the filament in the conventional way. In the event of the outer grid touching the anode, all the valves in the receiver are saved from destruction. Particularly efficient are the new Marconi and Osram pentodes with 2-, 4- and 6-volt filaments having slopes ranging from 1.65 to 2. The 6-volt member—the PT625—will deliver a very large undistorted output with 15 volts negative bias, 250 volts on the anode, and a maximum of 200 volts on the screen-grid.

Mutual conductance which is synonymous with a figure of merit for L.F. valves has been improved considerably; the Mullard P.M.256, for instance, has a conductance of 3.25 mA. per volt, the figure for the Marconi and Osram P.625 is 2.5, and those for the new 2-volt Mazda output valves—the P.220 and P.240—3.4 and 3.7 respectively. Thus there is now little need for more than one valve between the detector and the loud speaker.

## ACCESSORIES OF INTEREST

**U**NDER this heading we may include all those pieces of apparatus, such as loud speakers, batteries, and gramophone pick-ups, which may be considered as external adjuncts to the receiving set proper. While they do not rank as components in the same sense as condensers and valves, they are none the less essential to the completion of any wireless equipment.

The manufacture of accumulator batteries had reached the stable state long before the advent of broadcasting, and one does not expect to find in this quarter any changes of a revolutionary character. Of the



B. & J. rejector unit with Litz-wound coils.

numerous types of battery produced specially for radio work, the greatest activity would appear to be among unspillable cells for portable sets and large-capacity "mass" type cells for sets using the popular 2-volt series of valves.

In spite of the enormous increase in mains-operated sets, the dry cell H.T. battery continues to hold its own. The fact that a firm of long experience in the wireless industry is marketing H.T. batteries as a new line this year may be taken as an indication that this much maligned but none the less convenient source of H.T. will survive for many years to

**The Trend of Progress.—**

come. The demands of the portable set and of people living in remote country districts are sufficient to ensure this.

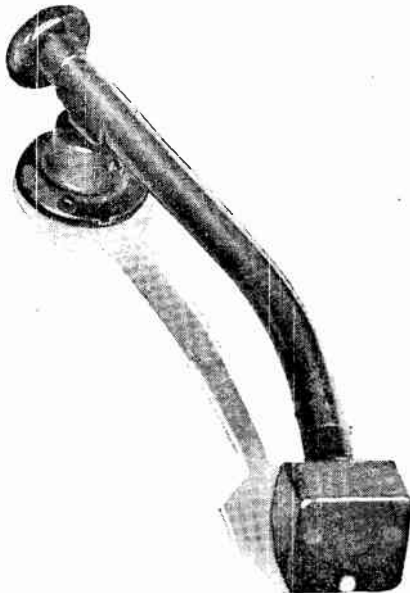
In view of the immediate necessity of improving the selectivity of out-of-date receivers to cope with the new Regional station, one might have expected to see more rejectors and

suggestions put forward in a recent B.B.C. pamphlet on the subject of selectivity.



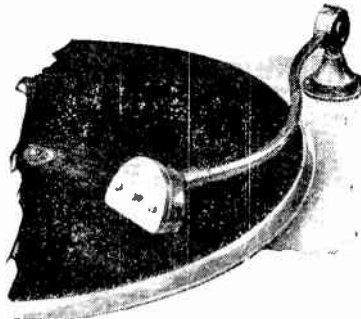
Lissen needle armature pick-up and moulded tone arm.

Gramophone attachments for the electrical reproduction of records are among the most important accessories of the modern radio receiver. This year we are able to report a very marked advance in the design of electrical pick-ups, not only as regards frequency characteristics, but also in the matter of record wear and needle track alignment. In all the leading makes the pick-up is mounted at an angle with the tone arm. By fixing this angle in relation to the length of the tone arm and the position of the tone arm pivot, it has been



The new Marconiphone pick-up and tone arm.

selectivity units for attachment between the aerial and the set. With one or two notable exceptions, manufacturers in general do not seem to be alive to a demand which is likely to be felt during the next few weeks for accessories of this type. The few rejector units on view, however, are well designed, and in most cases are wound with Litz wire to ensure a high value of H.F. current in the closed circuit. It is interesting to note that the New London Electron Works, Ltd., are marketing a 50ft. length of aerial wire in accordance with the



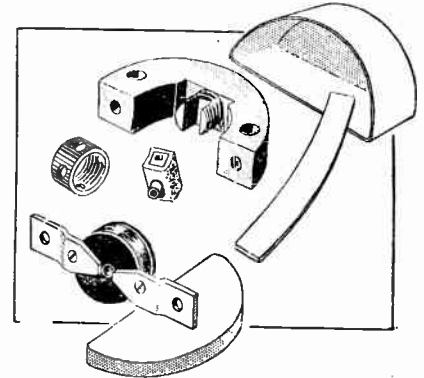
Burndept needle armature pick-up and tone arm.

found possible to reduce tracking errors to within 2 or 3 per cent.<sup>1</sup> The improved tracking in conjunction with a general lightening of the moving parts and a reduction in the degree of damping, have reduced

<sup>1</sup> See *The Wireless World*, August 7th, 1929, p. 132.

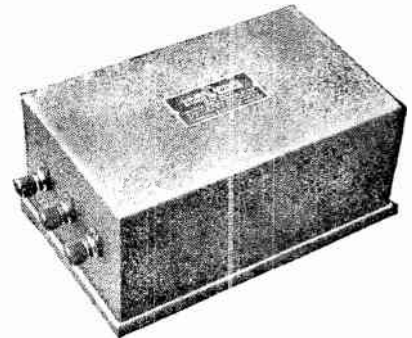
record wear almost to vanishing point. Tests have proved that with modern pick-ups it is possible to play a record more than two hundred times before the first traces of wear are apparent, while the useful life in practice is considerably more than this.

The influence of the standard frequency records recently issued by the Gramophone Co., Ltd., is to be observed throughout the Exhibition.



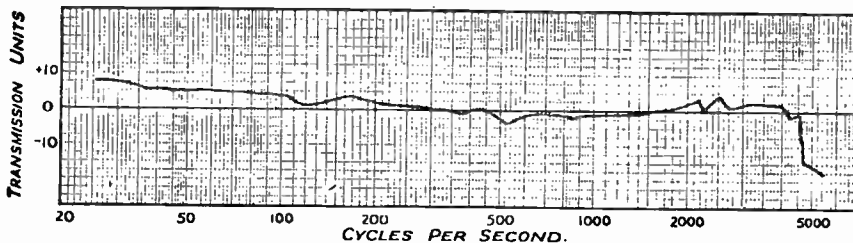
Component parts of the Burndept pick-up.

Even if frequency characteristics are not published there is evidence that all the leading makers are using these records in their design departments, and that empirical methods of development are giving place to exact measurement. One of the first conclusions to be forced on the notice of designers is that the mass of the reed or armature has, in the past,



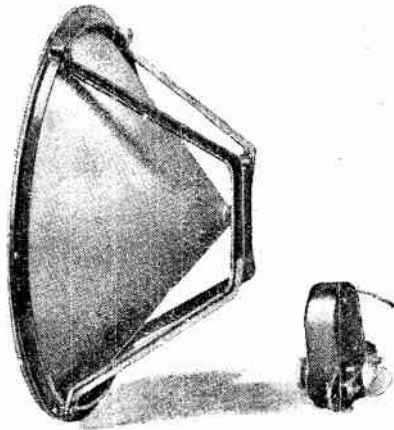
Gambrell "Novotone" tone correction unit.

been far too great, with the result that a nasty resonance has appeared within the range of fundamental frequencies used in speech and music. Consequently, we find this year that the successful pick-ups employ reeds



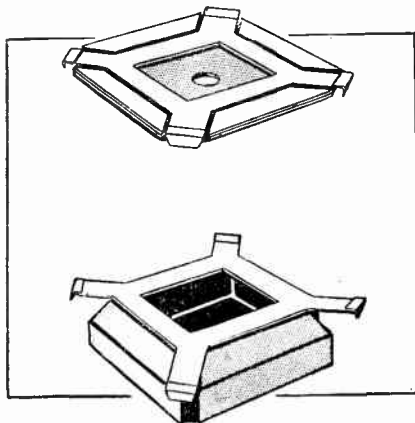
Characteristic of the new Marconiphone pick-up.

**The Trend of Progress.**— of microscopic dimensions; the modern pick-up and its moving parts are now reduced to the scale of a wrist-watch.



Brown "Vee" unit and cone chassis.

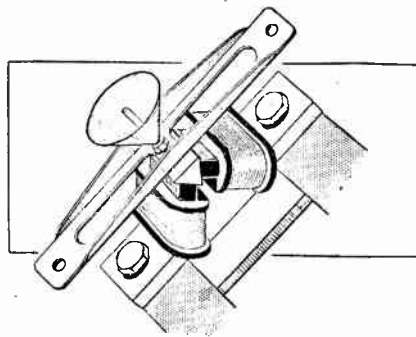
The new Burndept "Needle Armature" pick-up is illustrative of the trend of pick-up design. Its small dimensions and graceful design may be judged from the accompanying photograph. The needle itself forms the armature and carries the magnetic flux; there is no moving part other than the small clamping screw and boss. The output is comparatively small, but the frequency characteristic is practically perfect and does not show more than a two-decimal variation between 125 and 6,000 cycles. Below 125 cycles there is an increase in the output to compensate for the restriction in amplitude of the low notes on the record.



Baker "Selhurst" parallel action centring device.

The Lissen pick-up also works on this principle, but dispenses with the set screw. The needle is embedded in a block of rubber, from which it can be easily withdrawn and replaced. The general level of output is of the order of 0.4 volt R.M.S.

Finally, there is the new Marconi-phonc pick-up, in which an excellent frequency characteristic has been achieved without dispensing with an armature, though this has been reduced to exceedingly small dimensions. It is significant that this pick-up has been developed in conjunction with the Gramophone Co., Ltd., and is one of the first products of the amalgamation. Obviously no one is in a better position to know the type of characteristic required in a pick-up than the makers of the records, and it is safe to assume that the characteristics of this pick-up may be taken as a standard for comparison.



Sketch showing the principle of the Brown "Vee" unit.

While on the subject of gramophone accessories, mention should be made of the "Novotone" filter unit. This instrument is connected between the pick-up and the amplifier, and, while compensating for high- and low-note loss, also raises the general level of the voltage output from the pick-up by about four times. A good modern pick-up does not require any correcting device, but the same cannot be said of the overall characteristics of an electric gramophone including the amplifier and loud speaker. The fact is that the "Novotone" does effect a remarkable improvement, which has been convincingly demonstrated.

No new principle in loud speaker design has appeared in practical form. The field is still divided between the moving coil and balanced

armature types, and numerous detail refinements are evident. The general trend is towards the production of "chassis" units ready for assembly

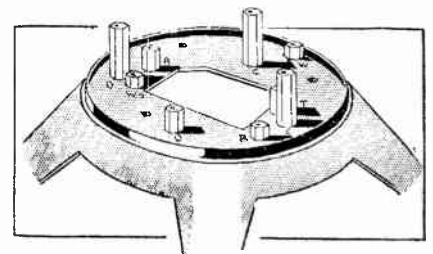


B.T.H. cone unit with concentrically corrugated diaphragm.

in a pedestal cabinet together with the remainder of the radio and gramophone equipment. In other words, the loud speaker must now be regarded as a component rather than an accessory.

Considerable ingenuity has been displayed in the design of vibrating reed and balanced armature movements, and a large variety of units of every conceivable type are now available at competitive prices.

Among complete cone units incorporating reed and balanced armature movements are the Brown Vee unit and the B.T.H. cone unit assembly. The latter equipment comprises a cone chassis in which the diaphragm is provided with concentric corrugations. These corrugations facilitate the formation of nodes so that the effective diameter of the dia-

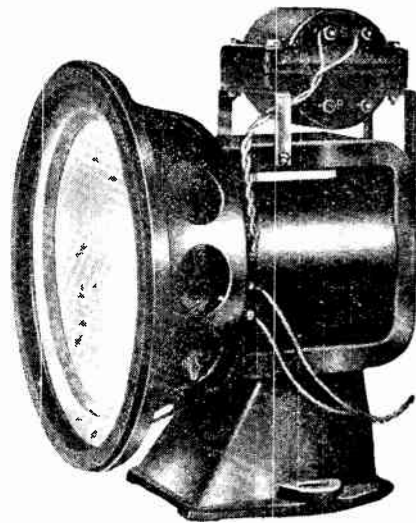


Baker "Selhurst" universal cone chassis.

**The Trend of Design.—**

phragm automatically adjusts itself to the frequency applied by the drive. At low frequencies the whole of the diaphragm is set in motion, while at high frequencies only the centre of the cone near the apex is in action.

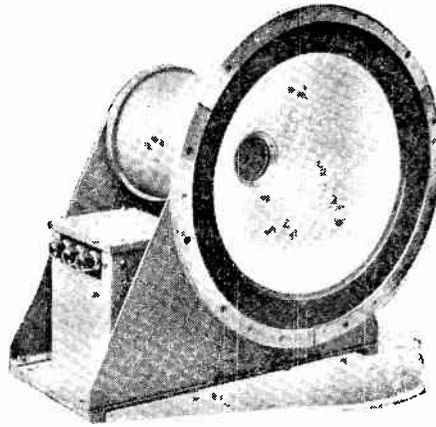
Messrs. Baker's "Selhurst" Radio have produced a Universal cone chassis, the frame casting of which is provided with a series of holes and raised lugs which are tapped to fit the majority of balanced armature movements on the market. Another ingenious development exhibited by this firm is the parallel-action



Redesigned Marconiphone moving coil unit.

centring device incorporated in the 1930 "Super Power" moving coil loud speaker.

The policy of "chassis" construc-

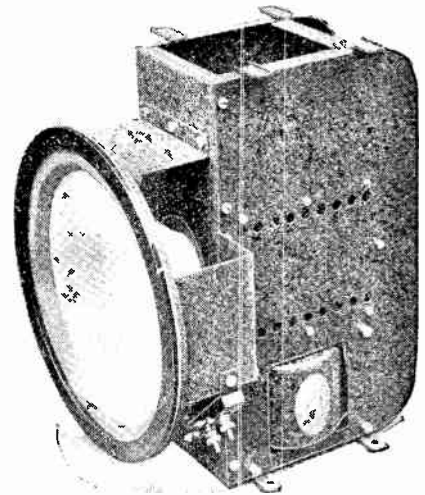


G.E.C. moving coil loud speaker unit.

tion has also extended this year among makers of moving coil loud speakers. Messrs. Kolster-Brandes, Ltd., and the G.E.C. are among the firms showing this form of construction for the first time. The production of a moving coil unit is also a new departure for Messrs. Ferranti, Ltd. This unit is beautifully constructed and incorporates a valve rectifier for energising the field magnet from A.C. mains; full details of the flux density, etc., are given in the report in the previous issue.

In view of the success of last year's

Marconiphone moving coil loud speaker, considerable interest attaches to the redesigned model for 1930. The cone diameter has been reduced and the centring "spider" is now omitted, giving a much more compact and robust form of construction. The production costs have also been reduced, but the quality of reproduction maintains the high standard of the previous model. We have heard the new model in operation, and it is evident that while the sensitivity to weak inputs is quite equal to the old model, the power handling capacity has been considerably improved.



Moving coil unit for A.C. mains—a new product of Messrs. Ferranti Ltd.

## NEW COMPONENTS SEEN AT OLYMPIA

IN a review of the components shown this year we find that the tendency is in the direction of improvement in quality rather than in quantity. This is evidenced by the increase in the number of manufacturers now supplying precise details of the performance of their wares under varying conditions of use. Information of this nature is becoming more and more essential to the set constructor, because it is only by a knowledge of the performance of the component parts that a high standard of reproduction can be attained in the complete receiver. We see, therefore, curves and figures displayed showing the impedance of such com-

ponents as H.F. chokes at different frequencies. The "Dual Astatic" H.F. choke of R.I., Ltd., is a case in point. Furthermore, this component is astatically wound, so that the external magnetic field is kept within reasonable bounds. The Eddystone version is now accompanied also by a curve showing its impedance at different radio frequencies.

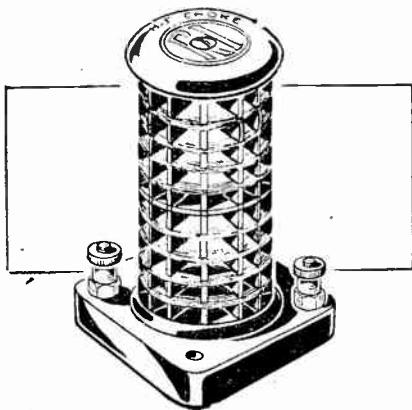
Information of a similar nature is being given by makers of L.F. chokes. With the ordinary type the inductance changes with the value of the steady current passing through its windings, due to the influence of ampere turns on the permeability of the iron. The Wearite choke does

not suffer any appreciable change in inductance between fairly wide limits of current value, this feature being emphasised in the family of curves published for their range of constant inductance L.F. chokes under different conditions of working. Another example is the Varley constant inductance choke. A value of 20 henrys is maintained when carrying D.C. currents of from 1 to 100 mA.

The several improvements made in valve design, particularly as regards super-power valves, have brought into being some additions to the range of heavy-duty output chokes. A typical example of modern practice is reflected in the Pye No. 687 model.

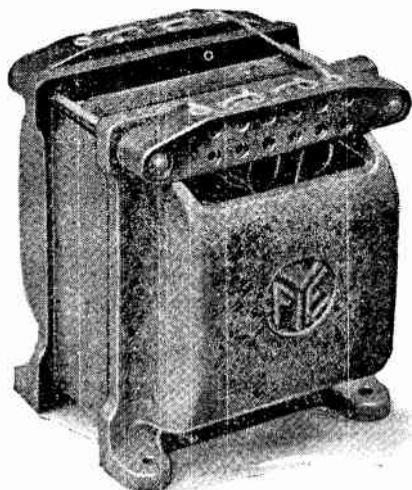
**The Trend of Design.—**

Sectional windings are employed, the ends being brought out to sockets mounted on a strip of insulating material. The sections may be connected in a variety of series-parallel arrangements, and thereby enable inductance values of from 1 to 32 henrys to be made available.



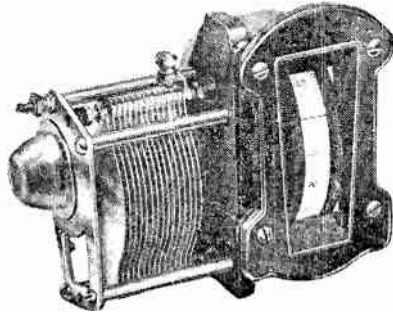
R.I. Dual Astatic H.F. choke with cover removed.

In spite of the technical difficulties concomittant with true ganging of H.F. circuits, many component manufacturers are giving attention to the design of condenser units for this purpose. A noteworthy example of the steps taken to compensate for discrepancies in the incidental capacities across the various circuits is exhibited in the design of the Utility "Mite" double condenser unit. Here the rotors are linked and driven by a drum control. To enable the small differ-



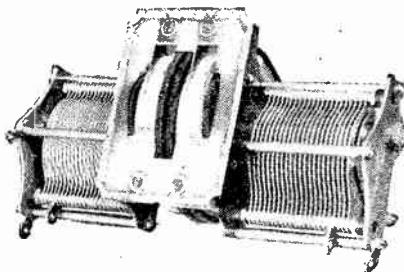
Eye sectional wound heavy duty L.F. choke Model No. 687.

ences in capacities to be corrected, provision is made for rocking the two sets of fixed vanes. By an ingenious mechanical arrangement, the stators are moved differentially.



Polar condenser in which the slow motion controls would be adjacent when a dual assembly is used.

When additional capacity is introduced into one circuit, the value of the capacity across the other is reduced. This must not be confused with a "trimming" device, since a given angular displacement of the stators does not represent a constant capacity change between minimum and maximum values of the condensers. It should be regarded as a compensating device which will require adjustment at various positions of the rotors.

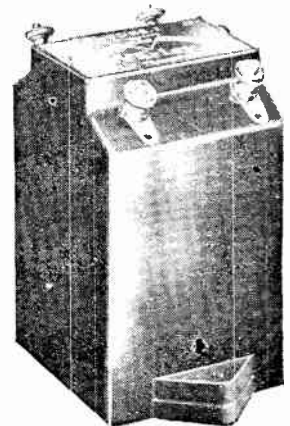


Burton Twin Drum condenser giving coarse tuning on the centre adjacent controls and fine tuning on the outer controls.

The semi-ganging of circuits, as obtained by the adoption of drum controls—arranged so that the operating edges are adjacent and placed conveniently for combined movement by one finger—is being widely adopted by set manufacturers. Consequently, we find an extensive range of condenser units exhibiting this feature. In the majority of cases both slow- and direct-drive drums are provided. Coarse adjustment is obtained by mounting the two direct-drive discs side by side, and fine tuning is then carried out independently by means of the slow-

motion drives, which are mounted generally on the outside. There are, however, some exceptions, notably in the case of the Polar assembly, where the slow-motion drives are adjacent and the coarse adjustments on the outside.

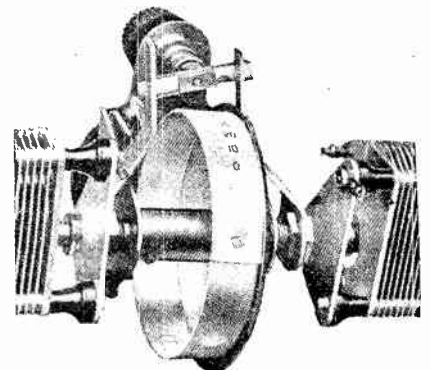
This method of tuning calls for a right- and a left-hand style of condenser. Manufacturing difficulties may occasionally arise. There is at least one example of a condenser designed for optional right- or left-hand drive. This is the J.B. "Universal Log" model, which is made in four sizes, ranging from 0.00015 mfd. to 0.0005 mfd. An adjustable steel



Special high permeability material is used for the core in this Varley "Ni-core" L.F. transformer.

centre spindle is fitted, and a single-hole fixing bush is provided at both ends.

While one does not find many special components designed particularly for use in portable sets, there are nevertheless some which can be included in this class. This fact is rather surprising, in view of the great popularity enjoyed by this



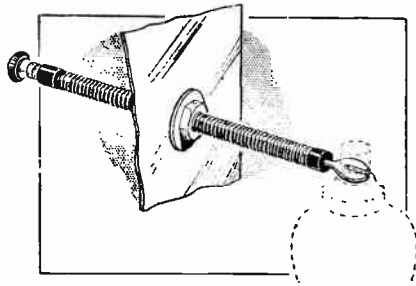
Provision is made for moving the fixed vanes by differential action in the Utility "Mite" double condenser.



**The Trend of Design.—**

type of receiver during the past twelve months and the present indications that it is likely to continue. The previously mentioned Utility "Mite" and the new J.B. "Tiny" condensers are, however, two excellent examples of real endeavour to produce a suitable component of very small physical size. The "Tiny" is fitted with a slow-motion drive, and, complete with knob, pointer and scale, costs 10s. for a 0.0005 mfd. size and 9s. 6d. for the 0.0003 mfd. model. Other sizes are available. Forno and Burton are two others firms who make condensers smaller than the familiar pattern, and these could be included under the same heading.

In some cases manufacturing costs have been the prime mover in the design of a component. For example, the wider use of mu-metal, and similar material, for the core in L.F. transformers has enabled the manufacturer to produce a component

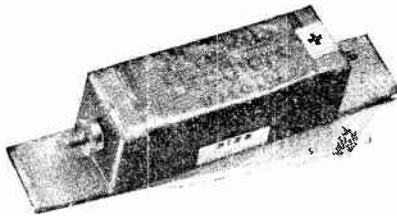


Bulgin "safety connector" for use with screen grid valves.

cheaper than one of equal quality using common transformer steel. In many cases a superior component has been developed. In view of the special properties possessed by these substitutes for steel, some care is required in their use, and this has occasioned a new method of linking together L.F. amplifying stages. Many of these transformers will not stand for more than one or two milliamps of current through their primaries, so that arrangements must be made to deflect the steady anode current through a parallel circuit and pass the A.C. component only through the windings. A discussion of these couplings does not come within the scope of this section, being concerned as we are only with components. Nevertheless, mention must be made of this as it is a vital

factor in the employment of such components as the R.I. "Hypermu" L.F. transformer and the Varley "Ni-core" range.

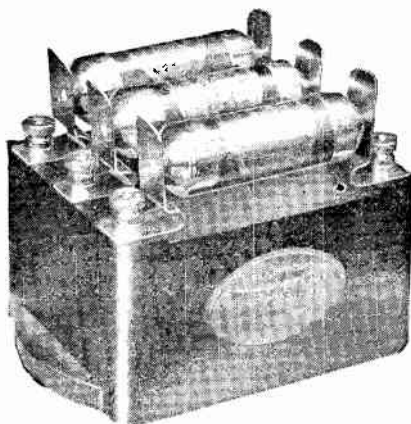
The Varley "Ni-core" L.F.



For biasing a S.G. valve the Siemens 0.9 volt cell is ideal.

transformers are likewise restricted in the value of steady current that may be passed through their primary windings. The "Ni-core I" will carry 2.5 mA. and "Ni-core II" 2 mA. only. The former costs £1 and the latter 15s. Both have a ratio of 4:1.

As an illustration that the development in one direction engenders improvements elsewhere can be cited the case of the screen grid valve. Its wider use since first pointing the way towards higher H.F. stage gain in a comparatively simple manner has resulted in component manufacturers producing additional parts especially for use with this device. Bulgin has evolved an interesting safety connector for the anode of the valve. This takes the form of a flexible wire encased in an armoured sheath to which is attached a fixing bush for anchoring to vertical screens or the side of a screening box. One end of the lead terminates in a spade connector for fixing under the top terminal on the valve, while the other end is finished off by

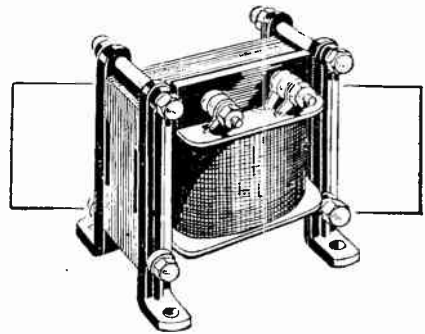


Ferranti triple anode feed unit.

a small terminal for attaching the lead carrying the H.T. As the connector is permanently fixed to a rigid part of the set, no damage can be done by removing the valve without first totally disconnecting the H.T. supply.

While on the subject of screen grid valves, mention must be made of the special grid bias cell developed by Messrs. Siemens Bros. and Co., Ltd., and now shown for the first time. It has a voltage of 0.9, and will give to the operating grid of a screen grid valve just the right amount of bias for the best working conditions. Hitherto the lowest voltage cell available was 1½ volts, and this over-biased the modern S.G. valve.

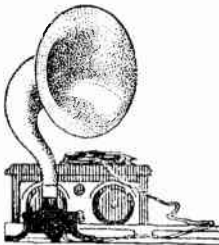
A new component, illustrating the more universal use of special devices to combat motor-boating in mains-driven sets, is a product of Ferranti.



Wearite constant inductance L.F. choke.

This is one of a range of anode feed resistance units comprising three resistance holders and three by-pass condensers. Its normal use is as a triple device where space is limited, but it has a further application, namely, that of a fixed potentiometer to supply the screen potential for a S.G. valve. Used in this manner, it assures a constant voltage on the screen of the valve in spite of slight fluctuations in the current.

Since the set manufacturer is endeavouring to make his products more like pieces of furniture than at any previous period in the short history of broadcasting, it behoves the component maker to add his mite towards this end. We thus find such firms as Ormond, famed for their dials, now showing these in a variety of colour schemes.



# AIDS TO SELECTIVITY

## Some Notes on the Use, Construction and Performance of Rejectors in a Simple Aerial Circuit.

By H. B. DENT.

IT is anticipated that the majority of broadcast listeners living in the north of London will be affected in one form or another by the change over from the Oxford Street site to Brookmans Park for the London Regional transmitter. Possibly by the time these notes appear in print all those so concerned will have had an opportunity to test the selectivity of their sets under the new conditions. Owners of receivers incorporating H.F. amplifiers with sharply tuned circuits should find no difficulty in listening to alternative programmes, but there must be many possessing less ambitious sets who will find that with the new station in operation the alternative programmes are now no longer receivable, or heard only

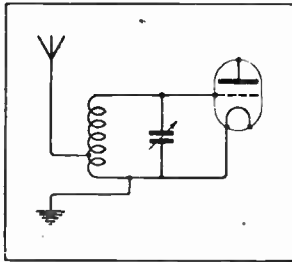


Fig. 1.—Typical aerial-grid circuit used in modern sets.

during intervals in the transmission.

For the present, one programme is to be transmitted from the new station, and since the alternative is either Daventry 5GB, or some of the more powerful Continental stations, the problem resolves itself into a consideration of the ways and means of eliminating the signals from the powerful local transmitter and rendering reception of considerably weaker signals possible. When the full programme of the new London Regional station is in force, it should be far easier to separate the two transmissions, because less amplification will be required. It is apparent that a modification or addition to the set will be necessary, but until it has been possible to study at first hand the effect on one's particular receiver, it is somewhat difficult to decide on the nature and extent of these modifications.

In the meantime some good work can be done with a rejector circuit, and this is perhaps the most satisfactory method of making provision, temporarily at

least, for alternative programmes. Of course, this is really a palliative, but oft-times recourse has to be made to palliatives until a remedy can be prepared. It is the object of these notes to discuss the best method of applying a rejector which will meet the immediate needs until such time as a more permanent cure can be devised. Perhaps the most popular type of aerial circuit used to-day is that shown in Fig. 1. This, then, will be taken as the basis for our discussion. It

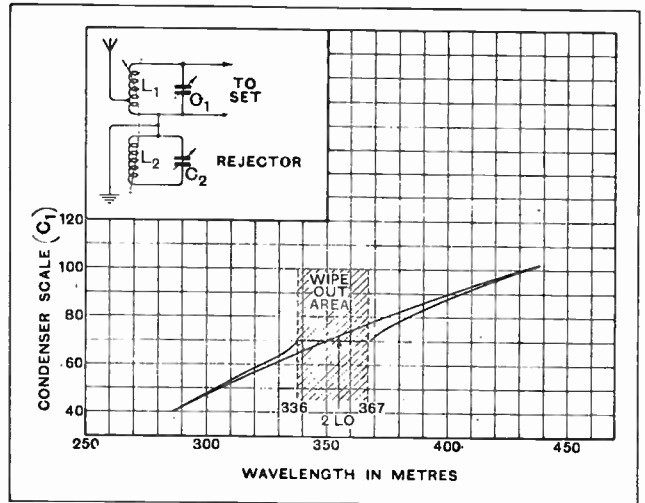


Fig. 3.—Curves showing the effect on the tuning of a circuit when a rejector is coupled to it. The uninterrupted curve is the normal calibration.

matters little what function the first valve performs, whether H.F. amplifier or detector, although if a high-frequency amplifying stage precedes the detector it will, by virtue of the higher selectivity, simplify the filtering-out of the unwanted signals.

### Absorption Rejectors.

For the purpose of this discussion rejectors will be divided into two classes—the "absorption" type and the "series" type. In effect they are identical, and it is only in their application that they differ. The "absorption" type, of which a typical example is shown in Fig. 2, consists of a tuned circuit  $L_2 C_2$ , arranged so that the coil  $L_2$  is inductively coupled to the aerial-grid coil  $L_1$ . It is desirable to use a low-resistance coil for the rejector, a small inductance in conjunction with a large capacity giving the best results. This must be judged by the effect the presence

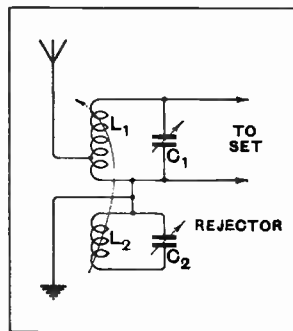


Fig. 2.—Circuit of a simple "absorption" type rejector.

**Aids to Selectivity.—**

of the rejector has on the receiving circuit. An appreciable resistance, that is, H.F. resistance, in the rejector circuit will necessitate a very tight coupling between the two circuits, and this will absorb energy from the aerial-grid circuit over a wider band of wavelengths than is really desirable in the interests of selectivity.

The ideal rejector is one that absorbs energy from the receiving circuit over a band of frequencies equivalent to that occupied by the modulation of the transmission it is desired to reject. This is not possible to achieve in a simple arrangement, but with the exercise of a little care in the design the "wipe-out" area can be kept reasonably small.

The curves in Fig 3 show the effect on the tuning of a circuit similar to that depicted in Fig. 2. The

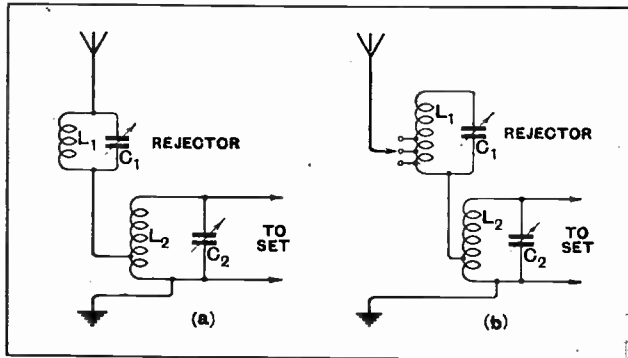


Fig. 4.—Circuits of the two "series" type rejectors. That shown in (b) is generally more satisfactory than the arrangement (a).

coupling between the aerial circuit and the rejector was such as practically to eliminate signals from 2LO (Oxford Street site) at a distance of  $1\frac{3}{4}$  mile. The "wipe out" area in this case represents a matter of 31 metres; that is to say, nothing can be received between the upper and the lower limits, or between 336 and 367 metres. A looser coupling has the effect of reducing the width of the "wipe out" area, but this is offset by the breaking through of signals from the unwanted station, so that little is gained by adopting this course. In this particular case the coil  $L_2$  was wound with Litz wire, 40 turns being used on a 3in. diameter former. The condenser  $C_2$  had a capacity of 0.0005 mfd.

**Series Rejectors.**

The "absorption" type of rejector necessitates a slight modification to the set, since space must be found inside the cabinet for the rejector coil and its condenser. However, there are alternative arrangements which can be applied external to the set and give very much the same results. These will be classified under the heading of "series" type rejectors because they can be connected in series with the aerial. Typical examples are shown in Fig. 4 (a) and (b). The arrangement in Fig. 4 (a) will be passed over with but a mention, and is only included to complete the series. It is effective certainly, but the coupling is far too tight for practical use, as the "wipe out" area extends over an unneces-

sarily large part of the waveband covered by the receiving circuit.

The circuit given in Fig. 4 (b) will be found satisfactory in most cases and readily lends itself to use with most receivers. The remarks passed regarding the type and size of coil apply with equal force to this case, although owing to the aerial-earth damping, possibly solid wire of fairly stout gauge could be used in place of the Litz. A practical test showed that a coil wound with 40 turns of No. 22 S.W.G. D.C.C. wire gave good results. Theappings for the aerial connection were made at 10th, 15th, and 20th turns from that end of the coil connected to the aerial terminal on the set. With the aerial connected across

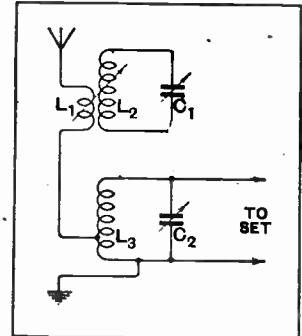


Fig. 5.—Modification of Fig. 4 (b) which justifies the use of a low resistance rejector circuit  $L_2C_1$ .

15 turns of the coil, little could be heard of the local station when the aerial condenser was detuned 10 divisions, on a dial marked 0-180, either side of resonance. The "wipe out" area was of the same order as that recorded with the direct absorption type, shown in Fig. 2.

A variation of this arrangement is given in Fig. 5. In this case a small coil  $L_1$  is coupled to the main rejector coil  $L_2$ . Tests showed that there was some justifica-

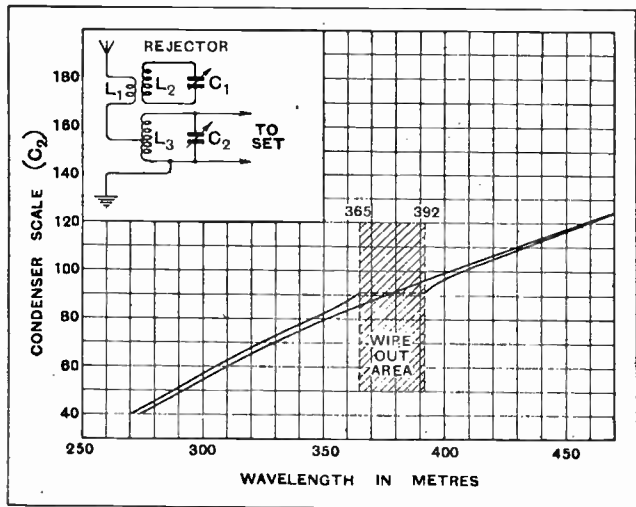


Fig. 6.—With the "series" type rejector a tight coupling tends to shift the "wipe-out" area to one side of the actual wavelength of the rejected signal (in this case that of 2LO).

tion for using Litz, although quite a good performance was recorded when solid wire of the gauge mentioned above was employed. The aerial coil  $L_1$  consisted of 15 turns of fine gauge wire wound over one end of  $L_2$ . Eight distance pieces were used and the turns spaced to occupy  $\frac{1}{2}$ in. in length.

This rejector was particularly good and measurements showed that the "wipe out" area was of the

**Aids to Selectivity.—**

same order as that given in Fig. 3. Whereas previously the local station's programme was audible over the whole range of the tuning condensers, with the rejector in position it was possible to receive signals as near as ten divisions off tune either side of that corresponding to the tuning position for the local station.

**The "Wipe Out" Area.**

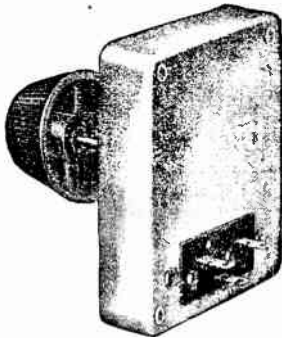
During the course of these observations on the performance of the various arrangements mentioned here, some rather peculiar effects were recorded. For example, with certain types of "series" rejectors it was noticed that the "wipe out" area was displaced and actually occupied a position some metres above the normal tuning position of 2LO. This is shown in the curve given in Fig. 6. With this particular arrange-

ment signals from the London station were fairly completely rejected, yet the blank area, as subsequently found by taking a calibration curve of the circuit with and without the rejector in position, showed that this appeared to be effective between 365 metres and 392 metres. This was finally checked with a heterodyne wavemeter and no signals could be tuned in between these two limits, although sundry Morse C.W. stations were heard on either side of the "wipe out" area.

It is not the purpose of these notes to explain the cause and effect, the object being to record observations with the various arrangements depicted here. Far more detailed investigation will be necessary before many of the rather unusual effects noticed can be satisfactorily explained; for the moment, the practical application of the rejector circuit is the first aspect to receive attention.

**SOME INTERESTING AMERICAN APPARATUS.**

THE Rothermel Corporation's programme for the coming winter season includes the marketing in this country of a number of new components not previously available on this side of the Atlantic. In addition, many of their familiar lines have been remodelled by the manu-



**Electrad super-Tonatron.** A power potentiometer rated to dissipate 5 watts.

facturers. Some new designs of Magnavox moving-coil loud speakers are now available. These are catalogued as "X-core" type and are supplied with 7 $\frac{1}{2}$ in. and 10 $\frac{1}{2}$ in. diaphragms. The A.C. models include mains and input, transformers, and dry metal rectifier, the prices ranging from £8 5s. to £11. A new component is the Mershon "Amrad" electrolytic condenser of high capacity and tested to withstand 400 volts D.C.; single and double types are available. The leakage current is given as 1 $\frac{1}{2}$  to 2 mA per 10 mfd. capacity.

Some new "Royal" metal-cased fixed condensers, ranging from 0.1 to 4 mfd., are now listed. These are tested to withstand 1,650 volts, and prices range from 2s. to 7s., according to size.

**New Volume Control.**

Of particular interest is the new "Electrad" super Tonatron. This is made as a variable high resistance and a potentiometer, and is claimed to dissipate 5 watts at any position of the contact. The resistance element consists of a

special graphite preparation fused at high temperature to an enamelled steel plate. A floating silver contact is employed, which adapts itself to any slight inequality of the surface and ensures smooth action. It is protected by a metal case with bakelite insulation and fitted with stout bronze contact springs. Prices are as follows: Resistances of 10,000 ohms and 50,000 ohms cost 12s 6d., and potentiometers of 10,000 and 25,000 ohms are offered at the same price. A special gramophone pick-up "fade-out" device for use with two turntables is priced at 15s.

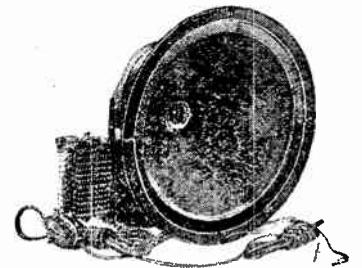
**Electric Gramophone Motor.**

Constructors of electrically driven gramophone equipment will be interested in the Bodine A.C. induction motor. This is a high quality piece of apparatus,



**Two types of American condensers.** That in the cylindrical container is an "Amrad" 90 mfd. electrolytic condenser; the other a "Royal" 2 mfd. 1650 volts test component.

and complete with turntable and necessary controls costs £10 10s. It is made for 110 and 220 volts 50 cycles A.C. supply mains.



**New Magnavox "X-Core" moving coil loud speaker.**

A range of power amplifiers for public address, and similar uses, and designed for A.C. mains operation, is another new feature. These are used extensively in the U.S.A. and are products of the Samson Electric Co.

**BOOKS RECEIVED.**

*Radiotechnik (Part VI), Die Elektrischen Wellen*, by Dr. F. Kiebitz, Professor of the Berlin University.—A short text-book on the propagation and theory of wireless waves. Pp. 125, with 28 diagrams. Published by Walter de Gruyter and Co., Berlin and Leipzig. Price Rm.1.50.

*Short Stories in Science*, by J. G. Crowther.—A popular treatise on natural science, including the Nature of the Universe, Refrigeration, Volcanoes, Lightning, The Atom, The Raman Effect, and many other subjects. Pp. 213. Published by George Routledge and Sons, Ltd., London. Price 5s. net.

*Radio Telegraphy and Telephony*.—A complete text-book for students of wireless communication, by Rudolph L. Duncan and Charles E. Drew. Pp. 950, with 468 illustrations and diagrams. Published by John Wiley and Sons, Inc., New York, and Chapman and Hall, Ltd., London. Price 37s. 6d. net.

# Broadcast Brevities

By Our Special Correspondent.

## A New 5GB.—B.B.C. Under Fire.—“Broadcasting House.”

### The Rebuilding of 5GB.

The B.B.C. has wisely decided to rebuild 5GB (Daventry) before it takes its permanent place in the regional scheme. “Daventry Junior” has always been a makeshift station and, judging from what I saw on my first visit to Daventry, the marvel is that the breakdowns have been so few. Contrasted with the “spick-and-spanness” of Brookman’s Park, 5GB is a “hookup” in the best English sense of the word.

When rebuilt, the station will be a replica of the Brookman’s Park station, but with only one transmitter. In this respect it will resemble the projected regional station for Ulster. The increase in power from 25 kW to 30 kW will, it is hoped, help to cut out that very noticeable interference from Langenberg.

### B.B.C. Disappoints at Olympia.

“And when the sun rose, where were they?” This question, in various forms, seems to have been on the lips of most visitors to Olympia. Where are the B.B.C.?

On the first day of the Show the much-heralded diorama was out of action; but, ignoring this lapse, the best friend of the Corporation could hardly describe the B.B.C.’s rôle at Olympia as a spectacular one.

Echoing John Henry, “It’s all wrong.” The B.B.C., as providers of the celestial food on which all those beautiful receivers thrive, should have taken Olympia by storm, demanding a place in the sun, and not merely an odd corner or two.

### Those Programmes.

If we imagine a succession of long waves of rather small amplitude we obtain a graphical delineation of the quality of the B.B.C. programmes. The waves of popular opinion are usually a little out of phase, so that when the B.B.C. programmes are emerging from one of the troughs, the public are just beginning to realise how bad the programmes have been. We seem to have reached such a stage at the present moment.

### Dance Titles Again?

Some of the criticism is being levelled at the dance programmes broadcast from outside sources. Personally, I know nothing more boring than to listen to a succession of unannounced items given by a disheartened cabaret band which is bound to secrecy regarding dance titles and which dare not burst into song lest

the dread secret should be revealed. I should not be surprised, however, if the B.B.C. were shortly to remove the ban on dance titles, despite the risk of “song-plugging.” Special care would be taken, of course, to prevent as far as possible any subsidising of artists by the dance publishers

### Morbidity at the Microphone.

The subject-matter of a singular broadcast from 2LO on October 10 is the beginning of the end of a man’s life. The action occurs during the infinitely short space of time taken by sudden death to establish itself. The title of the drama is “The First Second,” by Peter Godfrey, and it will be produced by Lance Sieveking.

### Below the Scenes at Portland Place.

Although “Broadcasting House” will not be ready for occupation until June, 1931, some of the toughest work has already been accomplished. To appreciate the immensity of the work the best plan is to take a seat in one of the crane

buckets—a privilege I enjoyed last week—and allow yourself to be gently lowered 40ft. below the surface of the road, until the bucket grounds on the reinforced concrete foundations. You are then on the lowest of the three basement floors, above which the building will tower another eight storeys.

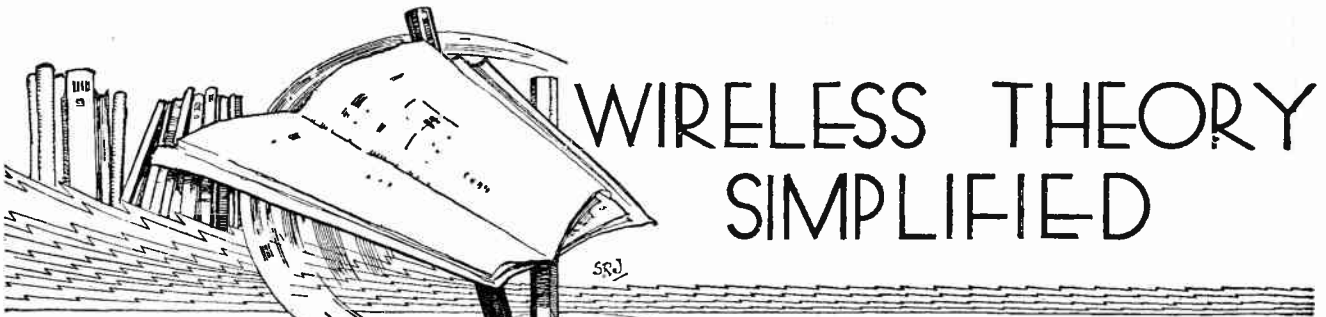
Col. Val Myer, the architect, drew my attention to a bubbling spring which will have to be diverted and “tanked” before the massive retaining walls around the site can be completed.

### Sound-proof Walls.

A really unique feature of “Broadcasting House” will be the absence of a central well which all normal buildings of its size require for lighting and ventilation. The centre will be taken up by a tower with sound-proof walls of solid brick 3ft. thick, and this will house the main studios and a theatre capable of accommodating 1,000 people. The studios will be two storeys in height and will be acoustically insulated from each other by single floors accommodating offices.



THE FUN OF THE FAIR. An interesting photograph taken on the opening day of the National Radio Exhibition. There have been record attendances.



# WIRELESS THEORY SIMPLIFIED

By S. O. PEARSON, B.Sc., A.M.I.E.E.

## Elementary D.C. Circuits.

(Continued from page 362  
of the previous issue.)

IN working out the example at the end of the previous part Ohm's law was applied to the complete circuit consisting of a 6-volt battery and an external resistance of 3 ohms connected across its terminals. The current was found to be 1.875 amps. and not 2 amps. as might at first have been expected, the reason being that the resistance of the battery itself makes its influence felt. From this it is clear that the electromotive force actually applied to the external 3-ohm resistance must be less than 6 volts. This is the truth, and its value can be very easily found by applying Ohm's law to the external resistance only. Let  $V$  denote this reduced value of the E.M.F. which is effective in driving the current through the resistance  $R$ . Then by Ohm's law

$$\begin{aligned} V &= I.R \text{ volts.} \\ &= 1.875 \times 3 = 5.625 \text{ volts.} \end{aligned}$$

So that although we have a 6-volt battery we are left with only 5.625 volts at the terminals when a 3-ohm resistance is connected across it. The remaining 0.375 volt has been absorbed in driving the current (1.875 amp.) through the internal resistance (0.2 ohm) of the battery. This can be verified by applying Ohm's law to the resistance of the battery, viz.: The E.M.F. required to drive a current of 1.875 amps. through a resistance of 0.2 ohm is  $1.875 \times 0.2 = 0.375$  volt. as before. This loss of pressure due to the internal resistance of the battery is commonly referred to as the *voltage drop* in the battery. It is always present to some extent and militates against efficiency, causing waste of energy in the battery, and, in the case of high-tension batteries in wireless circuits, it very often results in instability and violent oscillation or howling.

### Electromotive Force and Potential Difference.

Now we must get back to symbols for a little while and introduce one or two new and important terms which recur very often in discussing the operation of any receiving circuit. The same circuit as that of Fig. 1 of the previous instalment is reproduced in Fig. 1, with

the addition of an ammeter  $A$ , a voltmeter  $V$  and a switch  $S$ . It will be supposed that the ammeter, which is connected in the main circuit, has a negligibly small resistance so that it does not reduce the current, and that the voltmeter which is connected directly across the battery terminals has such a high resistance that the current taken by it is negligibly small.

When the switch  $S$  is closed and a current of 1 ampere is flowing round the circuit the voltmeter will give a reading  $V$  which, as we have seen, is less than the electromotive force of the battery; but if  $S$  is opened the voltmeter reading will rise until it equals the actual E.M.F. of the battery, because the current has now ceased and therefore no fraction of the E.M.F. is being absorbed in overcoming the battery resistance. From all this it might at first appear that the E.M.F. of the battery is not a constant thing, but varies according to the current. But this is not the case—the electromotive force of a battery is a constant quantity (except when the battery is running down), depending only on the chemicals and elements from which it is made and, to a certain very small extent, on the temperature. It is only the resulting electrical pressure existing between the terminals which varies, and it is here that we must introduce the term "potential difference" (P.D.).

### Voltage, Pressure and Potential.

The electrical pressure between any two points in a circuit, as measured with a voltmeter, is called the potential difference between those two points. When measured in volts it is sometimes referred to as "the voltage." For the word "potential" we can always substitute the word "pressure," meaning, of course, electrical pressure.

It is very important to get a clear conception as to the difference in meaning between electromotive force and potential difference. Although each is measured in volts they really have different meanings, which must not be

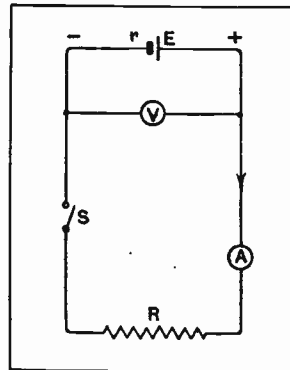


Fig. 1. — Simple circuit showing loss of voltage in the battery due to internal resistance.

**Wireless Theory Simplified.—**

confused. Electromotive force is the driving force set up in the cells by electro-chemical action (or in a dynamo by electromagnetic action), and is a constant in the case of a battery or cell. Potential difference, on the other hand, is the resulting pressure built up when the current is being forced against the various opposing resistances in the circuit. If the circuit is open the resistance is infinitely great and the potential difference between the terminals of the battery builds up to a value exactly equal to the E.M.F. To assist in grasping this idea of opposed forces, consider a steamer standing stationary on a calm day in still water and that suddenly the engines are started and propellers rotated so as to give a steady forward thrust of, say, 50 tons. The steamer will immediately begin to move and its speed will get faster and faster; but it will not go on accelerating indefinitely—there will come a time when the resistance of the water and air will prevent further gain of speed. The speed will build up to just such a value that the resisting forces exactly oppose the driving force.

This is precisely what happens in our battery circuit: When the switch is closed the current builds up until it has reached just such a value that the resisting forces exactly counterbalance the driving (electromotive) force. The E.M.F. is the driving force, and the potential difference is the resulting back pressure due, in this case, to the motion of the electrons against the resistance in the external circuit.

**Potential.**

There is yet another aspect of the word "potential" which must be considered. In our wireless work we often encounter the phrase "plate potential" or "anode potential." For instance, when it is stated that a valve is meant to operate with an anode potential of 150 volts most readers will know that this indicates that the valve should be operated with a potential difference of 150 volts between the anode and the negative end of the filament. But why the negative end of the filament? The reason is that the negative end of a valve filament is usually "earthed" in a receiving set, so that the potential of the anode is really the potential difference in volts between the anode and earth. In general, then, it must be understood that the potential at any point in a circuit is the potential difference between that point and "earth," the potential of the earth being considered as zero.

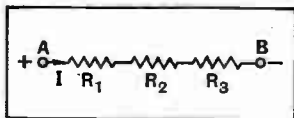


Fig. 2.—Resistances in series. Total resistance =  $R_1 + R_2 + R_3$ .

The energy possessed by anything is the capacity it has for doing work of some kind. For instance, a wound clock spring has the capacity for driving a clock for a definite length of time. In the same way a battery or an accumulator possesses energy which is stored in a chemical form, and, when a current is drawn from the battery, work of some kind is done, the nature of this work depending on the type of apparatus connected to the battery.

In the simple battery and resistance circuit which we have been considering the work done is represented by the driving of the electrons through the resistance of the circuit, this causing the resistance wire to become heated. Actually the energy which is coming from the battery is not being destroyed, but simply converted into heat—another form of energy. It is a well-known law that no energy can ever be created or destroyed, but merely converted from one form into another. By suitable means we are able to convert the stored energy in the battery into motion, light, sound, heat, etc.

The temperature to which our resistance wire will be raised will depend on the rate at which energy is being put into it, that is, on the rate at which work is done, and it is this rate of expenditure of energy with which we are most concerned. It represents the power being expended in the electric circuit.

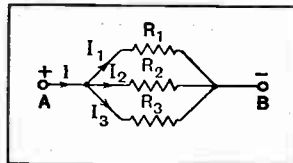


Fig. 3.—Resistances in parallel. The current divides in inverse proportion to the respective resistances.

In ordinary mechanical things the rate of doing work, i.e., the power, is given by the product of the driving force and the rate of movement of the driven body, and similarly in the electric circuit the power is equal to the product of the electromotive force (electric driving force) and the current (rate of movement of electrons). The unit in which the electric power is measured is the *watt*, where one watt is the power represented by a current of one ampere flowing under a pressure of one volt. Thus in a circuit where the pressure is E volts and the current I amperes the power being expended is given by

$$P = E \times I \text{ watts.}$$

If the potential difference between the ends of a circuit is E volts and the current in it is I amperes the power being put into it is  $E \times I$  watts no matter into what form it is being converted. But when the circuit consists of a simple resistance of R ohms the whole of the power is utilised in producing heat. From Ohm's law we know that  $E = I \times R$ , and, substituting this in the above expression for the power, we get

$$P = I^2 R \text{ watts.}$$

**Heat Losses in Relation to Current and Resistance.**

This is a very useful expression indeed, and enables us to calculate the power, in watts, being lost as heat in any circuit where we know the resistance and the current. It should be noted that the power being converted into heat is proportional to the square of the current, so that by doubling the current in a given circuit we expend four times the power. This is obviously the case, because in order to double the current the voltage must be doubled also.

The conclusion is that whenever a current flows through a circuit heat is produced, and, conversely, whenever heat is produced by an electric current resistance is present in the circuit. The latter fact will prove of great assistance to us when considering alternating current circuits at a later date.

**Wireless Theory Simplified.—****Series and Parallel Circuits.**

A number of resistances are said to be connected *in series* if they are so arranged that the same current passes through each in turn. In Fig. 2 we have three resistances,  $R_1$ ,  $R_2$  and  $R_3$ , connected in series, and it can be shown very easily that the total resistance  $R$  of this circuit is equal to the sum of the individual resistances, namely:—

$$R = R_1 + R_2 + R_3.$$

It is very important to remember that at any instant *the current is the same at every point in a series circuit*. Series connection is sometimes referred to as cascade connection.

Resistances are said to be connected in parallel when arranged as shown in Fig. 3. Let  $E$  be the potential difference applied between the ends  $A$  and  $B$  of the circuit. Then the individual currents through the respective resistances  $R_1$ ,  $R_2$  and  $R_3$  will be  $E/R_1$ ,  $E/R_2$  and  $E/R_3$ , and the total current will thus be  $I = E(1/R_1 + 1/R_2 + 1/R_3)$  amps.; therefore  $I/E = 1/R_1 + 1/R_2 + 1/R_3$ . But by Ohm's law  $E/I$  is the combined resistance  $R$  of the circuit, and thus  $I/E$  is the reciprocal  $1/R$ . For the parallel circuit, then, we have

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

or, expressed in words—for resistances in parallel the reciprocal of the resultant resistance is equal to the sum of the reciprocals of the individual resistances.

**Numerical Example.**

Suppose that in a receiving set we are using three valves each rated for a filament voltage of 5.5 volts, but requiring currents of 0.1, 0.25 and 0.3 amp. respectively. Dividing each of these currents into the voltage we get for the resistances of the valve filaments 55 ohms, 22 ohms and 18.33 ohms respectively. The reciprocal of the combined resistance is thus

$$\frac{1}{R} = \frac{1}{55} + \frac{1}{22} + \frac{1}{18.33} = 0.1184,$$

and the resistance  $R = \frac{1}{0.1184} = 8.47$  ohms.

This is the equivalent resistance of all three valves in parallel, and if our working is correct the total current will be obtained by dividing the voltage by this figure:

$$\text{Total current } I = \frac{5.5}{8.47} = 0.65 \text{ amp.}$$

Also  $I = 0.1 + 0.25 + 0.3 = 0.65$  amp., which checks both the method and calculation as being correct.

In the foregoing pages we have discussed the fundamental principles of the very simplest of electric circuits chiefly for the benefit of those readers who have not studied these principles before in any detail. The discussion is necessarily very brief, but it is hoped that sufficient has been said to give the reader a good idea of what takes place in such circuits. Without these fundamental ideas it would be impossible to follow intelligently the succeeding discussions on alternating current circuits and the application of the principles to receiving circuits.

**BY-PASS CONDENSERS FOR HIGH FREQUENCY.****Taking H.F. Resistance Into Account.**

**M**OST modern receivers positively bristle with decoupling resistances and condensers that are intended to divert into harmless paths the various alternating currents that might cause trouble if allowed to stray about. When it is currents of low frequency that we are trying to by-pass through earthing condensers to the filament of the valve it is only necessary to choose condensers of large capacity, the type having paper dielectric serving perfectly well.

The selection of a condenser for a high-frequency circuit, however, needs rather greater care. When dealing with high-frequency currents it is no longer quite safe to assume that of two condensers, one having ten times the capacity of the other, the larger will offer one-tenth of the impedance to their flow. There now enters into the question the resistance offered by the condenser plates themselves to the passage of high-frequency currents.

Let us imagine that a foil condenser is constructed from a long, narrow strip of waxed paper, with a very thin metal foil on each side, and that connection is made to the two foils at the same end. If a high-frequency voltage is applied to the terminals the full voltage will be operative across the waxed paper dielectric in their immediate neighbourhood, but owing to the very appreciable resistance of the foils the voltage-

drop along them will be great enough to render the far end of the strip practically inoperative as a condenser. The far ends of the foil are, in fact, protected from the applied voltage by a very thorough and elaborate decoupling scheme of series resistance and parallel capacity. A two-microfarad condenser constructed on the lines suggested, in which the shortcomings of many paper condensers are illustrated in exaggerated form, might well offer no less impedance to currents of very high frequency than a condenser of nominal capacity one-tenth or one-hundredth of its value, but with foils of negligible resistance. In the usual mica condenser, for example, there are usually two sets of small parallel foils, so arranged that every individual foil in each set makes direct connection with the appropriate terminal on the case. With such a mode of construction the effective resistance of the foils will be negligible.

Several manufacturers of paper condensers have arranged to make connection to each foil at a very large number of places, so that with their products the full rated capacity will be effective even at very high frequencies. The choice of one of these, or of a mica condenser, is a measure of precaution that it would be wise to take when choosing condensers to by-pass high-frequency currents in a modern high-gain amplifier. —A. L. M. S.



# THE PENTODE AS AN ANODE RECTIFIER

## Incorporating the Detector in a Receiver.

By A. L. M. SOWERBY, M.Sc.

(Concluded from page 286 of the September 18th issue.)

BEFORE building a receiver in which the pentode occupies the position of detector, it is desirable to know a little more of its behaviour than can be brought to light by the simple measurements that were described in the first part of this article. We have seen that the characteristics of the pentodes at present available are such that resistance-coupling to the next valve is desirable, and that by suitable choice of auxiliary and signal-grid voltages and of anode resistance we can obtain more sensitive detection than the three-electrode valve can provide. We have still to consider the effect on the efficiency of rectification of shunt capacities in both plate and auxiliary grid circuits, and to investigate the damping effect that the detector produces on the tuned circuit from which, in a normal receiver, it receives the voltage that it is called upon to rectify. Further, it will be of interest to make some sort of rough estimate of the rectified low-frequency voltage that the pentode will hand on to the next valve for further amplification, and of the most satisfactory high-frequency input that the valve requires for efficient rectification.

### By-pass Condensers.

In order to determine whether the presence or absence of shunt capacities in anode or auxiliary-grid circuits affect in any way the process of rectification proper<sup>1</sup>, a constant high-frequency voltage was applied to the valve and the change in plate current due to the rectification of this voltage was read. In order to ensure that the input to the valve really did remain constant while alterations were being made to its plate circuit, the arrangement shown in Fig. 7 was adopted. The resistance  $r$  had a value of some 150 ohms, which was deemed low enough to be negligibly small in comparison with

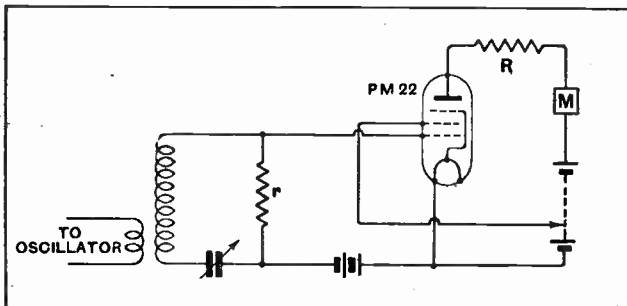


Fig. 7.—Using the pentode detector as in the above circuit, condensers were connected across plate and auxiliary-grid circuits. No change in rectified current was observed.

any parallel resistance due to the valve, while it was found to be high enough to flatten the tuning of the circuit sufficiently to make certain that capacity changes due to the condensers connected would not, by upsetting the tuning, introduce unintentional alterations of the input voltage:

With these precautions condensers of various values, ranging from 0.0001 mfd. to 0.01 mfd. were connected in turn between plate and filament and between auxiliary

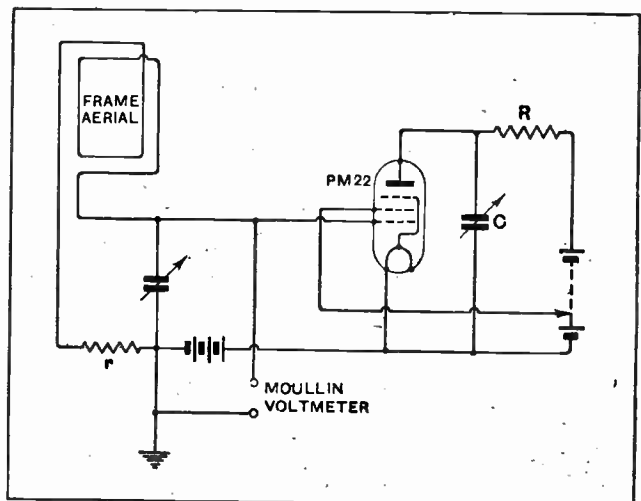


Fig. 8.—With the aid of a calibrated condenser C and a Moullin voltmeter, this circuit enables the damping introduced into the tuned circuit by the detector to be measured. The magnitude of the damping is compared with that produced by the resistance  $r$ . See Figs. 9 and 10 for the results obtained.

grid and filament of the PM22. The deflection in the meter M obtained when no external capacity was connected across either of these paths remained unchanged whatever the value of the condenser used. From the point of view of the rectification of a carrier wave only, any value of external capacity from zero upwards may be used without in any way affecting the efficiency of the rectifier.

It has, however, been shown that the presence of a shunting condenser across the anode circuit of the valve is an essential to the proper reception of a modulated wave.<sup>2</sup> Furthermore, it is known<sup>3</sup> that this condenser helps to reduce very considerably the load imposed by the detector upon the tuned circuit from which it is supplied with signals, so that we must not conclude from the experiment just detailed that it is safe to omit this condenser entirely.

<sup>1</sup> Journal I.W.T. Vol. I, No. 4, pp. 148-151.

<sup>2</sup> The Wireless World, March 13th, 1929, p. 279.

<sup>3</sup> The Wireless World, May 22nd, 1929, p. 524.

**The Pentode as an Anode Rectifier.—**

To investigate the connection between the load on the input circuit and the output capacity, the apparatus shown in Fig. 8 was set up. The frame aerial used had an inductance of 225 microhenrys, and the circuit as a whole, including all losses due to the Moullin voltmeter and the dielectric losses due to the pentode rectifier, but

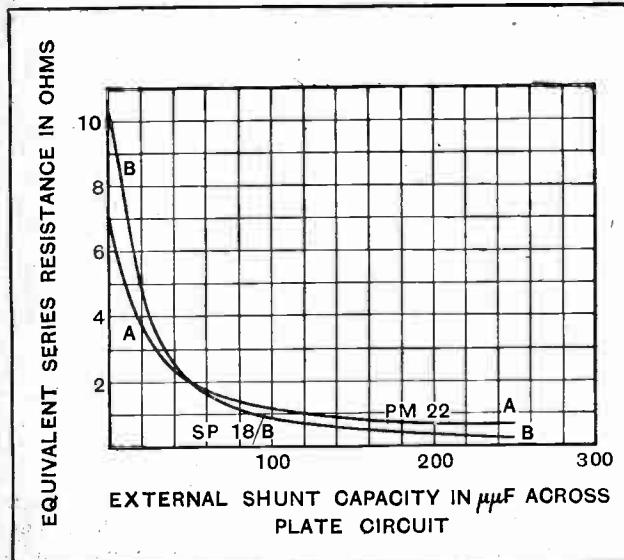


Fig. 9.—Equivalent series resistance introduced by detector with different output capacities. See Fig. 8.

not including any feed-back through the latter, had a high-frequency resistance of 7.9 ohms at the wavelength of 2LO (356.3m.). The resistance  $r$  represents one of a series of small high-frequency resistors, any one of which could be put into the circuit at will.

The first step was to tune in 2LO and to read on the Moullin voltmeter the voltage induced by that station across the tuned circuit for a number of different values of the resistance  $r$ . During this process the filament of the pentode was not lighted. These results were then plotted as a curve, so that the resistance required at  $r$  to reduce the high-frequency voltage to any value within the range of measurement could be read off. Incidentally, this series of readings gave the high-frequency resistance of the circuit that has just been quoted.

**Damping in Grid Circuit.**

The filament of the pentode, adjusted for rectification ( $E_a = 145\text{v.}$ ,  $E_{avr.g} = 20\text{v.}$ ,  $E_g = -5\text{v.}$ ,  $R = 0.22$  megohm), was then lighted, the circuit retuned, and the voltage was read on the Moullin voltmeter for various settings of the calibrated shunt condenser C. For all settings of this, the voltage was slightly lower than had been obtained with the pentode filament unlighted, showing that there was reverse reaction through the grid-plate capacity of the pentode. Each of these voltages could equally well have been attained with the filament of the PM22 disconnected, but with some value of  $r$  in the tuned circuit. The value of  $r$  equivalent in reducing the voltage to the presence of the pentode was read off from the curve already mentioned, and the results so obtained

were plotted, as shown in Fig. 9 (curve A), against the value of external shunt capacity added at C.

As a comparison this series of readings was repeated, the pentode being replaced by a Cosmos SP18/B valve ( $m = 35$ ,  $R_o = 70,000$  ohms) in order that the damping introduced by the pentode might be compared directly with that produced by an ordinary valve of roughly similar characteristics. Curve B of Fig. 9 shows the equivalent series resistance introduced by this valve for different values of external shunt capacity.

**Equivalent Series Resistance due to Damping.**

Comparison of the two curves shows that for an external shunt capacity of 0.0001 mfd., which is about the largest value that can be used without audibly sacrificing the higher musical notes, the equivalent series resistance introduced by either of the two detectors examined is in the neighbourhood of one ohm. This damping need not be regarded too seriously, though one would greatly prefer that it should be absent altogether. The result of the damping is shown in another form in Fig. 10, where input voltage, using the circuit of Fig. 8, is plotted against the value of external shunt capacity. The reduction of voltage at the grid of the detector due to the damping that it imposes amounts to about 12 per cent. with the suggested shunt capacity of 0.0001 mfd.

A separate experiment on the same lines showed that there was no advantage to be gained by connecting a condenser from auxiliary grid of the pentode to filament. The source of current for this circuit, however,

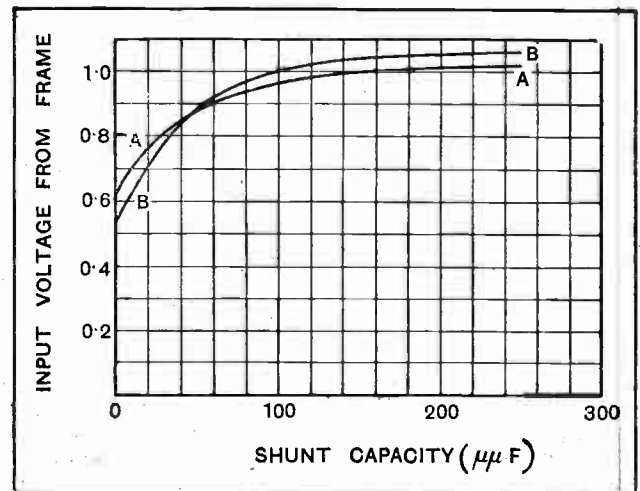


Fig. 10.—Reduction of input voltage due to damping of frame aerial by reverse reaction through the detector. Compare Figs. 8 and 9.

was a small block of H.T. accumulators, in good condition and freshly charged, so that it is probable that the impedance between auxiliary grid and filament was in any case very small, even in the absence of a condenser. If an eliminator were used it would probably be necessary to connect a condenser here also. In any case it would be advisable, in a practical receiver, to decouple this circuit with the usual condenser and resistance, so that the point really does not arise.

**The Pentode as an Anode Rectifier.—**

The last measurement made consisted in supplying the pentode with high-frequency modulated at 500 cycles by a low-frequency generator, measuring both the input of high-frequency and the output of rectified "signals." It is not necessary to describe the apparatus used for producing the "signals" for rectification; it amounts practically to setting up a private zLO for oneself and

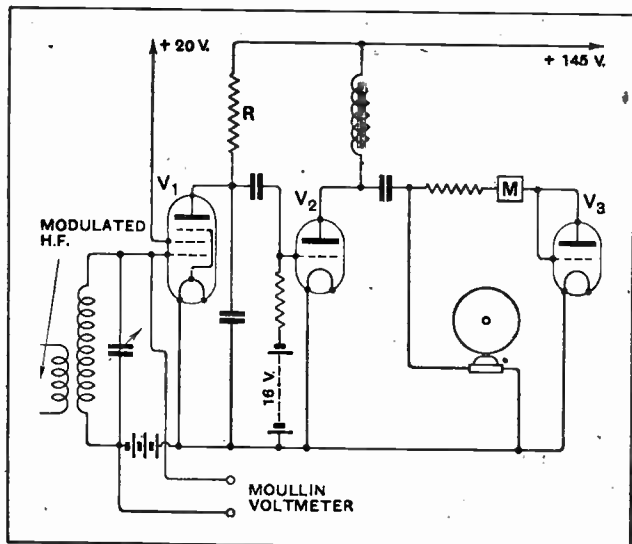


Fig. 11.— $V_1$  is the PM22 detector,  $V_2$  an amplifier and  $V_3$  together with the meter M, measures the audio-voltage across the loud speaker. The Moullin voltmeter measures the high-frequency input. With this circuit the L.F. output to be expected from the detector for any given H.F. input of normal modulation was determined. See Fig. 12 for results.

using it to transmit a continuous "tuning note" from one side of the room to the other. The apparatus is complicated, but perfectly well known to all those who are interested in such experiments.

The chief difficulty that arises in connection with it lies in determining the degree of modulation in use; for the present purpose this was got over by adjusting the modulation-depth to be approximately the same as that of zLO when sending out loud passages of dance music. The pentode detector, with its associated valves, was employed in making this adjustment.

**Measuring the L.F. Output.**

In order to read the low-frequency voltage developed across the resistance in the anode circuit of the valve, an amplifying valve followed by a Taylor voltmeter was used, the two together having previously been calibrated. The detector together with the valves and meters used to measure input and output respectively are shown in Fig. 11. In this  $V_1$  is the PM22 valve adjusted as an anode detector as before, R being again 0.22 megohm. The modulated high-frequency voltage applied to its grid from the miniature transmitter was measured by a Moullin valve voltmeter. The 500-cycle output was applied to the grid of  $V_2$ , a D.E.5a valve amplifying in the normal manner. A loud speaker, introduced in order to have an aural check on the proper behaviour of the entire apparatus (11

valves in all were employed, not counting mains rectifiers) was fed from this valve, and the voltage developed across it measured by means of the Taylor voltmeter shown.  $V_3$ , the valve forming part of the Taylor voltmeter, was a D.E.R., the meter M being a microammeter. Before connecting the pentode, known 500-cycle voltages were applied to the grid of  $V_2$ , and the corresponding readings of M noted, so that the voltage developed across R in the complete set-up could be determined by simply reading M.

**Detector Efficiency.**

The results derived from all this equipment are given in the curves of Fig. 12, in which the R.M.S. value of the modulated high-frequency input is plotted against peak audio-volts output. Curves are included for two values of anode resistance with the pentode, and for two other valves. The pentode will give, without overloading, an output just large enough to supply a second pentode used in the conventional manner as output valve, requiring for the purpose to be supplied with about 1.3 volts R.M.S. of normally modulated high-frequency. Thus where adequate high-frequency amplification is available, there is no need to interpose a low-frequency stage between the detector and the output valve, even though there is no transformer to provide a little free amplification.

Since the peak value of the high-frequency voltage is about 2.15 times the R.M.S. voltage when the modulation is 50 per cent., this is the largest input with which

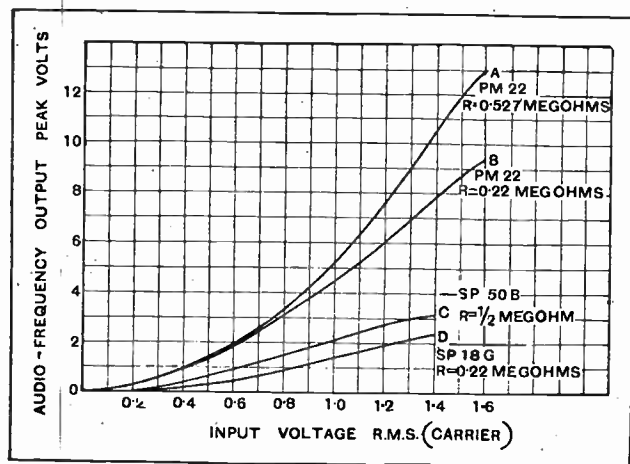


Fig. 12.—Rectified L.F. output from pentode and other detectors supplied with normally modulated high-frequency.

it will deal. This is indicated in the curves by a tendency to flatten out at the upper ends. The greater output of the pentode, as compared with the triodes, is sufficiently obvious from Fig. 12 to require no further stressing.

Summing up all that has come to light during these measurements, we may say that the pentode forms an unusually satisfactory resistance-coupled rectifier for small and moderate high-frequency voltages. It is about twice as sensitive as the triode that it replaces, and introduces about the same amount of damping into the grid circuit. In this latter respect, indeed, it might be

**The Pentode as an Anode Rectifier.—**

made perfect if the valve makers chose to produce a special model of the valve for this purpose.

With the triode there is no hope whatever of doing away with this unwelcome effect, for it owes its origin to the capacity between grid and plate of the valve. In the pentode, although two grids, earthed so far as signal potentials are concerned, are interposed between plate and signal grid, the capacity between these electrodes remains practically unreduced because the leads to both are taken out at the base of the valve. If the lead to the plate were brought through the top of the

bulb, as in the screen-grid valve, and some small attention were paid to screening within the valve, the grid-circuit damping could quite easily be reduced to completely negligible dimensions. If a valve on these lines were produced it would be the first to be specifically designed for rectification since the days of the old soft grid-detector. Two models would be needed, one having figures like those of the PM22 here discussed for resistance coupling, and one with an A.C. resistance of not more than 10,000 ohms for use with a transformer for large inputs. The latter valve at least would also find application in another important direction.

**HAPPY PROPHETS.**

The enthusiasts who predicted a record success for the 1929 National Radio Exhibition have been more than justified. During the first three days over 40,000 visitors passed through the turnstiles, and the average daily attendance exceeded that of 1928 by nearly 3,000.

**GOOD BUSINESS.**

Within a few hours of the opening of the Show enough business had been transacted to cover the entire cost of the Exhibition.

**A NEW HUNTING GROUND.**

The B.B.C. test transmission van is now being used in the Glasgow district in a search for a site for the Scottish Regional station. We understand that the Post Office will not contradict the rumour that the van is hunting for "pirates."

**CUTTING OUT THE CACKLE.**

Broadcast advertisements are stated to have killed enthusiasm for wireless in Spain. A new State decree, which establishes a system of wireless licences, stipulates that not more than a hundred words of advertisement matter shall be broadcast in one hour.

**SHORT-WAVE PICTURE TRANSMISSION.**

Experiments in "Fultograph" picture transmission on short waves are being conducted at Vienna. These tests, which enable definite comparison to be made regarding the relative ranges of tele-

**CURRENT TOPICS.**

graphy, telephony and picture telegraphy, take place daily on a wavelength of 41.42 metres. The call sign is UOM, and the following schedule is observed:—

Telegraphy.—10.10 a.m. to 10.20 a.m.

Telephony.—10.20 a.m. to 10.30 a.m.

Picture Telegraphy.—10.35 a.m. to 10.45 a.m.

In the afternoon a similar transmission takes place at 3.10 p.m., continuing until 3.45 p.m. Reports on reception will be welcomed by Fultograph Gesellschaft, M.B.H., Austria, 1V Frinz Eugenstrasse 10, Vienna.

**BRITISH WIRELESS GEAR FOR POLAND.**

An important success for British industry has been secured by Marconi's Wireless Telegraph Company, Ltd., who have been successful in obtaining one of the largest orders given of recent years in connection with broadcasting services. This order is for a large extension of the Polish broadcasting organisation which, following the English example, is to be remodelled so as to provide alternative programmes for the greater part of the country.

The new equipment will comprise one 120 kW. aerial input broadcasting trans-

mitter with full modulation, two high-power regional stations with 16 kW. aerial input, and three local relay stations. The 120 kW. station will be situated near Warsaw, and will be used in addition to the 12 kW. Marconi station, which is already giving such an excellent service at Warsaw and has been in operation there since 1927.

**MOROCCO JOINS THE MOVEMENT.**

The first wireless show in Morocco is to be held from November 30th to December 8th.

**ULSTER SHOW.**

The Belfast Wireless Exhibition will hold sway in the Ulster Hall from October 9th to 13th.

**FRENCH LOUD SPEAKER "WAR."**

A campaign has been opened in several districts in France against noisy loud speakers. At Châteldon, Puy-de-Dome, an article of French law has been invoked whereby it is an offence to create "nocturnal uproar," even inside a house, if it is audible in the street. A by-law has been created forbidding "open window" loud speakers after 10 p.m.

**BROADCASTING FOG SIGNALS.**

To overcome the difficulty experienced by navigators in judging the distance of a fog syren, an interesting experiment in wireless telephony is to be made, probably at the Cumbrae lighthouse, by the Clyde Lighthouses Trustees. After the sounding of each blast from the syren the words "one," "two," "three," will be transmitted at intervals corresponding to the time the sound waves would take to cover one mile. By noting the time lag between the reception of the wireless signal and the sound of the syren, mariners will be able to determine with fair accuracy how far their ship is from the source of sound. At the moment when the syren sounds, the name of the station or lighthouse will be given.

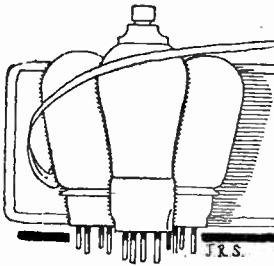
**T.C.C. ELECTROLYTIC CONDENSERS.**

We regret that in the Show Forecast in our issue of September 18th the impression was conveyed that the Telegraph Condenser Company, Ltd., had entirely redesigned their electrolytic condensers of the 2,000 mfd. type. This is not the case. The company has, in fact, added to the range by producing a double type of the same condenser with a capacity of 4,000 mfd.



**A WARM WELCOME.** There have been no "lost children" at Olympia, every visitor being given the opportunity of securing the best Guide to the Show before entering the portals of the Exhibition.

READERS' PROBLEMS.



"The Wireless World" Supplies a Free Service of Technical Information.

The Service is subject to the rules of the Department, which are printed below; these must be strictly enforced, in the interest of readers themselves. A selection of queries of general interest is dealt with below, in some cases at greater length than would be possible in a letter.

**A Selective Two-valve Set.**

I have a straightforward direct-coupled two-valve set consisting of a leaky-grid detector with reaction, followed by a transformer-coupled I.F. stage. This functions well on my local station, but the arrangement does not permit me to receive other stations, owing to lack of selectivity. I understand that you have published a two-valve receiver which has a high degree of selectivity, and shall be glad if you would give me the details of this.

R. W. G.

A set such as you have in your possession is an extremely unselective arrangement, and it is possible by careful design to produce a receiver having a degree of selectivity greatly in excess of this without in the least sacrificing distance-getting properties, and without appreciable loss of quality.

A receiver of this type was described in full on page 143 of the issue of this journal dated February 6th, 1929. Home-constructed coils were used, and full details were given. In case you do not care for the task of coil construction, you will find that these coils are available commercially.

o o o o

**Correct Milliammeter Position.**

I have a milliammeter with a scale reading of 0 to 50 mA., and have been advised that the correct position for this is between the H.T. and the L.T.—terminal of the set in place of the usual short length of wire that connects these terminals together inside the set. I have temporarily connected it in this position, but notice that the needle is constantly and regularly fluctuating. The movement of the needle is not large, but the rapidity of the fluctuations are such that the needle appears almost as a blur. Reception is considerably distorted. Can you tell me where I have gone wrong?

J. E. G. M.

The sole purpose of putting a milliammeter in the position you show is to enable a reading to be taken of the total current consumption of the set. To leave a meter in this position, however, is wasting its potential usefulness, and, furthermore, it will cause low frequency instability and consequent distortion unless shunted by a large capacity con-

denser. The trembling of the needle and the distortion you notice are due to the fact that you have inserted the meter in this position without such a shunting

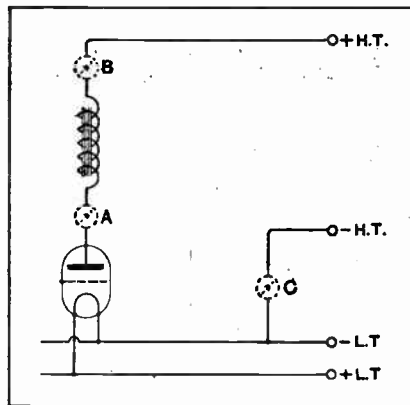


Fig. 1.—Alternative positions for an anode current milliammeter. The correct position is at B.

condenser. A meter having this scale reading should be connected in the plate circuit of the last valve, where it will act as a useful indicator of overloading of this valve. In order to make quite sure that you place it in the right position, we give a diagram in Fig. 1.

You will notice that the meter is shown

**RULES.**

- (1.) Only one question (which must deal with a single specific point) can be answered. Letters must be concisely worded and headed "Information Department."
- (2.) Queries must be written on one side of the paper, and diagrams drawn on a separate sheet. A self-addressed stamped envelope must be enclosed for postal reply.
- (3.) Designs or circuit diagrams for complete receivers cannot be given; under present-day conditions justice cannot be done to questions of this kind in the course of a letter.
- (4.) Practical wiring plans cannot be supplied or considered.
- (5.) Designs for components such as L.F. chokes, power transformers, etc., cannot be supplied.
- (6.) Queries arising from the construction or operation of receivers must be confined to constructional sets described in "The Wireless World" or to standard manufacturers' receivers.

Readers desiring information on matters beyond the scope of the Information Department are invited to submit suggestions regarding subjects to be treated in future articles or paragraphs.

in three positions, (A), (B) and (C). (C) is incorrect for the reason we have just stated; (A) is also incorrect, because the meter is at the high potential end of the external anode impedance. It should be connected at the low potential end of the choke, that is, in position (B).

**Safety First.**

Can you give a definite ruling upon the question which has arisen among members of our local radio society as to whether it is necessary to turn the H.T. eliminator off first or to turn the filaments of the valve off first when "closing down" for the night?

P. N.

The rule is that the eliminator should be switched off first, and when preparing to receive signals again the eliminator should be switched on last. In many cases eliminators are designed to avoid this difficulty, and when this is so it is immaterial which is switched off first. It is most imperative, however, that where this safeguard is not provided the eliminator should be switched off before the filaments are turned off, otherwise there is risk of damage to the eliminator, and risk of shock to any person who accidentally touches certain parts of it. The effect of leaving the filaments on for fractional time after the eliminator is extinguished is that the fixed condensers discharge themselves in a normal manner through the appropriate receiver circuits.

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**Record III. or New Kilo-Mag Four?**

I am thinking of constructing one of the new receivers which have appeared recently in your journal, but cannot make up my mind whether to construct the "New Kilo-Mag Four" or the "Record III," and should be glad of your guidance on this point. I may say that I want long range, but do not desire to sacrifice quality on this account.

D. H. G.

The question of which of these two receivers to construct depends solely on whether you wish the set to be operated entirely from A.C. mains or otherwise. Both sets are long-range instruments, and both are productive of good quality. If you have A.C. mains in the house, we should certainly advise the "Record III"; otherwise, of course, the "New Kilo-Mag Four" should be chosen.

**A.C. Valves in the New All-Wave Four.**  
I have had the "New All-Wave Four" receiver in operation since it appeared in your journal last year. I now desire to use it with A.C. valves, but do not wish to use one of the new screen-grid type valves, but wish to employ an ordinary A.C. triode. Can you tell me what alterations I should have to make? I wish to retain my existing aerial-grid coils and H.F. transformers, if possible.

S. F. B.

The best advice we can give you is to refer to you to page 274 of our issue dated September 5th, 1928, where you will find full constructional details of a receiver which is to all intents and purposes the "New All-Wave Four," modified and rebuilt for use with A.C. mains, using a triode, such as you describe. You can use your existing aerial-grid coils and H.F. transformers.

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#### Pick-up Position.

My present set consists of one H.F. valve followed by an anode bend detector and two stages of resistance coupling. I wish to use a gramophone pick-up, but am uncertain whether to use two or three valves—that is, should the pick-up be used in front of the detector valve or in front of the first L.F. valve? I should be glad if you would decide this point for me.

L. L. H.

In your particular case we would certainly advise that the pick-up be used in front of the detector valve. It may be placed in the grid return lead of that valve, but if you intend to insert a jack for the purpose make sure that no fixed condenser present in the set is in parallel with the pick-up, otherwise a loss of high notes will occur.

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#### Choke Filter Again.

I have constructed a straightforward three-valve set for use in connection with a D.C. mains eliminator; the H.F. valve is coupled to the detector by a transformer of the type used in several of your recent sets. I find, however, that "motor-boating" is very persistent. Can you suggest the cause of this? I enclose a theoretical diagram for your guidance.

G. P. R. N.

It is quite a straightforward matter to diagnose your trouble from the diagram. The trouble is evidently due to the fact that you do not use a choke filter output circuit in conjunction with the output valve. In all probability you will find that if this is used the set is completely stable.

We give herewith, in Fig. 2, the connections for adding a choke filter output circuit. There is a right and a wrong way of connecting the loud speaker, and if you adopt the wrong method results will be just the same as though you had not adopted the choke filter. The wrong method is shown in dotted lines. It will be seen that although this method of connection gives the advantage that no direct current passes through the loud speaker wind-

ings, thus safeguarding it from breakdown, it still permits the A.C. component of the energy present in the plate circuit of the valve to pass through the source of H.T. supply. A study of the correct method of connection clearly shows that the A.C. energy is almost entirely diverted to filament negative via the loud speaker.

With regard to the extra fixed condenser shown in series with the loud speaker, this is not absolutely necessary unless headphones are to be used. If you contemplate the use of long extension leads it is advisable to put in this extra condenser, and its value must be 8 mfd. and the value of the condenser normally in position must also be 8 mfd.

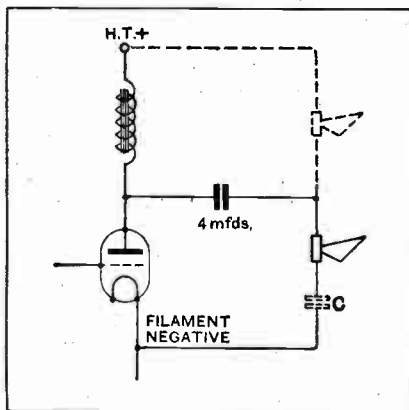


Fig. 2.—Illustrating the correct method of connecting the loud speaker in a choke filter circuit.

The reason is that you have two condensers in series with each other, and although they have this large capacity, the resultant capacity (in accordance with the rule for condensers in series) will only be 4 mfd. You will thus see that if you use one condenser it should have a 4 mfd. capacity, but if you use two, both must be 8 mfd.

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#### New Valves in a New Set.

I notice that the designer of the "New Kilo-Mag Four" mentioned that in all probability new valves which will be suitable for use with the "New Kilo-Mag Four" will be shortly available. Can you tell me when these are likely to appear?

S. R. D.

We would refer you to page 205 of our August 28th issue, where some of these new valves are reviewed.

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#### A Pick-up Recorder?

I am thinking of experimenting with the making of gramophone records, and should be grateful if you could tell me the best type of gramophone pick-up to use, and, if possible, inform me how to use it.

P. N. M.

You are evidently under the misapprehension concerning the precise function of a gramophone pick-up. This instrument is solely intended to be used in cases where it is desired to convert the acoustic energy from the record into electrical

energy so that it may be amplified and passed to a loud speaker which again converts it to acoustic energy. It is impossible to use a pick-up for the reverse process.

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#### An Accumulator Charging Precaution.

I wish to charge my H.T. accumulators from my mains, which are A.C. Until recently the mains have been D.C., and the job has been done by means of a simple lamp resistance. I propose, in the interests of cheapness, to build the A.C. charger described in your issue of August 3rd, 1927. Can you inform me if this is still to be recommended?

G. N. R.

We should not advise you to make use of this instrument now, as it means that the accumulators will be directly coupled to the A.C. mains, and, in view of the regulations that are now in force, it is advisable to use a transformer to isolate the rectifier, and the accumulator on charge. This prohibits the use of a cheap bell-ringing transformer, and means that you must build your instrument with a proper transformer having two secondary windings (we here assume that you are intending to use a valve rectifier).

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#### Transformer Ratio.

My friend who is constructing a receiver intends to use a moving-coil loud speaker which is wound to a low resistance. He intends using a pentode valve in the last stage, and has requested me to write to you to ascertain whether it would be correct to use one of the many transformers which are specially designed for use after a pentode valve.

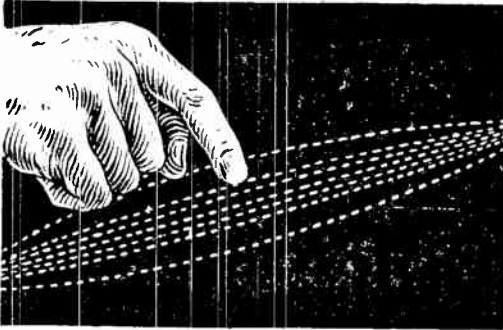
D. G. L. H.

It is not possible for us to give a definite reply in this case. You will appreciate that in the case of a low "resistance" loud speaker it is necessary that the secondary of the transformer be also wound to a low "resistance," which in the ordinary course of events means a big step-down in ratio. Many of the transformers you mention have only a small step-down and are intended primarily for the purpose of enabling the pentode type of valve to be used in connection with a moving-coil loud speaker of the "ordinary" type, that is, the type wound for use after the ordinary super-power valve. This obviates the necessity of winding the actual coil with a large number of turns.

We advise, therefore, that before purchasing a transformer you ascertain from its makers what type of loud speaker is intended to be used in conjunction with it.

You will appreciate that in order to "match" the output valve or valves with the loud speaker it is really necessary to use an output transformer whose primary is wound to harmonise with the output valve or valves, and whose secondary is wound for use in conjunction with the particular type of loud speaker concerned. You will perceive from this that the ratio of the transformer then automatically settles itself.

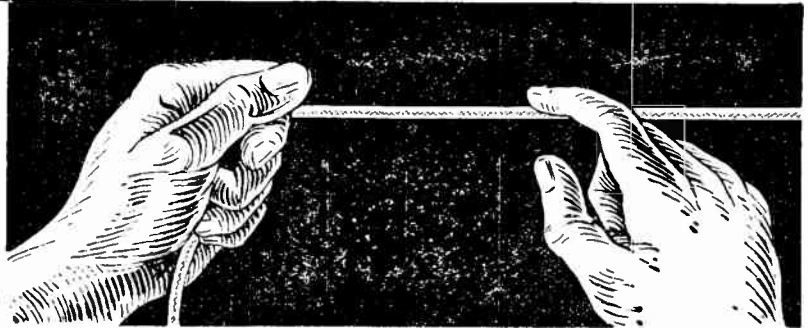
# "TWANG" A TAUT WIRE



— THEN TRY TO  
"TWANG" A RUBBER  
COVERED CABLE

— YOU CAN'T!

**MICROPHONIC  
NOISES ARE  
LARGELY DUE  
TO FILAMENT  
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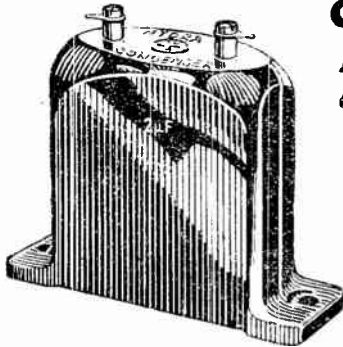
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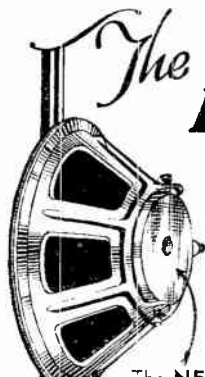
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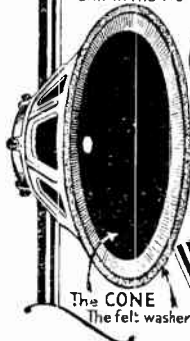
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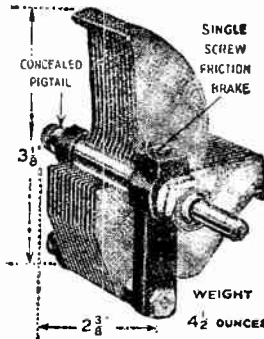
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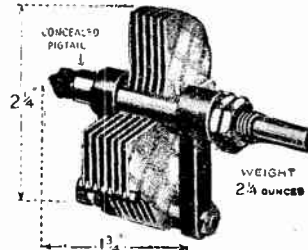
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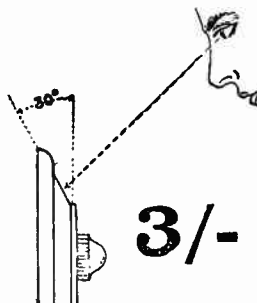
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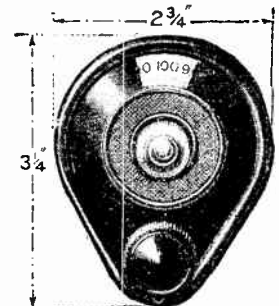
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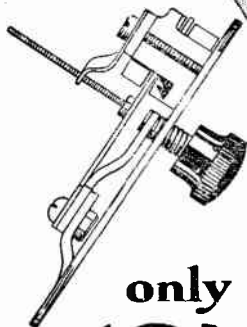
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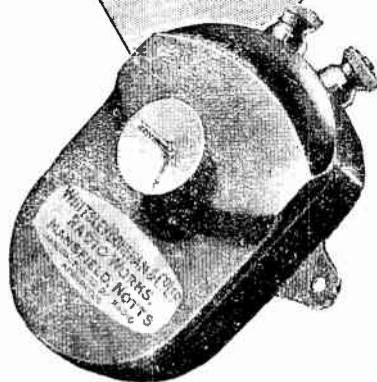
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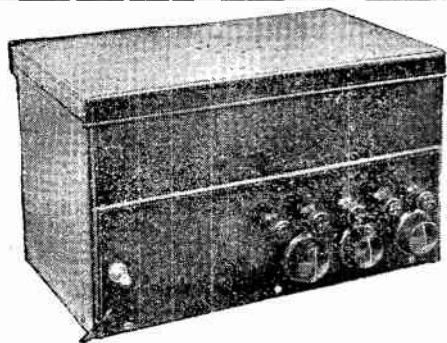
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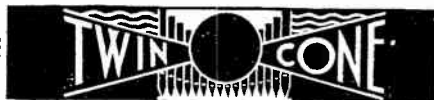
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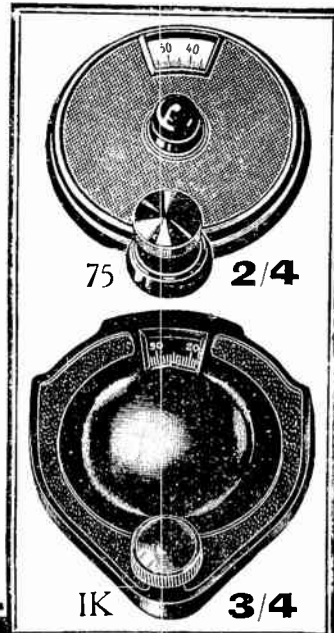
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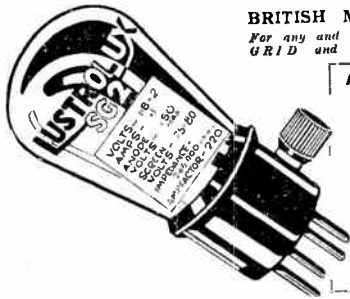
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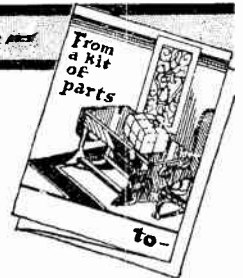
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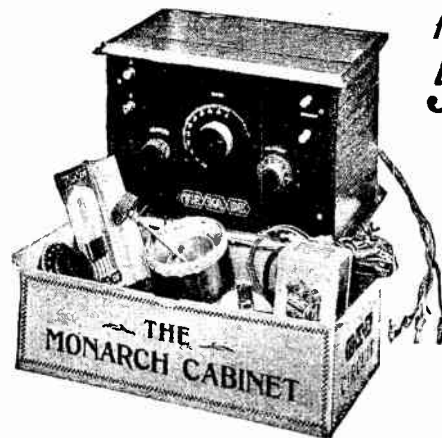
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NATIONAL 1977

## RECEIVERS FOR SALE.

- SCOTT SESSIONS** and Co., Great Britain's Radio Doctors.—Read advertisement under Miscellaneous. [0264]
- 3-VALVE** All-wave Receiver, latest type, powerful, perfect; £4.—V. Taylor, 57, Studley Rd., Stockwell, London. [0274]
- RECEIVERS** for Sale.—Portable 5-valve, suit case type, complete, as new, perfect; £9/17/6.—N. Taylor, 57, Studley Rd., Stockwell, London. [0323]
- 5-VALVE** Portable, complete, new, in perfect order; £10, cost double.—Bracey, 8, Graham Rd., Mitcham, Surrey. [6233]
- PYE** Portable Receiver, new June; £15.—Wyatt, 8, Willis St., Loxells, Birmingham. [6395]
- MULLARD** Master Three, exactly to specification, L. and S.W. coils and valves, £6; short wave coils, 22-85 m., 7/6.—Box 3262, c/o *The Wireless World*. [6391]
- MARCONI** 5-valve Set (model 51), with all power unit, complete with valves, practically new, perfect; cost over £30, accept £15.—Woodley, 58, Cheap-side, London, E.C. Phone: City 1307. [6383]
- EXPERIMENTER'S** Surplus.—6in. M.C. Instruments, 8-0-8 milliamperes, 0-100 millivolts, 0-8 volts, 20/- each; 0-130 and 260 volts, 25/-; 4in. ditto, 0-9 and 45 volts, 15/-; Crompton potentiometer with mirror galvo., £7/10; Kelvin electrostatic voltmeter, 0-130 volt, £5.—Box 3252, c/o *The Wireless World*. [6386]
- SIX-SIXTY** Mystery Receiver, with valves, cabinet, and £3/15 Marconi cone speaker; £11.—J. Hawkins, 11, Station Laue, Wombwell, near Barnsley. [6400]
- 4-VALVE** Bandmaster Receiver, complete with valves, D.C. H.T. eliminator, accumulator, line amplifier speaker, etc., all under 6 months old, perfect condition; going abroad; £9.—Arnott, 49, Warwick Av., Bedford. [6399]
- NATIONAL** Portable, month old, perfect, equal new, £13/10; Amplion R.C.1 speaker, little used, 55/-; Osram valves, D.E.L.612, D.E.H.612, D.E.5B, D.E.5, new condition. 6/- each.—Horspool, 47, Church St., Southwell, Notets. [6398]
- BURNDEPT** Ethogram, as new and in perfect order; will accept £33 for quick sale; good reason for disposal.—Phone or call before 8 p.m., Albert Dock 1678. 368, Barking Road, Plaistow, E.13. [6397]
- 2-VALVE** Burndept, perfect, with valves and coils; 50/-.—Nicholson, New Rd., Sleringham. [6372]
- BURNDEPT** 7-valve Superhet, 1926-27, £15; Burndept Ethogram 5-valve, £15; Burndept Echo phone IV, £7; Marconi amplifier for V2, 35/-.—Jama Scott and Co., Radio Engineers, Dunfermline. [0321]
- SIMMONDS BROS.**—Receivers constructed to your own or any published design; also repairs, reconstructions, and modernisations at moderate charges; best materials and workmanship guaranteed numerous testimonials; quotations free—Address Shireland Rd., Smethwick. [588]
- EPOCH**
- EPOCH**
- EPOCH** Moving Coil Speakers Greatly Improve the Results of all Receivers from 2 valves upwards. [601]
- SCIENTIFIC DEVELOPMENT Co.**, 51, Fishergate Preston.
- We Offer You the Following Inducements to Purchase Your New Receiver or Other Apparatus from us.**
- FIRSTLY.**—Unbiased advice. The principal of our firm has twenty years' professional wireless experience, having been at the Government Experiment Stations in 1910. He has been Manager for the St. John Telephone Co., radio expert to the G.E.C., a Chairman of the Technical Committee of the National Association of Radio Manufacturers. His advice saved our clients many thousands of pounds for, everybody knows, there is no hobby on which money is wasted on useless apparatus by the uninitiated.
- SECONDLY.**—We take your old apparatus in exchange for new, as we have means of disposal of much that the ordinary man finds it difficult impossible to sell; send us a list of your old apparatus, or, better still, send us the apparatus, and state a new requirement. We will then make our offer of your goods, and if you do not approve, which is unlikely, we will return the parcel, carriage paid.
- IF** You are in doubt as to the Make of Receiver or other Apparatus you should Purchase, write us, and we will advise you; we have no leaning towards any particular maker, and will tell you the particular instrument you should buy for your purpose.
- SCIENTIFIC DEVELOPMENT Co.**, 51, Fishergate Preston. Tel.: 1364.
- OMNIVOX** Portable, perfect order, complete, de-station model; first £6 gets it!—Frost, Clerkenwell Rd., E.C.1.

Mention of "The Wireless World." when writing to advertisers, will ensure prompt attention.

Receivers for Sale.—Contd.

**SOLODYNE** Five, complete with valves, components, as specified; £8/15, or offers.—H., 21, Bryon Gardens, Sutton, Surrey. [6456]

**MARCONI**PHONE Straight Eight Receiver, complete with coils for 230-550 and 700-1,900 meters, valves and grid bias battery, Lucas Miliam 52-amp-hour accumulator, with power and carrying strap, Ferranti trickle charger for 200-250v. 50 cycle A.C. mains; £31/10.—Box 3282, c/o *The Wireless World*. [6449]

**PHILLIPS** 3-valve A.C. Set (complete), unused and new, cost £23, first cheque £18/10 secures; also 2 Pentodes, 2v. each, 9/6; Celestion speaker, C10, 63/-; A.F. 3 18/-; Brown vco unit, 19/-; other items.—Write Box 3281, c/o *The Wireless World*. [6448]

**COSSOR** 1930 3-valve Kit, unopened; cost £8/15, take £7/10; buying mains kit.—Box 3277, c/o *The Wireless World*. [6445]

**TO** Clear Stock.—200 42/- portables; given away at 17.6 each, complete and perfect.—138, High St., E.L. [6444]

**MODERN** Wireless Transportable Four, mahogany, any trial, after seven; what offers?—M., 52, Eshe Rd. North, Huddlesands, Liverpool. [6439]

**MARCONI** Model 44, complete with 2 screen grids, detector and Pentode, as new, £17/10; Amplion Lion power chassis, £4/10; R.K. moving coil 6-volt field, 54; Brown vco unit, £1.-1, Hamilton Drive, Giffrock, Renfrewshire. [6434]

**MODERN** 2-valve Set, Aneloy valves, 50/-; A.F. 3, 15/-; exchange good L.S. unit.—Forsyth, Netherlaw, Darlington. [6425]

**FOR** Sale, 1928 Solodyne 2 S.G., det. Pentode, coils for long and short wavelengths, excellent results, complete with valves, £15, or near offer; Ferranti eliminator, to suit above, £10; moving coil speaker, mounted on screen baffle, wound to suit Pentode, £7/10; would accept reasonable offer for the lot; also number of valves, S.G. Triode, Pentode (2v., 6v.), cheap.—Addy, 12, Broadway Av., Cheshire, Cheshire. [6422]

**G.E.C.** New Osram Music Magnet Kit, complete and unopened; bargain, £7/10.—7, Palmerston Rd., Northampton. [6338]

**TO** Short Wave Enthusiasts.—Professionally made "W.W." Empire S.W. Two, perfect order, listen to America for hours with hands off; £5, or offer.—A. Watson, Holly Cottage, Kirkswood, Penrith. [6426]

BATTERIES.

**WET** H.T. Replacements.—Sacs (capped or uncapped), highest grade, No. 1, 10d. per doz.; No. 2, 1/9 per doz.—See below.

**ZINCS**—Best quality (wired), No. 1, 8d. per doz.; No. 2, 9d. per doz.; orders valued 5/- carriage paid, otherwise 6d. for postage.—British Battery Co., Clarendon Rd., Watford, Herts. [0258]

**WET** H.T. Batteries.—Parts per dozen, jars, No. 1, 2 1/2 x 1 1/2 square, 1/3; No. 2, 1 1/6; zincs, No. 1, 10d.; No. 2, 11d.; sacs, No. 1, 1/2 dozen; No. 2, 1/9; terminals, 8d., 10d.; dozen cells (18 volts), complete with bands and electrolyte, No. 1, 4/1; No. 2, 5/-; post 9d.; high efficiency, long life, self charging, upkeep small; send 6d. for sample unit; illustrated booklet free, carriage free orders 10/-; write for free list wireless bargains; trade supplied.—W. Taylor, 57, Studley Rd., Stockwell, London. [0039]

**BETTER** Accumulator Charging.—We guarantee precise charging and maintenance by expert personnel. The prices are very economical and include trouble-free collection and delivery; also hire and part hire service of Oldham batteries; official Oldham service station.—Aneloy Radio (associated with Aneloy Products), 35, Hindmans Rd., East Dulwich, S.E.22. Tel.: New Cross 4074. [5926]

**STANDUP** Wet Batteries for H.T. Supply.—Increase your range and improve your reception by adopting a long life self-charging battery; by its aid you will hear true music that is enjoyable from the lowest chord to the mighty volume; because a Standup produces pure current that flows steadily and noiselessly at all times, and for months after the ordinary dry battery will have found the dustbin. A satisfied customer writes: Your batteries are very true; I get perfect reception and a lot more stations. Price list with particulars free.—Scottish Batteries, Braxside, Uphall Station. [6146]

**EPOCH.**

**EPOCH.**

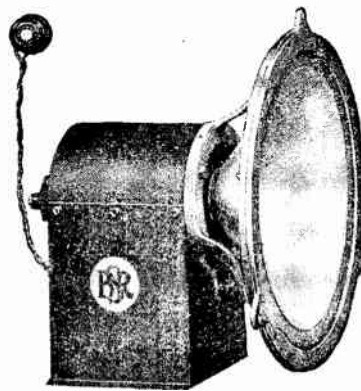
**EPOCH.**—Watch Epoch grow! [6021]

**START** the Season Well.—A wet H.T. battery is within your reach now; take advantage of our astounding price reductions due to clearance of surplus stock; we offer the following job lines:—porous pot cells, 3/- dozen; No. 1 sac cells, 2/9 dozen; electrolyte oil, 6d. bottle; electrolyte powder, large size 9d., smaller sizes 6d. and 4d.; carriage extra.—Pearson Bros., 32, Cawdor St., Poplar, London, E.14. Phone: East 6155. [6279]

**C.I.E.S.** Accumulator Hire and Maintenance Service (5 mile radius).—98, Cherry Orchard Rd., Croydon. [6374]

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Batteries.—Contd.

**ACCUMULATORS**; deferred payments; high, low tension.—Haynes, Rear 847, Old Kent Rd., S.E.15. [6150]

**PENTODE** Users.—Write for details of new size self-charging wet battery; 40,000 milliamps, 6d. per volt; illustrated catalogue giving data, post free.—U. Taylor, 57, Studley Rd., Stockwell, London. [0273]

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**TANTALUM** Electrode Strips for H.T. Rectifiers, suitable for A.C. mains eliminators; 2d. each, or set of 8, 1/-.—17, Dalton St., West Norwood, S.E.27. [0308]

**VORTEXION** Transformers, chokes, etc., wound to any specification; write or phone for quotation; best quality component—only.—Vortexion, 72, Merton Rd., Wimbledon, S.W.19. Tel.: Wimbledon 2814. [0319]

**ATLAS** Eliminators, D.C. £1/17/5. A.C. £3/17/6; Nesper trickle chargers, 29/6. Phone Gerard 6268 for demonstration.—Greatrex and Co., 184, Regent St., London. [6072]

**HARLEY** Eliminators for 200-250 volts A.C., full wave model, 2 tappings, 0-150v. and power, 30 m.a., £3/17/6; half-wave model, 2 tappings, 60v., and 120v., 20 m.a., £2/15; D.C. model, 5 tappings, £1/7/6.—Write for particulars, obtainable only from, Hartley, Eagle Place, Bradford. [6192]

**PHILLIPSON'S** Safety High Tension Battery Eliminator.

**PHILLIPSON'S** Safety Eliminators Give Consistent Results.

**PHILLIPSON'S** Safety Eliminators are Guaranteed for 12 months.

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**PHILLIPSON'S** Safety Eliminators are Housed in Art Enamelled Metal Boxes, fitted with 12ft. of flex and a Bakelite plug, and are constructed from the very best material throughout.

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**PHILLIPSON'S** Safety Eliminators are Described and Illustrated in our Booklet "Radio Power." Have you had your copy?—Write to-day to PHILLIPSON'S and Co., Ltd., Radio Engineers, Astley Bridge, Bolton. Phone: 2038. Grams: Safety Bolton. Est. over 50 years. [0318]

**TRANSFORMERS** and Chokes for Battery Eliminators, and for all wireless purposes, receiving or transmitting; enquiries invited.—Chester Bros., 244, Dalston Lane, London, E.8. [6136]

**UNIFLEX** H.T. Eliminator Kit, giving 15 milliamps, 120 volts 30/- kit of parts, already mounted on baseboard, with complete instructions for simple connecting.

**THIS** New Improved Uniflex Model is the Finest Value in England, and includes shielded mains transformer, with terminals, heavy chokes, 3 Hydro condensers, tested 500 volts D.C., Loewe vacuum resistance and clip, valve holder, panel already drilled with three sockets fitted for negative, 60 volts, and 120 volts; all the components mounted on a wooden base board and neatly boxed, with full instructions and picture diagram, ready for assembling in a few minutes.

**HOW** to Order.—Just send a postcard for one complete 30/- kit, carriage paid (if 15/- Mullard D.U.10 valve is to be included, ask for 45/- kit); all kits sent c.o.d. (pay the postman); thousands of these kits now in use all over the world; hundreds of testimonials.

**FULL** Particulars and Diagram free; dealers write for terms.—Liverpool Radio Supplies, Uniflex Works, 64, Myrtle St., Liverpool. [6231]

**TANTALUM** and Lithium for A.C. Rectifiers; make up your own inexpensive chargers; blue prints for H.T. and L.T., 1/- each; Lithium electrodes fitted with terminals, 2-3 amps. and 5-8 amps.—Blackwell Metallurgical Works, Ltd., Speke Rd. Works, Garston, Liverpool. Phone: Garston 980 (2 lines). [6282]

**AUSTIN** Power Transformers and Chokes Command Success in Any Eliminator, appreciated by every user, H.T.3 and H.T.4, 16/-; H.T.1, 17/-; H.T.2, 20/-; A.3, 12/-; A.4, 15/-; any output supplied to 1/2 K.V.A., low resistance chokes up to 100 H. from 12/6; guaranteed free advice, stamp.—Austin Mills, 8t. Albans Av., Ilcaton Chapel, Stockport. [6410]

**CHARGING** Dynamo, new condition, perfect, 25-30 volts 150 watts, £3/10; another, similar, 20 volts 100 watts, £3; specifications, photo, stamp.—George Smith, 22, Quantock Rd., Weston-super-Mare. [6405]

**EPOCH.**

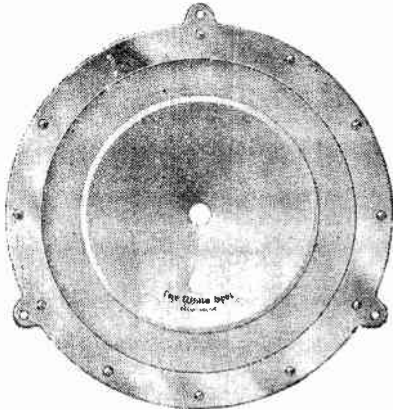
**EPOCH.**

**EPOCH.**—Something new in trickle chargers.

**EPOCH.**

**EPOCH.**—See the marvellous new range of trickle chargers. [6458]

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**WHITE SPOT CHASSIS**  
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**SAVAGE'S** Specialise in Wireless Power from the Mains: reliable apparatus at reasonable prices.  
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**ALIAS** Eliminators, D.C. £1/17/6, A.C. £3/17/6; A Nesper trickle chargers, 29/6. Phone Gerrard 6268 for demonstration.—Greatrex and Co., 184, Regent St., London. [6451]

**MARCONIPHONE** All From Mains Unit, H.T., J.T. and G.H. from D.C. mains, almost new; cost £6/10 recently, accept £4/10. M. Cohen, 4-6, Perry's Av., Princelet St., London, E.1. [6431]

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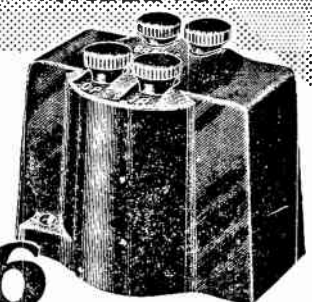
**CABINETS**, 16 1/2 in. x 7 1/2 in. x 11 in., mahogany, hand finished 7/6, unpolished 5/6; oval front, 10 1/2 in. x 6 1/2 in., 6d. extra; baseboard, 6d.; carriage free.—F. W. Ramsey, 65, Shaftesbury St., London, N.1. Clerkenwell 7139. [6145]

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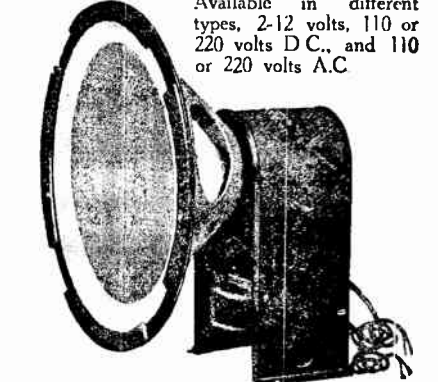
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PRICES: 2-12 v. (for Accumulator Drive), £5 5s. D.C. Models £5 10s. A.C. Models £7 10s.  
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FINEST American Types, astonishing value, special offer oak cabinets, hinged lid, baseboard, highly polished, lake 12in. x 6in. panel; sample, carriage paid, 6/6; trade discounts for quantities.—Mag-Radio, 112, Warstone Lane, Birmingham. [2665]

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EPOCH.

EPOCH.

EPOCH Cabinets for Moving Coil Speakers; see some novel designs at Stand 218, Olympia. [6023]

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COILS, TRANSFORMERS, ETC.

1,000-OHM Decoupling Resistances for "Wireless World" Circuits; 1/6 each, post free.—Groves Brothers, St. Mary's Place, Shrewsbury. [6232]

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GROVES BROS.' Decoupling Resistances are obtainable from Most Factors and Dealers, but if any difficulty send direct to above address. [6305]

RECORD III Coils, 44/; new Kilo-mag four, 40/; S.G. Regional, 37/6.—Radiograph.

FOREIGN Listeners Four, 6 coils, 50/; Europa portable, 21/; Europa III, 18/6.—Radiograph.

S.G. Multiple Portable, 22/6; Everyman four, 30/; interchangeable Everyman and cones, 72/6.—Radiograph.

LITZ Wire 2/40, 1/6 per dozen yards; 27/42, 2/6 dozen yards.—Radiograph.

REDFERN'S Deep Ribbed or Bevel Tube, 5d. per inch; suited for winding, 1/6 extra; any coil, part or wire supplied to "Wireless World" specification.—Radiograph, Station Rd., New Inns, Handsworth, Birmingham. [6273]

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EPOCH.

EPOCH.

EPOCH.—See the new range of Epoch A.C. main-transformers. [6459]

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EPOCH.—A dynamo is not required for the new models Epoch moving coil speakers. [6025]



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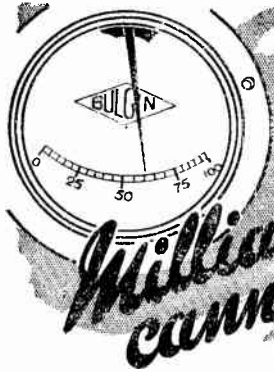
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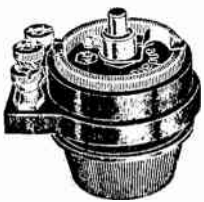
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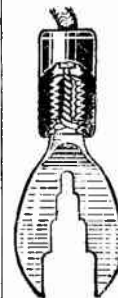
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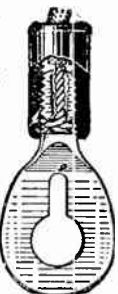
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**C**ALL at our Works at Croydon and Examine all Models; you will be convinced of their superiority.

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**V**ERY Model can be Supplied as a Complete Speaker, ready to connect to receiver if desired.

**A**LL Baker's Moving Coil Speakers are manufactured throughout at Croydon, and are British.

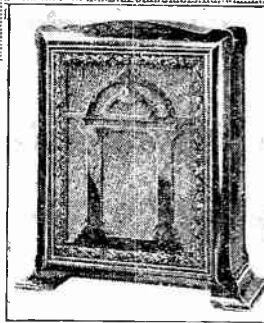
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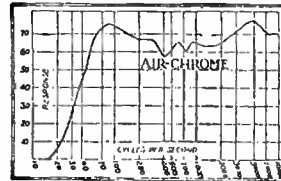
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[5669]

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**Components, Etc.. for Sale.—Contd.**

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**NAMED** inseparably with Radio Part Exchange, wherever the English language is spoken.

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**POINT Two.**—We must see the material; making offers for material we have not seen proves inadequate, indefinite, and misleading; it helps no one and progresses nowhere; upon reflection, this is obvious, as the value of an article greatly depends on its condition and production age; the likelihood of receiving an inadequate offer for material sent to us can be determined by the fact that our rejected offers are, and always have been, below 1%.

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**600-OHMS** Decoupling Resistances; see advert. under Coils. — Groves Brothers (Manufacturers). [6306]

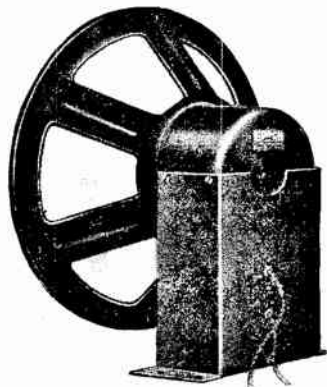
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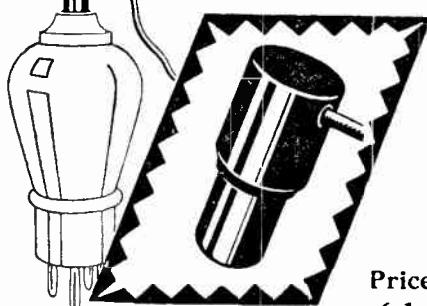
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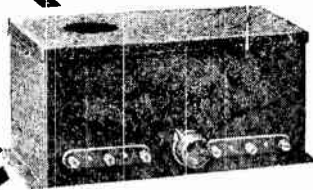
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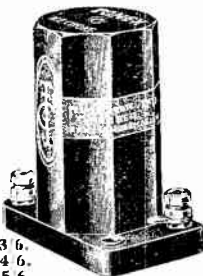


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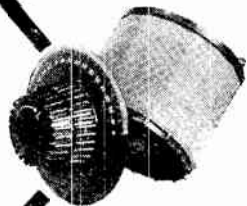
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NEW Kilo-Mag and Record III Metal Cabinets, complete with base and screens, finished oak or mahogany, 45/- each; Foreign Listeners' Four screens, 5/- each; see advertisement under Coils.

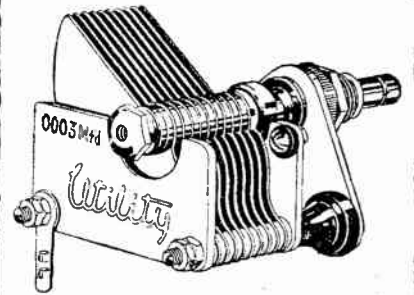
"WIRELESS World" Kit.—Metal cabinets, complete with oak base and switches; 37/6.—Stott, 63, Syke Rd., Rochdale. [6421]

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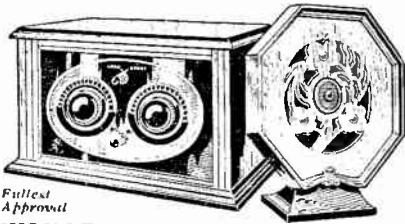
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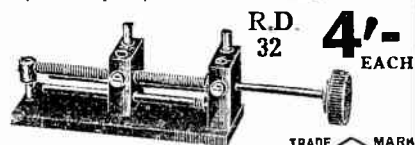
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**W**AVEMETER, Bowyer-Lowe, literally as good as new; list price £6, sell £4/10.—Fairhaven, Letchworth, Herts. [6441]

**P**HILLIPS I.T. Accumulator Charging Unit, 200-230 mains, as new, £2; Magnavox (M.K.7) speaker unit, 30/-; three Marconi locals, ratios 2 to 1 and 4 to 1, 10/- each; valves, D.E.5, D.F.513, D.E.5A, 5/- each; above as new.—141, Fitzalan St., Sheffield. [6438]

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**T**WO Eureka Concert Grand, one Baby Grand transformers, 20/-, or will separate; also Micromain D.C. eliminator, various tapings, 25/-.—Hind, 72, Squires Lane, Finchley. [6430]

**P**.M.12, P.M.14, P.M.22, P.M.24 Valves, guaranteed equal new, 16/6 each; Marconi 44 receiver, 2 S.G., H.F., detector and power, set only; sacrifice £3/10, as new.—38, Redvers Drive, Orrell Park, Liverpool. [6423]

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**C**LIMAX Auto-Bat Mains Transformer, 200-240 volts, 18/6; also Loewe pick-up, 12/6; A.C. valve, 12/6.—J. R., 73, Woodgrange Rd., E.7. [6415]

**H**AVE You Experimented with the Calton-Stewart H.F. Air-spaced Choke? By post 2/-.—Calton-Stewart, 28, St. Enoch Sq., Glasgow. [6411]

**F**ERRANTI A.F.5 22/6; R.I. super, 15/6; Edison 2v. pentode, 12/6; Celestion C.10, oak, 45/-; all perfect.—Doig, Lyndhurst, Dunoon. [6409]

**D**.C. Eliminator, 12/6; B.T.H. pick-up, 25/-; P.625 valves, 7/6, little used; high class portable gramophone, £2/15; all perfect.—48, The Warren, Heston, Middx. [6408]

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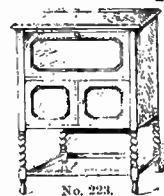
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**Y**OUR Old Apparatus Taken in Part Payment for Latest Type; see our advert. in column Receivers for Sale.—Scientific Development Co., 51, Fishergate, Preston. [0229]

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**P**ATENTS and Trade Marks, British and foreign.—Gee and Co. (H. T. P. Gee, Member R.S.G.B. and A.M.T.H.E.), 51-52, Chancery Lane, London, W.C.2. Phone: Holborn 1525. [0001]

**K**ING'S PATENT AGENCY, Ltd., 146a, Queen Victoria St., E.C.4.—Free advice and handbook on patenting inventions and registering trade marks by registered agents with 43 years' experience. [0002]

**REPAIRS.**

**S**COTT SESSIONS and Co., Great Britain's radio doctors; read advertisement under Miscellaneous column. [0263]

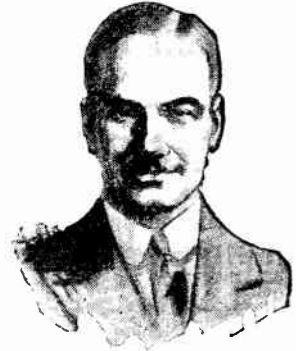
**T**WELVE Months' Guarantee Accompanies all our Repairs; any make of I.P. transformer, headphones, or loud-speaker repaired and despatched within 48 hours; 4/- post free; don't discard if burnt out; terms to trade.—Transformer Repair Co. (Dept. W.), 214, High St., Colliers Wood, S.W.19. [0011]

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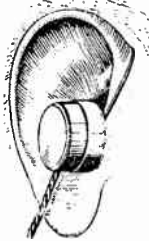
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**FREE—Inventor's Guide on Patents.**—T. A. A., 253 (W), Gray's Inn Rd., London, W.C.1. [4127]

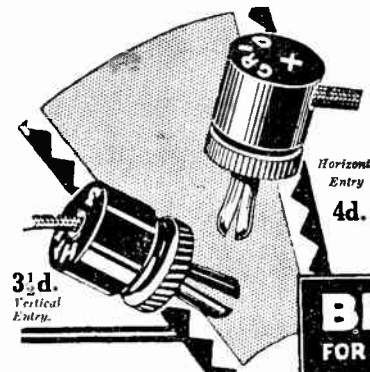
**130 "Wireless Worlds,"** January 5th, 1927, to July 31st, 1929; offers—"Ingledene," Leamington Rd., Wallasey. [6412]

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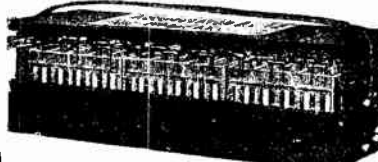
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Ferranti, Ltd.	7	Peto Scott Co., Ltd.	47	Wright & Weaire, Ltd.	43
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## SINQUERS

SAVE YOUR ACCUMULATORS SET A SINKER SENTRY! HE'LL NEVER LET YOU DOWN.



Double the life of your cells! Avoid being let down by a run-out accumulator. Sinquers tell you the exact state of your battery and warn you when it needs recharging. Just drop them in and leave them to it. 1/- per carton from most dealers or 1.3 post free from actual makers.

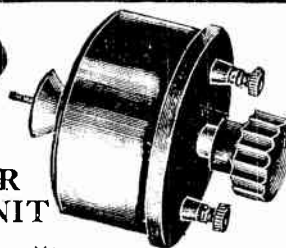
FIDDIAN BAWTREE & CO., Oakhill Road, Sutton.



LOUD SPEAKER CONE UNIT

of exceptional quality. Brown Bakelite Case, double damped action eliminating chatter. Guaranteed. 14" CONE GIVES WONDERFUL RICH BASS NOTES.

PUGH BROS., 95/101, Holloway Road, N.7.



9/- POST FREE.

## REPAIRS

Any make of L.F. Transformer, Loudspeaker or headphones repaired and dispatched within 48 HOURS—TWELVE MONTHS' GUARANTEE with each repair. 4/- Post Free.

Terms to Trade.

TRANSFORMER REPAIR CO., Dept. W.

214, High Street, Jolliers Wood, London, S.W.19

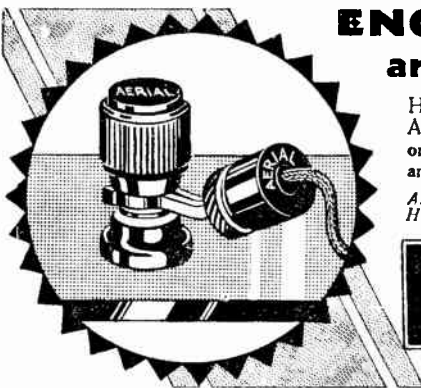


PORTABLE GRAMOPHONES from 21/- Post 1/6.

MAKE A GRAMOPHONE OR BUY CABINETS FOR WIRELESS at a quarter shop prices. Order set as shown. British double spring motor, 12" velvet turntable. Swan Arm, Metal Soundbox, amplifier, needle clips, for 21-38/- 8 pp., and build your own Cabinet. Machines sold by others at £10-£20 do not contain better fittings. Motor from 8/8. Repair Parts. List free. 64 pp. 1930 Catalogue, drawing and How to make Gramos, 2d.

REGENT FITTINGS CO. (W.O.) 120, Old Street, London, E.C.1.

## ENGRAVED and A SPRING GRIP



Here's the Pelling-Lee idea of a spade terminal. An insulated handle with the name clearly engraved on it—a spade with a spring that grips—a finish and appearance that improve any set.

Ash your dealer for Belling-Lee Belling-Lee 4 1/2d. Handbook "Radio Connections." Spade Terminal

**BELLING-LEE** FOR EVERY RADIO CONNECTION

Advt. of Belling & Lee, Ltd., Queensway Works, Ponders End, Middlesex.

## NEW KILO-MAG FOUR

BERCLIF COILS

Price 50/- the Set

Also Complete Receivers

Prompt delivery. Trade Supplied.

**SIMMONDS BROS.** SHIRELAND ROAD, SMETHWICK

## METAL CABINETS

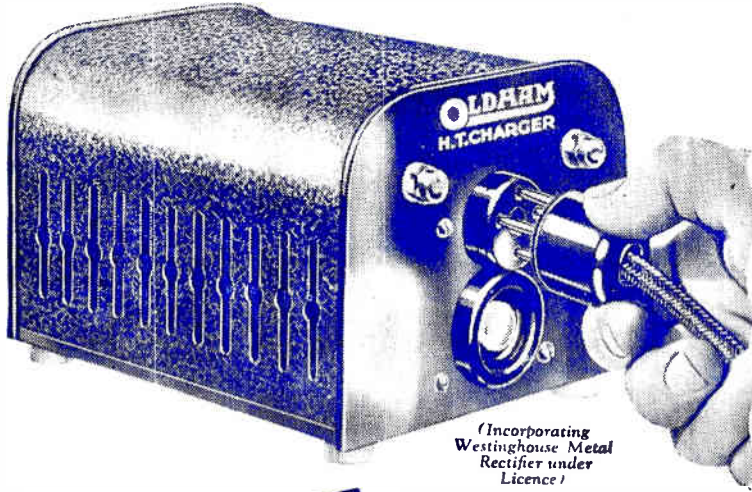
Complete with Base for New Kilo Mag Four, Jacobean Finish.

Price 57/6. (CASH WITH ORDER)

RIGBY & WOOLFENDEN, ROCHDALE. SHEET METAL WORKERS.

Mention of "The Wireless World," when writing to advertisers, will ensure prompt attention.

# HAVE "CONCERT-PITCH" RADIO ALWAYS!



(Incorporating Westinghouse Metal Rectifier under Licence)

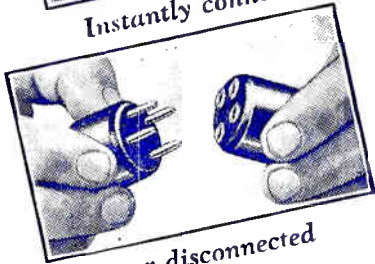
DON'T be "let down" during that special item—don't put up with doubtful reception. Have "concert-pitch" radio *always*. The new Oldham H.T. Charger will keep your H.T. accumulator "up-to-scratch"—always at full power—ready to supply your Set, however heavy its demand. It charges automatically too—you just plug-in-out-in—that's all. Not a single wire to disconnect—no terminals to unscrew—switch always in safe position. No shocks—your Set is always isolated from the mains by a heavy duty transformer. The Oldham H.T. Charger has no valves to burn out—no moving parts—nothing to wear out. It will charge any H.T. Accumulator up to 180 volts. Handsome in appearance and strongly built, it will give years of satisfactory service.

For A.C. Mains only 200 to 250 volts (40 to 60 cycles) complete with Mains Plug and 4-way quick change plug and socket.

## 63/-



Instantly connected—



or disconnected

These illustrations show the convenience of the 4-way plug method evolved by Oldham. The 4-way socket is permanently connected to the Receiver to H.T. +3, H.T. +2 and H.T. +1. The 4-way plug is connected to the H.T. Accumulator to H.T. +60 volts, H.T. +90 volts and H.T. +120 volts, or to any other desired voltages. For use the plug and socket are connected together as shown in these illustrations. For recharging, the plug is inserted into the Oldham H.T. Charger as shown in the top picture. The bulb glows when the Accumulator is on charge.

# OLDHAM

## H.T. CHARGER

OLDHAM & SON, LTD.  
Denton, Manchester.  
Telephone - Denton 301 (4 lines)

Glasgow Depot: 200 St. Vincent Street  
Telephone . . . . . Central 4015  
Birmingham Depot: . . 62 Moor Street  
Telephone . . . . . Central 3131

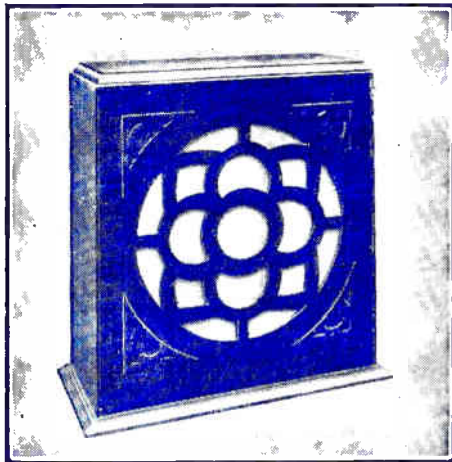
London Office:  
40 Wicklow Street, Kings Cross, W.C.1  
Telephone - Termini. 4446 (3 lines)

# Crowds surge towards Marconiphone stands at Olympia

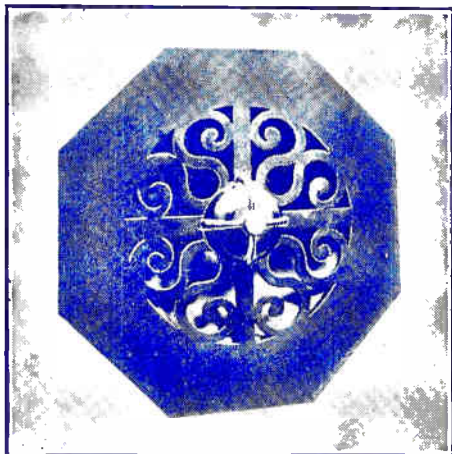
*where new sets, speakers*

*and mains units arouse*

*tremendous enthusiasm*



*Model 60, an entirely new and greatly improved cone speaker in a dignified cabinet. Gives beautiful reproduction of both music and speech. Price £3.*



*The famous "Octagon" cone speaker, with its clear, full tone, is now obtainable in two distinct styles. Always splendid value, it is now reduced in price to 30s.!*

**W**HEN you get to Olympia, go straight to where the crowd is thickest, and there you will find the Marconiphone stands.

On these stands—Nos. 79 to 84—you will be able to see the very latest in wireless, designed by Marconiphone engineers to satisfy your every need.

New sets of astonishing efficiency, in beautifully designed cabinets, for mains or battery operation; new mains units, simple and reliable, for use with any set, in place of batteries and accumulators; new and improved loud-speakers, including a Moving Coil model, at a new low price.

All these, together with the famous Marconi valves, are the best that technical skill can offer you.

If you cannot visit Olympia write for particulars to the Marconiphone Company Limited, 210-212 Tottenham Court Road, London, W.1.

## MARCONIPHONE



*The first and greatest  
name in wireless*

### Olympia: Stands 79 to 84


# The Wireless World

3<sup>D</sup>

AND RADIO REVIEW

*The Paper for Every Wireless Amateur*

Wednesday, October 9th, 1929.



**TONES  
VOLUME  
DISTANCE**

PUT NEW LIFE INTO YOUR RECEIVER

**Mullard**  
THE MASTER VALVE

ANY SET WORKS BETTER WITH AN



D.C. H.T. UNIT  
2F 10 £1.9.6 complete

Write for Free Illustrated Booklet on "EKCO-ELECTRIC" Radio!

**"EKCO"**

MAINS-POWER UNIT

E. K. COLE, LTD., DEPT. W, "EKCO" WORKS, LEIGH-ON-SEA

'Whiteline' for Safety



The WHITELINE VALVE HOLDER  
PRICE 1/9

TESTED RADIO APPARATUS

**BOWYER-LOWE**

RADIO WORKS. LETCHWORTH, HERTS.

Green for Safety!



**T.C.C.**  
CONDENSERS

Advt. Telegraph Condenser Co. Ltd.  
Wales Farm Rd., N. Acton, London, W.3

879

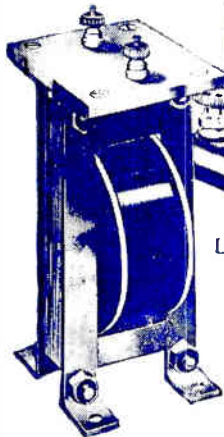
# SET BUILDERS!

**use Lotus components  
for easy assembling!**

**D**RAW the curtains and gather round the table. Now's the time to try your hand at building some of the new radio sets with Lotus components. You'll enjoy the trouble-free building, the easy slipping together of these well-made units. Each is a masterpiece of mechanical perfection, strong, neat and accurate. Instead of buying a number of varying makes of components, choose all yours from the Lotus range. Lotus components are made to work together in harmony, and they ensure easy assembling and the achievement of all that the designer claims.

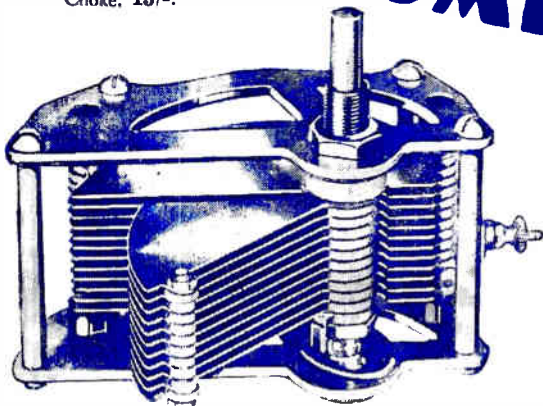


Lotus H.F. Choke, 5/6d.



Lotus L.F. Intervalve transformer, 12/6d.

Lotus L.F. Power Choke, 15/-.



Lotus Logarithmic condensers in all capacities from 5/-.

Made in one of the most modern radio factories in Great Britain



Lotus All Mains Unit, £7.7/-.

Lotus Power Transformer, £1/15/-.

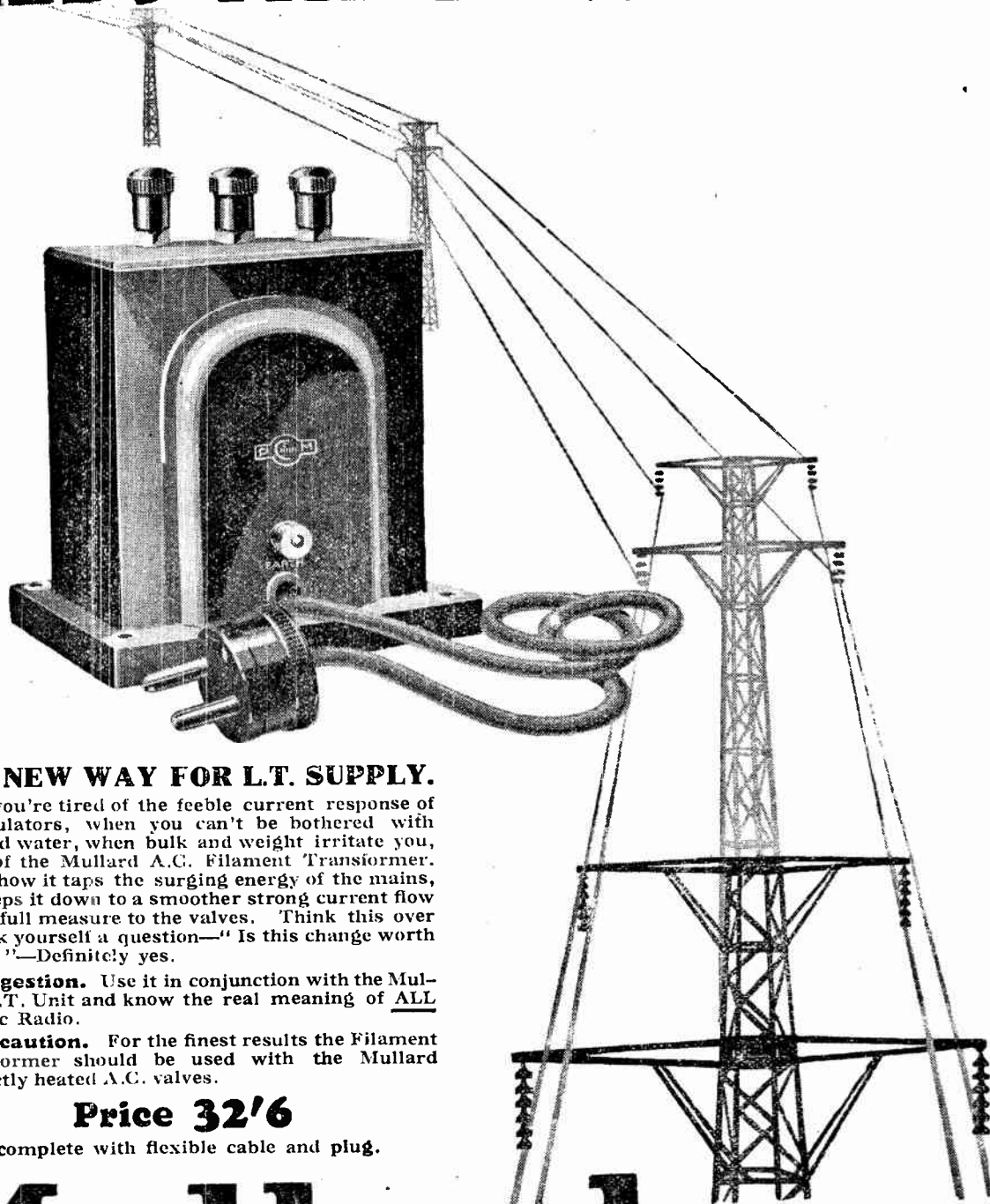
**ASK YOUR RADIO DEALER TO GIVE YOU A COPY OF THE NEW LOTUS CATALOGUE OR SEND DIRECT TO THE MAKERS AND IT WILL COME POST FREE**

## LOTUS COMPONENTS

**GARNETT, WHITELEY & CO., LTD., LOTUS WORKS, LIVERPOOL.**

*Mention of "The Wireless World," when writing to advertisers, will ensure prompt attention.*

# THE POWER STATION FEEDS THE FILAMENT



## THE NEW WAY FOR L.T. SUPPLY.

When you're tired of the feeble current response of accumulators, when you can't be bothered with distilled water, when bulk and weight irritate you, think of the Mullard A.C. Filament Transformer. Think how it taps the surging energy of the mains, and steps it down to a smoother strong current flow giving full measure to the valves. Think this over and ask yourself a question—"Is this change worth while?"—Definitely yes.

- ★ **A Suggestion.** Use it in conjunction with the Mullard H.T. Unit and know the real meaning of ALL Electric Radio.
- ★ **A Precaution.** For the finest results the Filament Transformer should be used with the Mullard indirectly heated A.C. valves.

**Price 32'6**

complete with flexible cable and plug.

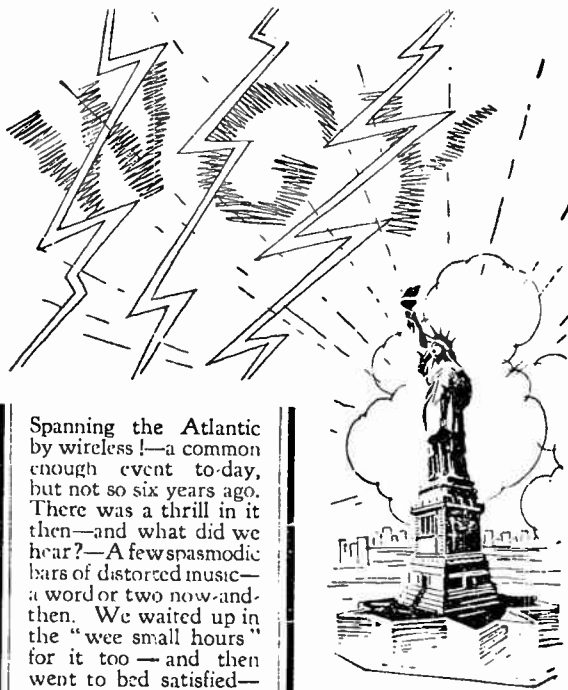
# Mullard

## MASTER · RADIO

*Advt. The Mullard Wireless Service Co., Ltd., Mullard House, Charing Cross Road, London, W.C.2.*

*Advt. Advertisements for "The Wireless World" are only accepted from firms we believe to be thoroughly reliable.*

# DO YOU REMEMBER?

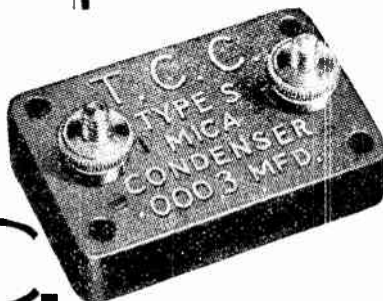


Spanning the Atlantic by wireless!—a common enough event to-day, but not so six years ago. There was a thrill in it then—and what did we hear?—A few spasmodic bars of distorted music—a word or two now-and-then. We waited up in the “wee small hours” for it too—and then went to bed satisfied—we had “got over.”

We marvel to-day that we managed to do anything at all with such elementary gear—it was a good performance for those days, however commonplace it may be now. Many things have changed since then but T.C.C. Condensers were used—as a standard—then, and are still the standard to-day.

Whenever you need a condenser ask for T.C.C.—and be safe.

Here is a .0003 mfd. Mica Condenser Price 1s. 3d. each, other capacities from .0001 to .01 mfd. Prices 1s. 3d. to 2s. 6d.



# T.C.C. CONDENSERS WERE USED THEN

Advn. Telegraph Condenser Co., Ltd., Welles Farm Rd., N. Acton, London, W.3



Mention of “The Wireless World,” when writing to advertisers, will ensure prompt attention.



P.G.F.5 Indicating (as illustrated) 20 a.h. 2v. 11/9

P.G.F.7 Indicating 30 a.h. 2v. 13/9

P.G.5 Non-Indicating 20 a.h. 2v. 9/-

P.G.7 Non-Indicating 30 a.h. 2v. 11/-

P.G.9 Non-Indicating 40 a.h. 2v. 13/-

## Like an Alarm Clock

They give you warning. Peto & Radford P.G.F. Accumulators tell you at a simple glance whether they are charged, half-charged, or run out. Add this handiness to their virtues as batteries, and you will agree that, at 11/9 for a 20 a.h. 2-volt cell, they are the best value on the market.

The Peto & Radford P.G.F. accumulator embodies these further special features. The plates are sturdy. Paste is held by interlocking grids. The lid is of crack-proof, acid-proof Dagenite, hermetically sealed at the edges. Terminals have acid-proof glands, and, because of their different diameters, they cannot be reversed. There is ample acid-room, and plates are held in place by glass keyways in the box.

Like every other P. & R. Battery, the P.G.F. is guaranteed for six months.

Send for particulars of this and other P. & R. Batteries (H.T. included) to

Peto & Radford,  
93, Great Portland Street,  
London, W.1.

(Telephone: Langham 1173.)

Glasgow Depot:  
45, Clyde Place.

# P AND R

London Sales & Repair Depot:  
107a, Plumico Rd.  
S.W.1.

PETO & RADFORD

## ACCUMULATORS

The beginning and the end in

## POWER

W.T.2.

This announcement is issued by  
The National Accumulator Co., Ltd.



# GREAT STUFF THESE BASS NOTES

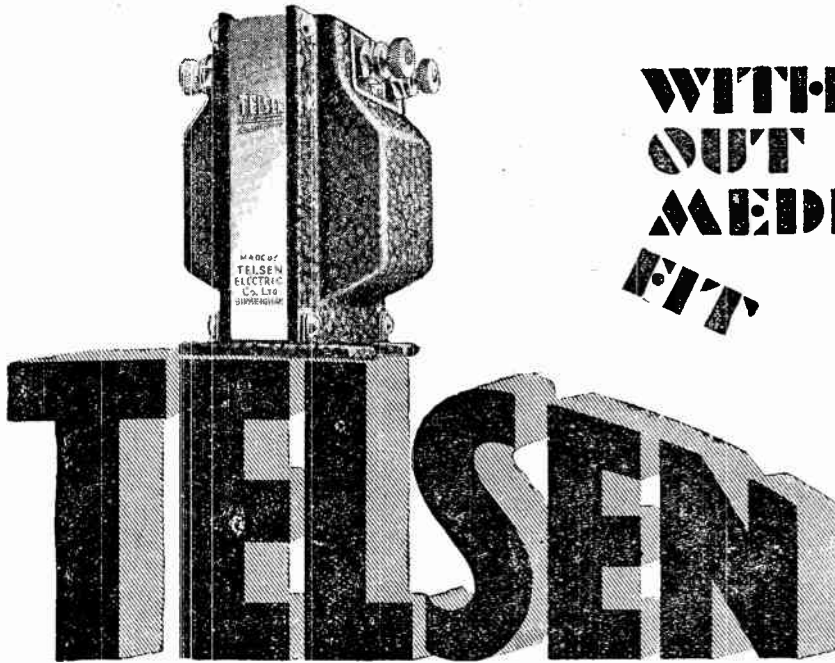


## WITH MELODY OUT OF THE MEDLEY

### FIT

Bass Notes—These being the most difficult notes to record correctly, it is the aim of all Transformer Manufacturers to attain perfect tonal reproduction of these notes; having attained this perfection, the High and Low Notes will also record successfully—providing the Transformer is constructed on sound Transformer Theory—here Telsen Transformers Excel—because we specialise in Transformer construction; we make nothing else; our very lives are steeped in Transformer Manufacturing. Try one now. They are entirely British.

"Radiogram" Model	"Ace" Model
<b>12/6</b>	<b>8/6</b>
Ratios 5—1 and 3—1	Ratios 5—1 and 3—1



# TRANSFORMERS

TELSEN ELECTRIC CO., LTD.

MILLER STREET, BIRMINGHAM.

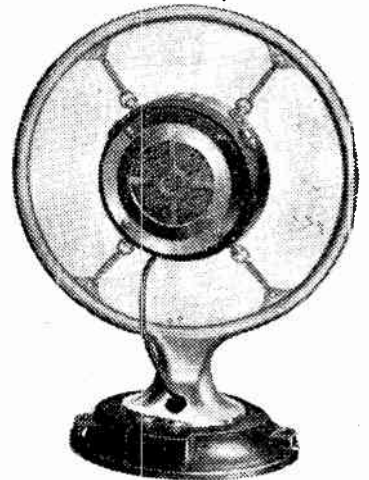
A.D.  
 ▲3 Advertisements for "The Wireless World" are only accepted from firms we believe to be thoroughly reliable.

# EVERY INFLECTION BROADCAST TO PERFECTION WITH

For public address systems, wireless telephony and similar work, this microphone is ideal, as the carbon granules employed are specially selected and meshed.



The instrument is particularly sensitive and has an excellent frequency response curve. It may be used with any suitable amplifier by connecting it in series with a 4 volt battery capable of giving 20 milliamps and the primary of a 1:30 step-up transformer.



Price £6 - 0 - 0

# MICROPHONE

*Your dealer has particulars of the Deferred Payment System.*

Advt. of **EDISWAN RADIO PRODUCTS**  
 The EDISON SWAN ELECTRIC CO., LTD., Head Office & Showrooms Ediswan Radio Division:  
 1a, Newman Street, Oxford Street, W.1. Museum 9801.  
 Incorporating the Wiring Supplies, Lighting Engineering, Refrigeration and Radio Business of the British Thomson-Houston Co., Ltd. SHOWROOMS IN ALL THE PRINCIPAL TOWNS.

W.11

# Get the Best from your Set— only the **GROSVENOR** can do it



The wonderful new Vitalising Element ensures continuous and satisfactory service. No other battery can give you the same service. It's the new Vitalising Element unique to Grosvenor that does it. Fitted by all the Leading Set Makers after the most exhaustive comparative tests, and **PROVED** to be the best.

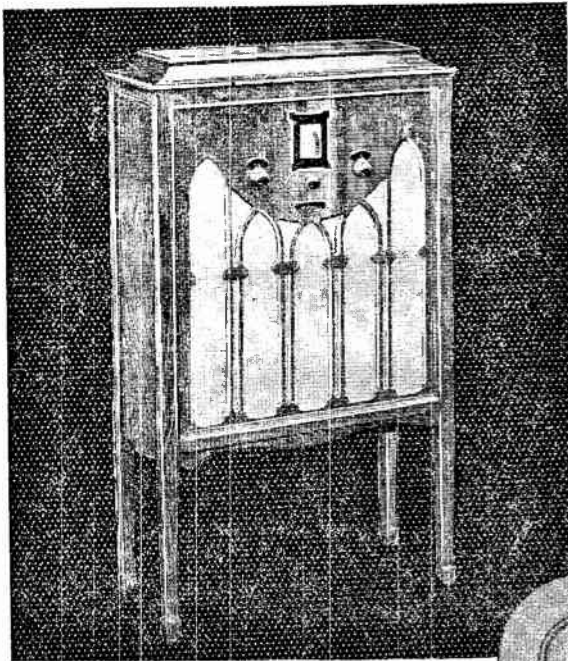
66 v. from 7/6      99 v. from 11/6

**THE GROSVENOR BATTERY Co., Ltd.,**  
 2/3, White Street, Moorgate, LONDON, E.C.2.

PATENTED

# GROSVENOR BRITISH MADE BATTERIES

*Mention of "The Wireless World," when writing to advertisers, will ensure prompt attention.*



# WHY OLYMPIA MARVELLED . . .

ALL POWER  
FROM A.C.  
MAINS

## COMPARE

the following details of the new  
**BURNDEPT A.C. SCREENED  
SEVEN** with anything you saw at Olympia

Enclosed frame aerial rotated without moving the cabinet—2 Screened Grid valves for enormous amplification and selectivity—single switch controls wave lengths 200/550 and 1050/1900 metres—drum control for tuning—L.F. stage and two super power valves connected in push-pull with an anode feed of 8 watts for immense undistorted output—new "Minstrel" double diaphragm loud speaker with balanced armature drive—provision for permanent connection of gramophone pick-up—volume control and dial illumination—and of course all power from A.C. mains for 36 hours on one unit of electricity.

# Burndeft

## A.C. SCREENED SEVEN

*Write for specification and details  
of generous Hire Purchase Terms.*

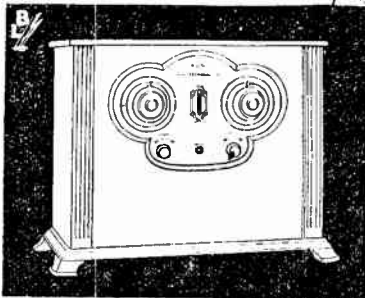
**BURNDEPT WIRELESS (1928) LTD.,**  
19, Eastnor House, Blackheath, S.E.3.



AND COMPARE THE PRICE!

**36 guineas** in oak, **37 guineas** in mahogany! A price which, when taking advantage of our generous hire purchase terms, is well within the reach of those who demand nothing but the very best.

TAKE A SEAT  
IN THE STALLS



THE VOX POPULI  
THREE RUNS OFF  
THE ELECTRIC  
LIGHT

Now let us hear what the Continental stations are offering. What was that Paris Show George was raving about? Give me the wavelength, someone. Just a second and—"Comme j'aime les voix jeunes." Ah, what a sparkling voice! That's Yvonne—hear the famous lisp! We might be sitting in the stalls . . .

The Bowyer-Lowe Screened Vox Populi Three is always like that. Front seats may be reserved for the few, but you can join the select circle without leaving your own fireside. A versatile set, ranging all over Europe for good entertainment. Moderately priced too. And if you prefer you can pay by easy monthly payments.

- List No. 370. Mains Drive D.C. 200-250 volts only . . . . . £28 . 0 . 0
  - List No. 369. Mains Drive A.C. 100-120 or 200-240 volts. 40-100 cycles . . . £33 . 10 . 0
  - List No. 339. battery model £20 . 0 . 0
- All prices include valves and royalty.

Ask your Wireless Dealer about the comprehensive range of Bowyer-Lowe Sets and Components, or write to Headquarters for illustrated literature.

THE  
**BOWYER-LOWE**  
CO., LTD.

in Association with  RecorCapphones Ltd.

London Showrooms:  
ASTOR HOUSE, ALDWYCH, W.C.2  
Head Office and Works:  
RADIO WORKS, LETCHWORTH, HERTS.

**BOTH LOOK  
ALIKE  
BUT ONE LASTS  
LONGER**



Two sweetmeats—both good to eat, both chocolate covered. But one contains a caramel, the other a cream filling. One lasts longer.

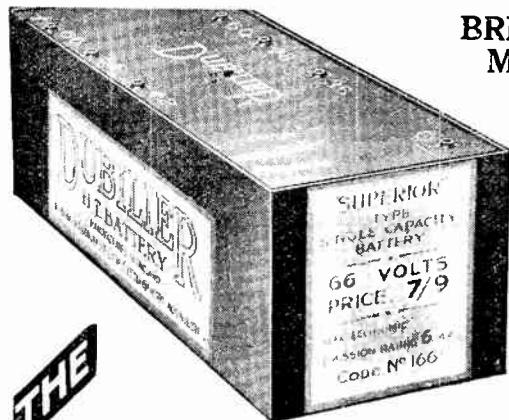
Special chemicals contained in the new Dubilier H.T. Battery make it far more than just another good battery—they make its working life materially longer than that of any other make of similar type. This claim is unquestionable. Read chapter and verse for it in the booklet—"A Bit about a Battery"—obtainable free from your dealer. Prove it by using a Dubilier Battery in your set now.

66 VOLT

7/9

SUPERIOR	
(Single Capacity)	
9 volt . . . . .	1/6
63 " . . . . .	7/6
66 " (with G.B. Tappings) . . . . .	7/11
99 " . . . . .	11/9
108 " . . . . .	12/9
SUPREME	
(Treble Capacity)	
60 volt . . . . .	13/6
63 " . . . . .	14/3
100 " . . . . .	22/-

BRITISH  
MADE.



LONGER  
LIFE AT  
LOWER  
COST.

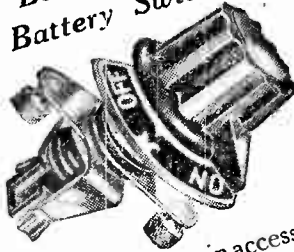
THE  
**DUBILIER  
BATTERY**

DUBILIER CONDENSER CO. (1925), LTD., Ducon Works,  
Victoria Road, North Acton, London, W.3.

Mention of "The Wireless World," when writing to advertisers, will ensure prompt attention.

# THE SWITCH that "TURNS" OFF THE SET

The Benjamin Rotary  
Battery Switch



This is a new Benjamin accessory offering a pleasant alternative to the usual pull and push type of switch. It is all insulated and has an indicating "on" and "off" dial, pointer knob, terminals and double contact. It gives a quick and positive make and break action, and is suitable for use with panels up to 3/8 inch thickness. You will see this component featured on quite a number of sets this season—ask to see it at your dealers and you will realize why.

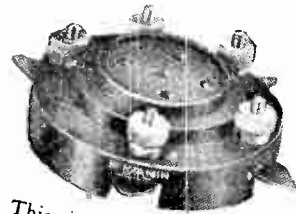
Price  
**1/9**  
each

**EXPERIENCE**, backed by  
4,000,000 sales, says:—

**"TO GET BETTER RESULTS  
BETTER GET BENJAMIN"**

# DOES THAT CIRCUIT CALL FOR A 5-PIN VALVE?

Here's the Valveholder  
for it—



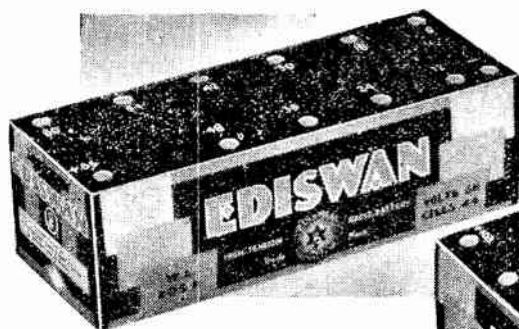
This is a new Benjamin product—a Valve-holder designed expressly for use with all 5-Pin Valves with centre leg connection. The well-known Benjamin anti-microphonic feature is incorporated, and also patented contact, which ensures perfect connection when using either split or solid pin Valves. The pin sockets are in standard positions, enabling the 5-Pin holder to accommodate, if necessary, the ordinary 4-Pin Valve.

Price  
**1/9**  
each

# BENJAMIN RADIO PRODUCTS

THE BENJAMIN ELECTRIC LTD., BRANTWOOD WORKS, TOTTENHAM, LONDON, N.17

*Write for leaflets giving full details of the new Benjamin components, which include a Ball Bearing Turntable (with folding legs) and a Pentode Valveholder.*



*Keep H.T.*  
**MAINTENANCE**  
*down to a*  
**MINIMUM!**

Used by the thriftiest set owners, moderate in first cost and giving better service over longer periods, EDISWAN H.T. BATTERIES have set up a new standard of Radio battery performance.

Ask your dealer for them

IF IT'S

**EDISWAN**

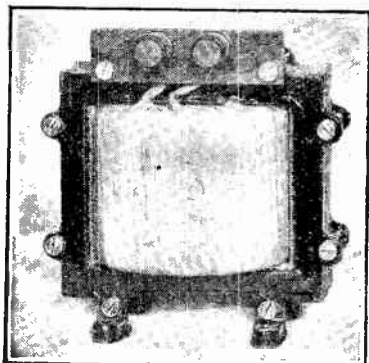
IT'S BETTER

The EDISON SWAN ELECTRIC CO., LTD.  
 123/5 Queen Victoria Street, London, E.C.4.  
 Showrooms and Trade Counters in all the Principal Towns.

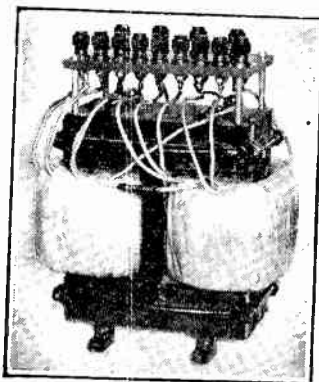


B.14

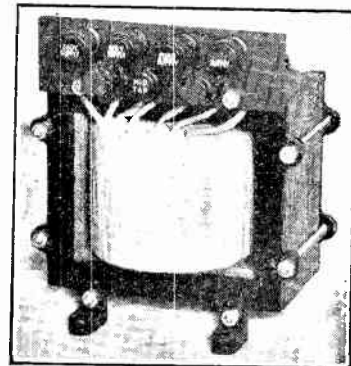
**Superior A.C. POWER TRANSFORMERS**  
 and **CHOKES** for the MAINS from 35/- each  
 for ALL INPUTS and OUTPUTS.



**SPECIAL  
 INTERVALVE  
 TRANSFORMERS  
 15/- EACH.**



*Special Quotations for Gramophone Radio and  
 Public Address Smoothing Chokes on application.*



**WILLIAM BAYLISS LTD.,** Sheepcote Street, BIRMINGHAM.  
 Telephone: Mid. 1409.      Telegrams: "Drawbench, B'ham."

*Mention of "The Wireless World," when writing to advertisers, will ensure prompt attention.*

# THE OUTSTANDING FEATURE AT OLYMPIA!

**D**ID you have the opportunity of hearing the wonderful quality of reproduction at our demonstration held in the Showrooms of the Olympia Motor Company facing the Exhibition?

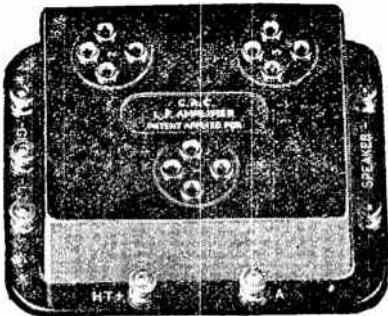
If so, you could not fail to have been impressed with the exceptional brilliance of tone and the perfect fidelity of every note. Thousands of visitors expressed their appreciation—and indeed their amazement—of the wonderful results we have attained; results absolutely unequalled by any other instrument not employing our patents:

**Yet the complete Amplifier weighs only 10 ozs. and measures only 5½" × 4½" × 1¾" high!**

The secret of the wonderful quality of reproduction lies in the method of amplification employed exclusively by us and which entirely supersedes any other known method, known as

## THE "C.A.C." LOW FREQUENCY COUPLER

The Heart and Soul of Every Perfect Radio Receiver or Radio-Gramophone!



**A**LL G.R.A. Instruments, from the small battery-fed Receiver to the powerful Cinema Talking Film apparatus installed in many Theatres throughout the country, embody exclusively this Low Frequency Coupler as the sole method of amplification.

The chief disadvantage of present-day Low Frequency Transformer Couplings is that the iron core militates against consistency of impedance in the plate circuit. It is admitted, of course, that through skilful design and manufacture a Low Frequency Transformer can be produced to give fairly constant amplification within the normal acoustical range, but falling-off of response is generally apparent at either extremity, particularly as regards the lower frequencies.

On the other hand, a Resistance-Capacity Coupling is adversely affected by the fact that the impedance of the Condenser coupling the two valves varies with the frequency, and this, combined with the value of the anode resistance used, restricts the band of frequencies accommodated by the particular combination of resistance and capacity used.

In this Coupler, however, no iron core is used, but, basically, two highly inductive windings with a minimum of self-capacity are so arranged that one end of the primary winding is connected to the anode of the first valve and the other to the source of high tension supply. The secondary winding is connected between the grid of the second valve and the battery used for applying a negative grid-bias to the second valve. Between the ends of the primary and secondary windings connected to the anode of the first valve and the grid of the second valve respectively, is placed a condenser of relatively small capacity. The secondary has more turns than the primary, whereby a step-up transformer effect is obtained and the condenser is so proportioned as to provide a leakage path for any peak voltages which may develop in either winding. This, together with the absence of iron core, avoids electrical resonance and background noises, whilst the high resistance of the primary limits the anode current of the first valve and thus avoids parasitic Low Frequency oscillations.

With this form of Coupling a very high degree of amplification may be obtained through a number of stages, the amplification still being substantially constant over the whole acoustical range.

### PRICES:

Two-stage .. .. . 35/-  
 Three-stage .. .. . 52/6

### ALL-MAINS TYPES:

Two-stage .. .. . 45/-  
 Three-stage .. .. . 60/-

Guaranteed for 2 Years.

### Are You Desirous of Building a Perfect Electrical Reproducing Gramophone?

**W**E have sold thousands of these Couplers as a result of our Olympia Demonstrations, for not only do they give results which cannot be hoped for by any other method, but the actual construction of such an instrument is simplicity itself by the use of this Component. We invite all those interested to write us, stating their requirements, and our technical department will gladly supply free wiring diagrams and advice. When writing, state whether battery-fed or all-mains models are desired, and if the latter, whether A.C. or D.C. mains are available, and the voltage of same.

We cordially invite all those interested in Perfect Musical Reproduction to hear this wonderful coupler under working conditions at our address below.

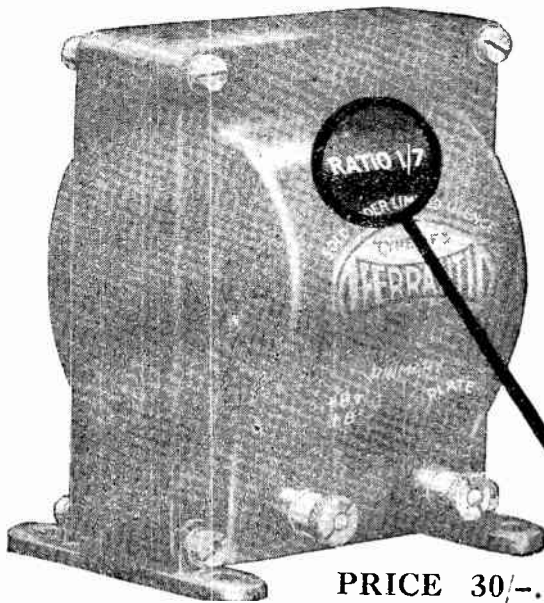
**GRAMO-RADIO AMPLIFIERS, LIMITED**  
 1a, NEW LONDON STREET, LONDON, E.C.3.

(Facing Fenchurch Street Station)

'Phone: Royal 4300.

FOREIGN AGENTS WANTED.

# A NEW TRANSFORMER



PRICE 30/-.

## ANOTHER LEAD BY FERRANTI

Recent developments in Radio have created a demand for a new transformer of the same quality and reliability as the AF5, but capable of greater L.F. amplification. In their class of medium ratio, the Ferranti AF3, AF4 and AF5 are still supreme: but changed conditions—notably the advent of the Screened Grid Valve—have rendered this a necessary addition to the standard range.

### THE AF5, RATIO 1/7.

Designed to ensure the maximum volume where only ONE L.F. stage is employed with Grid Leak rectification. It is particularly suitable for sets of the S.G.3 type, where greater amplification is desired than is usually obtained from one L.F. stage. The new ratio is not intended for use in receivers employing more than ONE stage of L.F.

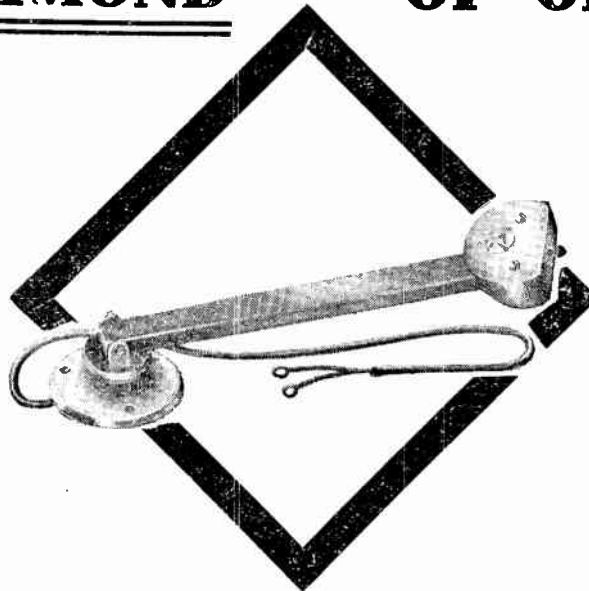
FERRANTI Ltd. HOLLINWOOD LANCASHIRE

# FERRANTI

## The "DIAMOND OF OLYMPIA"

### The R.G.D. Magnetic Pick Up

The R.G.D. Magnetic Pick Up, as used in the R.G.D. Radiogramophone. No record wear, perfect tracking, a scientific instrument specially developed for moving coil speaker reproduction.



The Enthusiasm for this New Pick Up at Olympia should be shared by Manchester Listeners



In oxidised SILVER  
£3 - 3 - 0.

In bronze  
£3 - 0 - 0

Literature on application

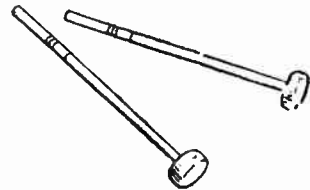
The **RADIO GRAMOPHONE DEVELOPMENT Co.,**  
ST. PETER'S PLACE, BROAD ST., BIRMINGHAM.

Mention of "The Wireless World," when writing to advertisers, will ensure prompt attention.





# THE DRUMMER FINDS HIS STICKS



**YOU** hear so little of the drums in ordinary loud speaker reproduction that the drummer might as well have no sticks! But . . . now there is a loud speaker that does *not* cheat you of half the broadcast. It finds the missing drumsticks. It reveals instruments hitherto silent. It reproduces notes you've never heard before. It is the new Brown Duplex Loud Speaker.

If you want to hear the broadcast in your home as it is played in the studio, buy a Brown Duplex Loud Speaker. In no other speaker will you find the features which are responsible for such amazingly realistic reproduction. Only the wonderful "Vec" movement and the new Duplex cone can give a tone that is so much sweeter and more mellow and a volume that is so much richer and more magnificent. Ask any Wireless Dealer!

**THROUGH THE WONDERFUL**

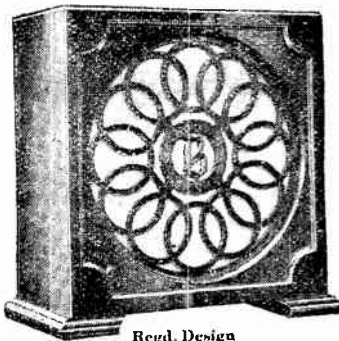
**NEW**

**IN THREE MODELS:**

*Design as illustrated. Mahogany or Oak.*

**V10 £5 10s. V12 £7 10s. V15 £12 10s.**

*Obtainable by easy payments. Ask your Dealers.*



Regd. Design

# Brown

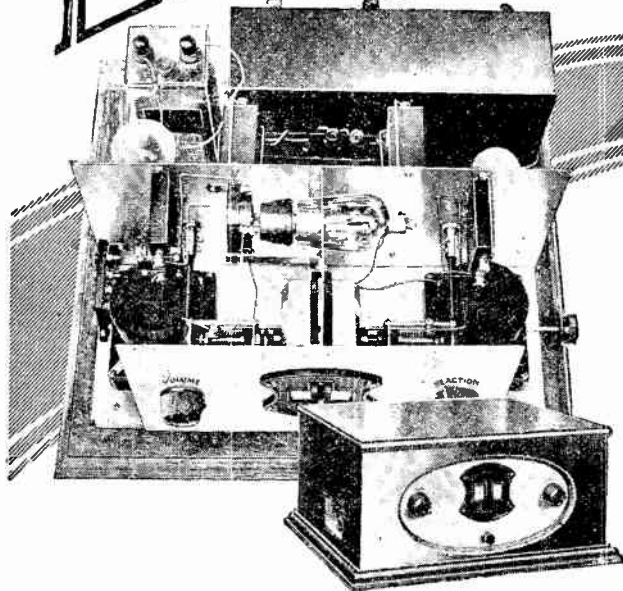
## DUPLEX LOUD SPEAKER

Adv. S. G. Brown, Ltd., Western Ave., N. Acton, London, W.3.

8476 

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**Start Building this LOTUS set To-day!**



Set builders—build and own the very latest radio development, the new 3-valve Lotus S.G.P. set. You can buy the kit for it and assemble it in a few hours and demonstrate to your friends the greatest range, power and selectivity of any set of the season. Start building the new Lotus S.G.P. to-day. The kit contains every unit you need except valves, cabinet and batteries, and can be bought at your nearest retailer's for the modest sum of £7-12-6. Diagrams and full instructions are enclosed.

# LOTUS

## 3-valve S.G.P. Set

Supplied with main components mounted and ready for immediate assembling. Prepared by the makers of Lotus components, Garnett, Whiteley and Co., Ltd., Lotus Works, Liverpool.

**Send this coupon now!**

To Garnett, Whiteley & Co., Ltd.,  
Lotus Works, Liverpool.

Please send me free copies of the latest Lotus booklets and instructions for building the Lotus 3-valve S.G.P. set.

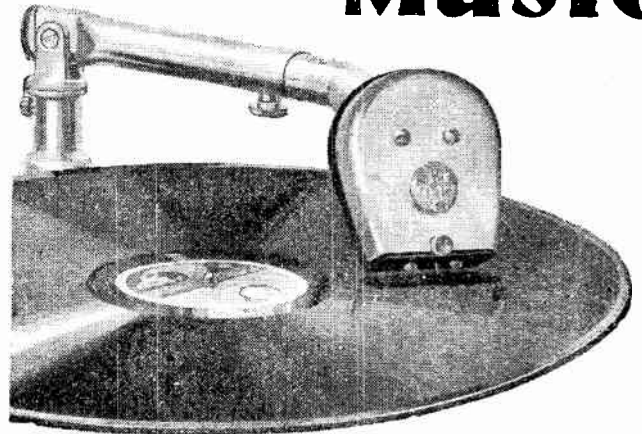
Name .....

Address .....

W.W. 9, 10 29.

Caution.

# MORE MUSIC



## .. LESS WEAR

This spring-balanced tone arm is so wonderfully designed that 97% correct tracking is obtained while there is absolutely correct needle weight on the record

Extremely sensitive and thoroughly reliable, the pick-up gives faithful reproduction over an astonishingly wide range of musical frequencies.

This instrument has been adopted as standard by many of the leading gramophone manufacturers.

**EDISWAN RADIO PRODUCTS**

PRICE

**45/-**

COMPLETE



W.10

## PICK-UP & TONE ARM

Your dealer has particulars of the Deferred Payment System.

Advt. of The EDISON SWAN ELECTRIC CO., LTD.,

Incorporating the Wiring Supplies, Lighting Engineering, Refrigeration and Radio Business of the British Thomson-Houston Co., Ltd.

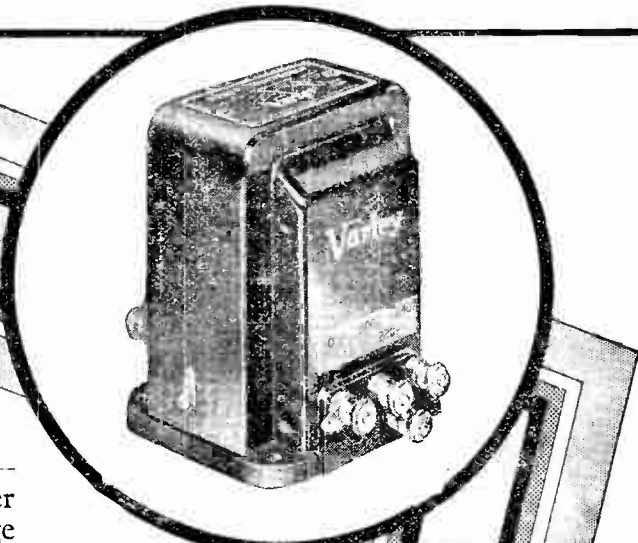
Head Office Edison Radio Division and West-End Showrooms:  
1a, NEWMAN STREET, OXFORD STREET W.1.

SHOWROOMS IN ALL THE PRINCIPAL TOWNS.

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# VARLEY

for RECTIFIER TRANSFORMERS



Experience in the designing of coils—and its many applications—for Power Work is the essential of good voltage regulation, and good voltage regulation is in turn the hallmark of the efficient Power Transformer.

Our experience in this particular work—extending over a period of some thirty years—has placed us in a unique position, and we have achieved a notable success in the power Transformers for Westinghouse Metal Rectifiers, Igranic-Elkon Rectifiers, and Thermionic Valve Rectifiers now being marketed.

Write for Section E of the Varley Catalogue.

**FOR WESTINGHOUSE METAL RECTIFIERS.**

- EP1 For H.T.1 Rectifiers .. .. £1 . 5 . 0
- EP2 For H.T.3 and H.T.4 Rectifiers .. 1 . 5 . 0
- EP3 For L.T. Rectifiers .. .. 1 . 5 . 0
- EP6 Multi-Volt Transformer (50 Watts) 2 . 5 . 0

**FOR IGRANIC-ELKON METAL RECTIFIERS.**

- EP4 For H.T. Rectifier .. .. 1 . 5 . 0
- EP5 For L.T. Rectifier .. .. 1 . 5 . 0

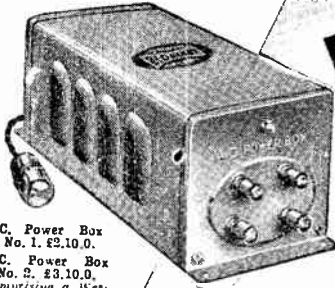
**FOR VALVE RECTIFIERS.**

- EP7 Multi-Volt Transformer (50 Watts) 2 . 10 . 0
- EP8 Multi-Volt Transformer (120 Watts) 3 . 10 . 0

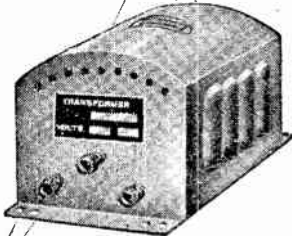
Full particulars of all models on application.



# Build your own MAINS UNIT



A.C. Power Box  
No. 1. £2.10.0.  
A.C. Power Box  
No. 2. £3.10.0.  
Comprising a Westinghouse Metal Rectifier and a Regentone Transformer.



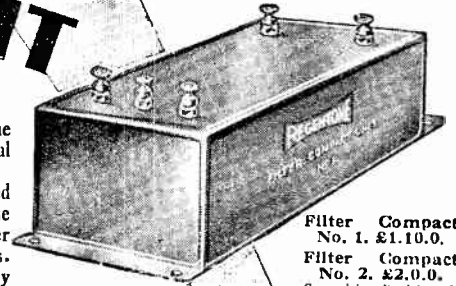
Full range of  
Power Trans-  
formers and  
Power Chokes.

For sturdy dependability you cannot beat Regentone products, absolutely trouble-free, simple and economical to use, and efficient and reliable in the using. All Regentone products are British made, and guaranteed for 12 months. This guarantee covers the Westinghouse Metal Rectifier incorporated in all A.C. Models, whether complete Receivers, Mains Units, or Mains Components. Build with Regentone Components, and combine efficiency with that latitude of application which is the ideal of every real radio enthusiast.

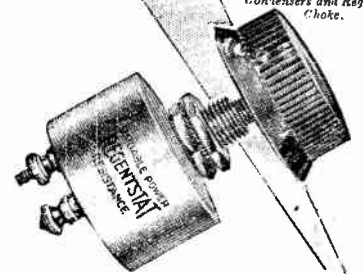
Our new ART BOOKLET contains interesting information on 'Radio from the Mains'—write for free copy.



for RADIO FROM THE MAINS



Filter Compact  
No. 1. £1.10.0.  
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No. 2. £2.0.0.  
Comprising British made  
Condensers and Regentone  
Choke.



The  
"Regentstat"  
The All-in-One Radio  
Resistance.  
7/9.

REGENT RADIO SUPPLY CO. 21, Bartlett's Bldgs, Holborn, Circus, London, E.C.4. PHONE CENTRAL 3681

## HOW TO BUILD AND OPERATE

### The Wireless AND RADIO REVIEW World

## MOVING COIL LOUDSPEAKER

(as described in "The Wireless World")

Complete  
Constructional Details  
and Dimensional  
Drawings

By F. H. HAYNES

Assistant Editor: "THE WIRELESS WORLD."

Second Edition, Revised.

WITH the moving coil type of loudspeaker the most faithful reproduction can be obtained. This booklet gives complete instructions for building an instrument, at a moderate cost, whose output is suited to home conditions. The design has been developed to form a standard for amateur workers, as, when once adopted, the dimensions cannot easily be modified.

Price 1/8 post free.

From the offices of "THE WIRELESS WORLD,"  
Dorset House Tudor Street, London, E.C.4.

W.W.70

## Expectations Surpassed!

Recent advertisers in "The Wireless World" write as follows:

"We would like to take this opportunity of assuring you of our faith in the results of advertising in 'The Wireless World.' We have inserted advertisements in several journals from time to time, but 'The Wireless World' was the only one which we can say achieved results. The replies received from the advertisements in your journal surpassed even our expectations, and consequently we have decided to advertise in no other wireless paper in the future."

MARSH & WRIGHT,  
10-15, Victoria Street,  
WEYMOUTH.

W.W.80.

Mention of "The Wireless World," when writing to advertisers, will ensure prompt attention.

# BLUE SPOT 99—£4:4:0

The Blue Spot 99 is all that a speaker should be. It is good to look upon—it is faithful in its every tone—it talks and sings and plays to you with a fidelity that only Blue Spot could ever produce. And at four guineas you are getting a speaker that you will proudly show to your friends as your latest acquisition. Hear it first at your dealer's.

*Driven by Blue Spot 66K, the finest speaker unit produced.*



**BLUE SPOT, STAND 30.**  
Manchester Radio Exhibition,  
CITY HALL. OCTOBER 16th-26th.

**F. A. HUGHES & CO., LIMITED, 204-6, Great Portland Street, London, W.1**

Phone: Museum 8630 (1 line).

Distributors for Northern England, Scotland, and North Wales: H. C. RAWSON (SHEFFIELD & LONDON) LTD., 100, LONDON ROAD, SHEFFIELD. Phone: Sheffield 26006; 22, ST. MARY'S PARSONAGE, MANCHESTER. Phone: Manchester City 3329.

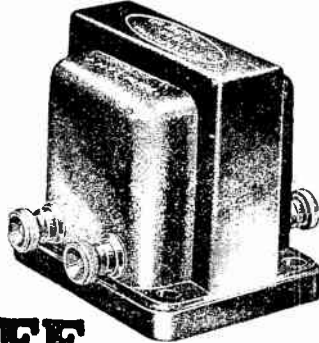
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# BE SURE SEE THAT IT IS A BurTON COMPONENT

The BurTON Transformer has been designed with the same care and precision as its fellow Components, and will be found to give perfect rendering of all Bass notes, which is a most important feature of all Transformer construction; try one now and notice the perfect rendering of all notes throughout the musical score.

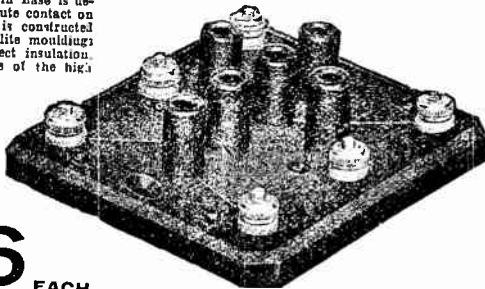
PRICE

**10/6**  
EACH



## BE SAFE

The BurTON Six Pin Base is designed to give absolute contact on all six points and is constructed with genuine Bakelite mouldings which ensure perfect insulation. This is an example of the high standard of perfection attained and the low prices of BurTON products. It is built to give the utmost efficiency.



PRICE

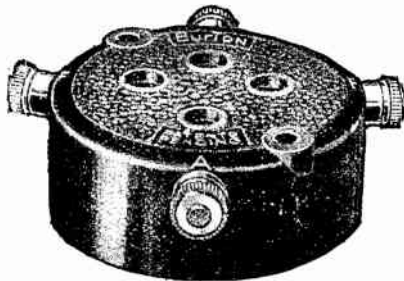
**1/6**  
EACH

## BE CERTAIN

The BurTON Valve Holder is unique in construction; it gives the effect of a Floating Action to your Valves, thus prolonging the life of your Set. It has four Floating Points, has no Rigidity, and gives prolonged life to your Valves.

PRICE

**1/-**  
EACH



ASK YOUR DEALER FOR FULL DETAILS

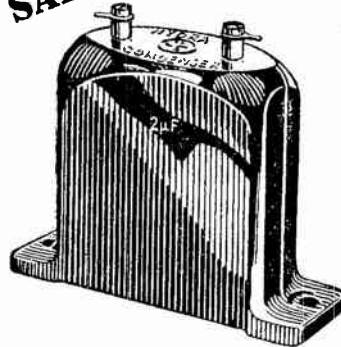


C.F. & H. BURTON, Progress Works, WALSALL, ENG.

# HYDRA alone makes "all-from-the Mains Radio"

**SAFE & SURE & SATISFACTORY!**

Buy an eliminator that incorporates HYDRA, and you can be sure the maker "knows his job" — knows that HYDRA are the condensers that make all-from-the-mains radio a practicable proposition.



You will get smooth, silent current, you will get accuracy and above all you will be sure of safety if you insist upon seeing HYDRA condensers in your eliminator.

**BEFORE YOU BUY  
AN ELIMINATOR  
ASK**

**"HAS IT GOT HYDRA  
CONDENSERS?"**

Write for names of manufacturers who standardise HYDRA in their Mains Units.

LOUIS HOLZMAN, 37, Newman St., London, W.1  
TELEPHONE MUSEUM 2641.

# ELECTRAD TRUVOLT

**All Wire Resistances**



Truvolt all wire variable resistances simplify the construction of H.T. eliminators. The contact arm glides endwise over the resistance wire giving unusually fine regulation. Truvolt variable resistances are designed for single hole mounting.

There are 22 stock resistance sizes each rated at 25 watts. Prices 12/6 each.

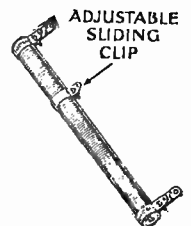
Electrad also makes a range of air cooled fixed resistances rated at 25, 50 and 75 watts.

Don't compromise with cheap imitations — Buy the original —

WRITE FOR FULL DETAILS

**THE ROTHERMEL CORPORATION LTD.,  
24 Maddox Street, London, W.1.**

'Phone: Mayfair 0578/9.



EVERYTHING

The  
**G.E.C.**  
your guarantee

ELECTRICAL

# IF YOU COULD SEE

the NEW "OSRAM MUSIC MAGNET" you would realise at once what a wonderful wireless engineering job it is.

# SO WHY NOT

WRITE for Instruction Chart which gives full particulars of how to assemble the parts, and results that have been obtained in areas up and down the country.



**PRICE COMPLETE**  
with OSRAM VALVES, GECOPHONE components and polished heavy oak constructors' cabinet, **£9**

The New

# Osram MUSIC MAGNET

MADE IN ENGLAND

Sold by all Wireless Dealers

## 6 MAGNETS

1. Single tuning control.
2. No changing of coils.
3. No soldering.
4. The simplest to assemble.
5. Widest possible choice of stations.
6. No aerial oscillation.

*The finest home constructors' proposition ever put before the public.*

### WRITE for INSTRUCTION CHART

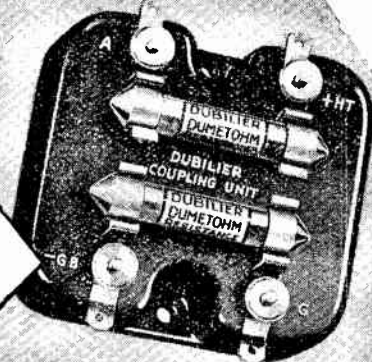
**SENT POST FREE**

This will tell you how to assemble the NEW "OSRAM MUSIC MAGNET." Gives details of stations received in areas up and down the country where stations have hitherto been difficult or impossible to tune in.

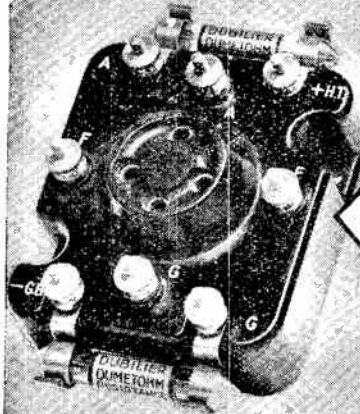
SEND A POSTCARD TO-DAY.

Advt. of The General Electric Co., Ltd., Magnet House, Kingsway, London, W.C. 2.

# DUBILIER FOR DURABILITY



R.C. COUPLING UNIT. Complete with Dumetohms. 7/-



COMBINED R.C. COUPLING UNIT AND VALVE HOLDER. Complete with Dumetohms 8/6

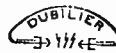


H.F. CHOKE. Four Types to meet all uses. Each 4/6

If obtainable from your dealer, write direct to us giving his name and address.

# DUBILIER RADIO PRODUCTS

Have you got the Booklet—"A Bit about a Battery." If not, ask your local dealer for a copy.



Dubilier Condenser Co. (1925) Ltd., Ducon Works, Victoria Road, N. Acton, London, W.3.

BC 251/C

# New Filaments New Types Greater Emission Longer Life



**FULLY GUARANTEED**

<b>5/6</b>	UNIVERSAL	<b>SUPER POWER</b>	<b>7/6</b>
<b>TWO VOLT</b>		<b>FOUR VOLT</b>	
Universal	- 1 amp. 5/6	Universal	- 0.75 amp. 5/6
Resistor	- 1 amp. 5/6	Resistor	- 0.75 amp. 5/6
Super H.F.	- 15 amp. 7/6	Super H.F.	- 1 amp. 7/6
Hyper-Power	- 3 amp. 9/6	Hyper-Power	- 15 amp. 9/6
Pentodion	- 3 amp. 18/6	Pentodion	- 15 amp. 18/6

WRITE FOR DARIO FOLDER!

## MANCHESTER RADIO EXHIBITION, Stand 107 Gallery.

The New Dario Valves are even better! New non-microphonic filaments of greater strength, longer life and higher emission! New bulbs together with the special milled base - for an easier grip! New internal construction! New low prices! Because of these improvements and because of these low prices Dario Valves have come to be known as the low-priced guaranteed favourites. When next you require a valve—change to Dario!



Best way to all Stations

From your Dealer or direct  
**IMPEX ELECTRICAL, LTD.,**  
 (Dept. C.), 538, High Road, Leytonstone, London, E.11.

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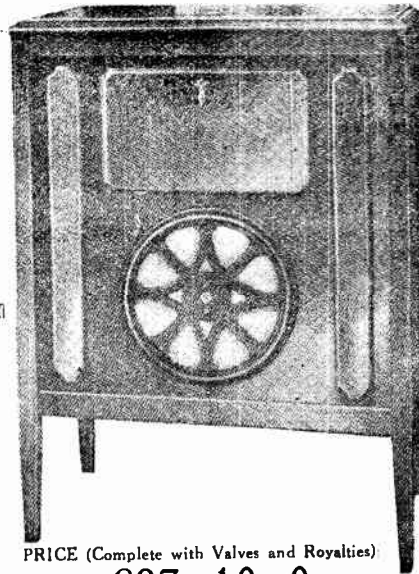




# OUR HIGHEST EXPECTATIONS OF SALES AT OLYMPIA WERE EXCEEDED ON THE 1st DAY WITH THIS SET

We are able to announce to our Northern Friends: This Silver Ghost wonder All Mains Set will be at the Manchester Radio Exhibition on Messrs. Houghton Butcher & Co.'s Stand No. 82, and extensions to our Factory will now enable us to cope with all demands.

The **SILVER GHOST**  
**ALL MAINS**



**SCREEN GRID**  
**3**  
**NO BATTERIES**  
**NO TROUBLE**

## THE LAMPLUGH RANGE :

- Radio Gramophones from £35-15
- All Mains "3" from £19-10
- The Popular "2" £4-2-6
- Silver Ghost Portables and Transportables.
- Silver Ghost Screened Grid "3," illustrated. Table Model - £10-10
- Reproducers - from £2-15

PRICE (Complete with Valves and Royalties)

**£27 : 10 : 0**

This Receiver has been specially designed to operate direct off A.C. (Alternating Current) Mains; no batteries are used, thus cutting out the trouble of charging accumulators and run down H.T. Batteries; moreover the receiver is far more powerful, resulting in additional quality of Loudspeaker reproduction. The circuit arrangement consists of the very latest type of High Frequency Amplifying Valve, ensuring long distance reception of numerous stations. It is absolutely safe, every precaution having been taken, and it is built to conform with I.E.E. Rules concerning such apparatus. Every component used is individually tested and is of the highest insulation and quality, ensuring freedom from breakdown. This receiver is built into a Console Cabinet containing a Balanced Armature Speaker of latest design. The Cabinet work is massive and of the usual Lamplugh finish. This Receiver is capable of giving Quality Loudspeaker reception from several Home and Continental Stations. Must be heard to be appreciated.  
*Supplied in Oak or Mahogany.*

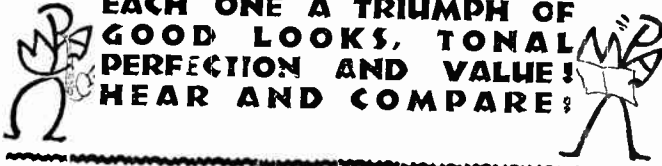
Send for  
Literature and  
the name of our  
nearest agent.

# LAMPLUGH QUALITY-BUILT RECEIVERS

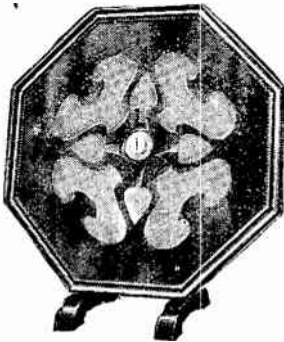
**S. A. LAMPLUGH LTD.,** Dept. WW,  
Kings Road, Tyseley, Birmingham.

# TAKE YOUR CHOICE

M.P.A. RESEARCH DEPARTMENT OFFERS YOU THESE 3 NEW M.P.A. SPEAKERS. SCIENTIFIC MASTERPIECES! EACH ONE A TRIUMPH OF GOOD LOOKS, TONAL PERFECTION AND VALUE! HEAR AND COMPARE!



## THE NEW M.P.A. POPULAR PLAQUE

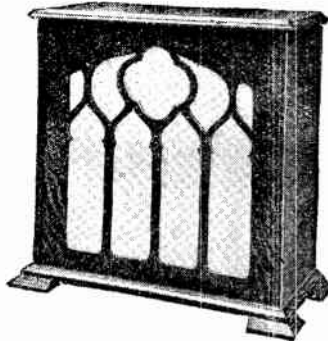


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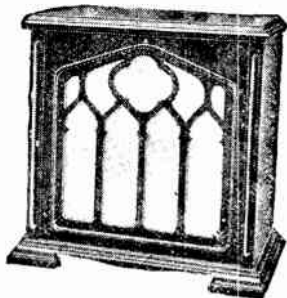
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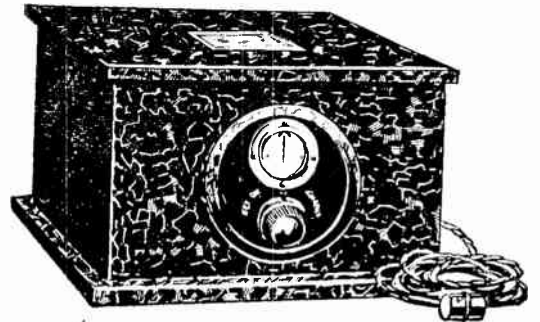


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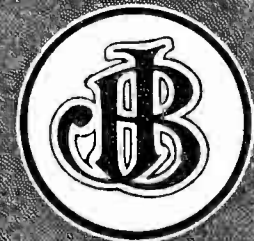
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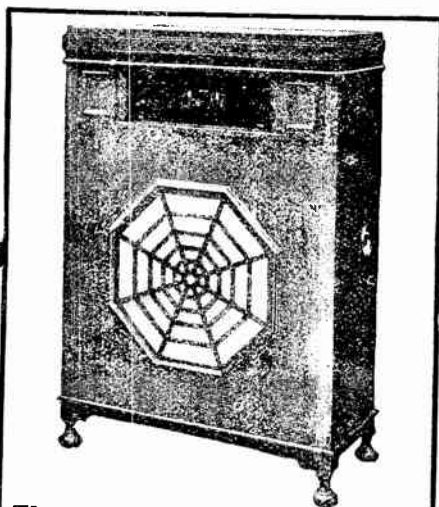
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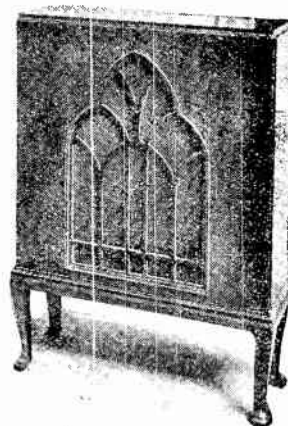


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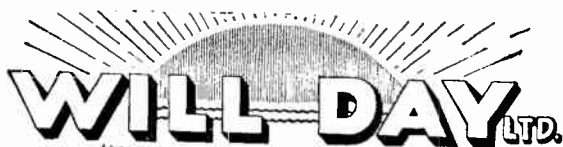
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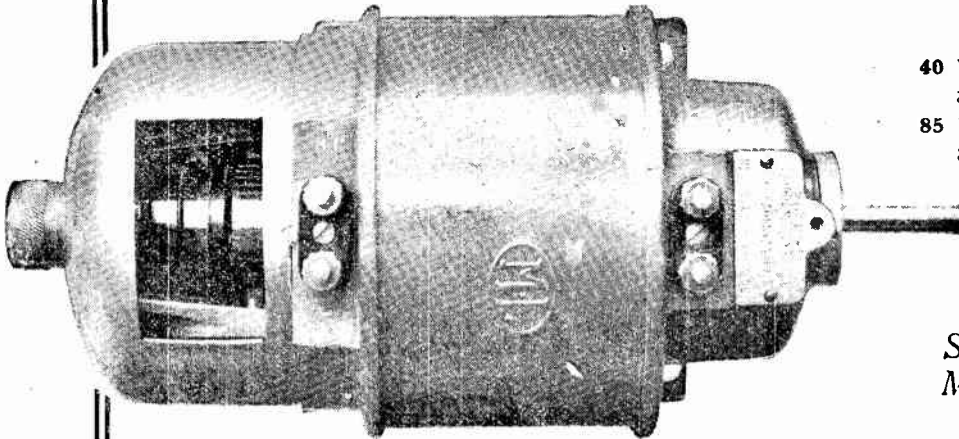
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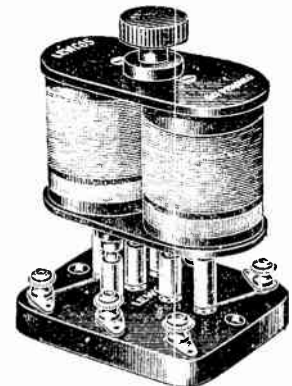
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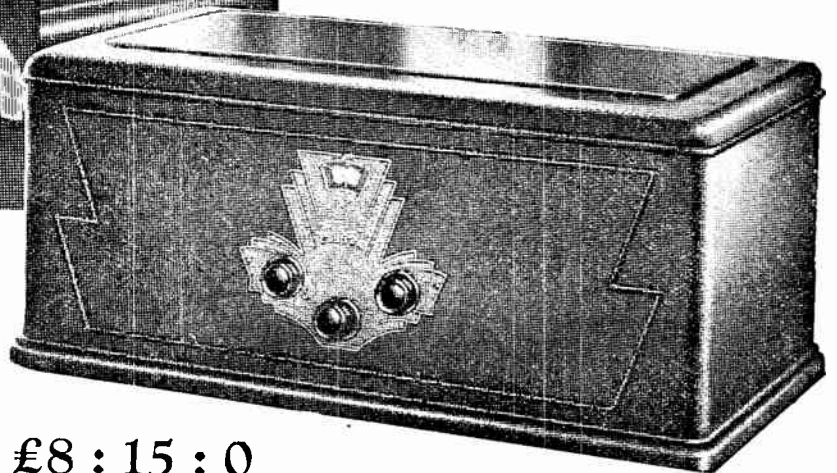
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AND  
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## TELEVISION.

THE past week has seen the inauguration of experimental transmissions of the Baird system of television from the B.B.C. London station, 2LO, but the number of people who are the wiser now that these transmissions have begun is very limited indeed, and the whole position appears to us to be so absurd that we wonder whether the inauguration of these experiments is really intended to be taken seriously or not. Those who have witnessed Baird television demonstrations in the past will know that only two or three people can "look in" at a time to one instrument, and there are, we understand, at the very most half a dozen instruments set up in this country to receive the B.B.C. transmissions. Add to this the fact that the transmissions are being conducted at 11 o'clock in the forenoon—a time when very few of those likely to be interested in the development of television are able to avail themselves of the transmissions—and we have altogether a collection of very good reasons why tele-

vision is not likely to make much progress in this country at present.

The Baird Company are not at present undertaking to manufacture television receiving sets; their object appears to be to endeavour to establish a patent situation under which they license radio manufacturers generally and draw royalties on every receiver sold. This is no doubt a policy which it is thought will, in the end, be to the advantage of the Baird Television Company's shareholders, but in the meantime manufacturers are, quite naturally, in no hurry to sign a licensing agreement which will presumably tie them up to paying royalties over a period, whether or not they may be dependent on Baird patents in the manufacture of receivers. The only way in which we can foresee success attending the efforts to launch television is if these efforts are wholehearted, and there is a genuine endeavour made to rouse enthusiasm on all sides. The Baird Company will gain nothing by stifling the project at the outset because they desire to guarantee their own participation in the financial gain which may accrue, neither can we expect any headway to be made so long as the B.B.C. conduct the experimental transmissions at a time when the amateurs and experimenters who are most likely to provide the enthusiasm needed to carry the thing through are unable to participate in the tests. It would be far better that the transmissions, or at least some part of the transmissions, should take place in the evenings or over week-ends, for that is the only way in which publicity amongst enthusiasts can be attained and when it will become possible for them to co-operate in the experimental transmissions and probe the possibilities of the system.

□□□□

## OLYMPIA SHOW COMPETITION.

AT the time of writing, a few days still remain before the entry forms for *The Wireless World* Olympia Show Competition are due to be received, but already a large number of early entries are reaching us. We anticipate that it will not be possible to announce the result of the ballot for two or three weeks, owing to the time required in the task of sorting out the votes and ascertaining the winners in each class.

Meanwhile, we hope that every reader has participated in the ballot by completing an entry form to send us. As soon as results are known they will be announced in *The Wireless World*, and the prizes will be awarded, whilst the winning apparatus will be reviewed in the pages of this journal.

# TRANSMITTING ON ULTRA-SHORT WAVES

By R. L. SMITH-ROSE, D.Sc., Ph.D.,  
A.M.I.E.E., and J. S. McPETRIE, B.Sc.



## Experimental Transmitting Apparatus for Wavelengths below 10 Metres.

**A**LTHOUGH it has been possible for some time past to generate on a laboratory scale oscillations of a frequency corresponding to wavelengths below 10 metres, the introduction of such wavelengths into commercial communication is taking place very slowly. This is partly due to difficulties in the technique of generation with appreciable power and the construction of sufficiently sensitive receivers, and partly to the very limited range which can be obtained in the transmission of such waves directly along the ground. Communication over anything but the shortest distances must therefore take place by means of waves transmitted through the atmosphere, and although this has been stated at times to be impossible a small amount of evidence to the contrary is now becoming available. With a view to assisting those readers who may care to experiment on the ultra-short wavebands, this article contains a brief description of

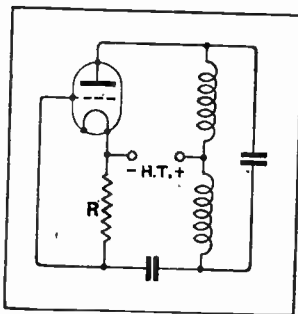


Fig. 1.—Circuit diagram of single-valve oscillator for very short wavelengths. The D.C. supply connections are omitted for simplicity.

some experimental transmitting apparatus which has been constructed and made to work; a further article describing a simple receiver for such short wavelengths will, it is hoped, be published later.

It may be said at the beginning that very few, if any, new principles have to be learnt and followed in the construction of short-wave apparatus, provided that due allowance is made for the change of frequency in regard to the effect of reactances, mutual couplings, etc. It has to be realised, for instance, that at a frequency of 100 million cycles per second, the reactance of a straight piece of No. 47 S.W.G. Eureka wire may be much more important than its ohmic resistance, and that when a straight wire is arranged in the form of an aerial and is tuned to the working frequency the radiation resistance is usually the predominating factor which limits the current flowing in the aerial.

In the design of a valve transmitter it is natural to give early consideration to the actual type of oscillating

valve circuit which it is proposed to employ. In a more comprehensive paper published in the current number of *Experimental Wireless* a somewhat detailed study is given of the various sorts of circuit of both the one-valve and two-valve type, with a discussion of their relative suitability for work at extremely high frequencies. One of the most important precautions to be taken in the construction of short-wave transmitters is to ensure that the coupling *via* the inter-electrode capacities of the valve is assisting the coupling due

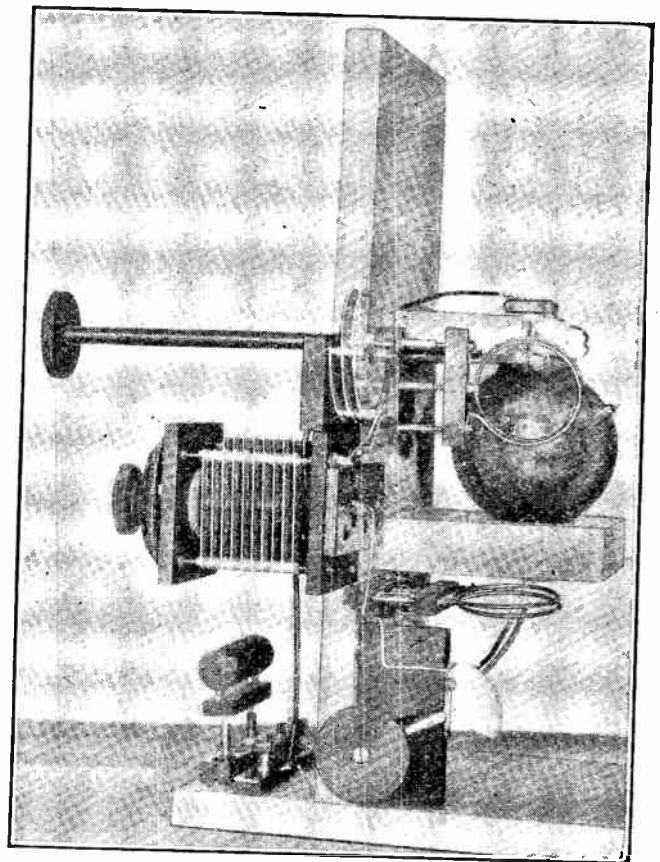


Fig. 2.—Single-valve transmitter for wavelengths down to 5 metres, employing a 100-watt valve in the circuit of Fig. 1.



**Transmitting on Ultra-short Waves.—**

to any mutual inductance whether stray or intentional. Many layouts of an otherwise useful circuit will not oscillate for the sole reason that these couplings are opposing each other.

**A Single-valve Transmitter.**

A most useful single-valve circuit for short-wave working is that sometimes known as the series-fed Hartley circuit illustrated in Fig. 1. Before attempting the construction of a transmitter based on this circuit it is important to get a clear idea of the magnitudes of inductance and capacity which are available for work on the wavelengths in question. To crystallise the reader's ideas it may be stated that a single turn loop of thick copper wire about 12in. diameter has an inductance of less than one microhenry, and that this requires only 36 micro-microfarads of capacity to tune it to a wavelength of 10 metres, or 9 micro-microfarads to tune to 5 metres. There is, therefore, not much to spare

in the matter of inductance and capacity, and every effort must be made to keep the dimensions of the subsidiary portions of the valve circuit as small as possible in order that the bulk of the small inductance and capacity available may be in the main oscillatory circuit.

Reverting to the circuit diagram given in Fig. 1, it is to be observed that a centre tapping point is required on the

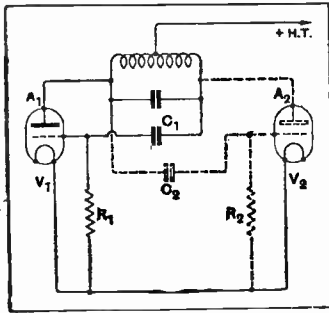


Fig. 3.—Circuit arrangement of two-valve oscillator showing its derivation from the series-fed Hartley circuit of Fig. 1.

inductance loop. While this may be made at the top of a single turn loop it is usually more convenient to use a two-turn loop in order to bring the tapping to the bottom of the coil where connection has to be made to its ends. In order to cover different ranges of wavelength it is convenient to mount these two-turn coils on small insulating blocks with three pins giving connections to the ends and centre of the coil. A single-valve transmitter employing a 100-watt valve in a circuit arrangement similar to that of Fig. 1 is shown in the photograph in Fig. 2. The transmitter is mounted on a panel of American white-wood, which material has a very low dielectric loss when kept dry. The main inductance is the two-turn loop to be seen in front of the valve. This is formed of No. 14 S.W.G. copper wire into a coil 2½in. in diameter, mounted on an ebonite block with the necessary three-pin connection. This coil is mounted directly on its tuning condenser, which contains two moving and three fixed plates as shown, and has a capacity of about 20 micro-microfarads. It will be noticed that an extended control handle is provided for this condenser in order to minimise hand capacity effects when tuning. The larger variable condenser seen to the left of the photograph is used for variable retroaction. As shown, this condenser is unnecessarily large and its capacity, while not being very critical,

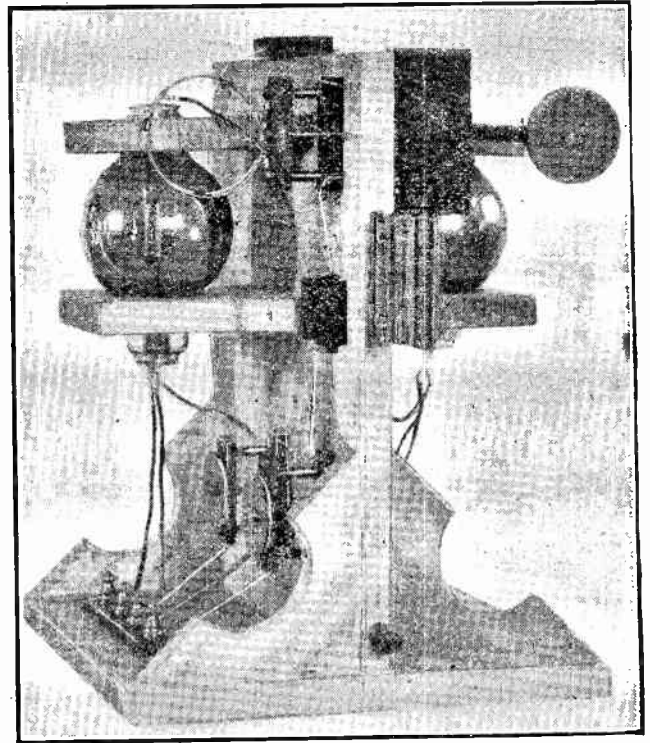


Fig. 4.—Two-valve 200-watt transmitter, wavelength 5 to 30 metres, using the circuit of Fig. 3.

need only have a maximum value of 100 micro-microfarads. The two-turn coil mounted horizontally beneath the valve formed, with the variable condenser below it, a rejector circuit in series with the grid leak. This was originally inserted as a means of ensuring that the self-capacity of the grid leak itself did not cause difficulties, but later experience has proved that it is difficult to use it effectively owing to the fact that it provides another circuit to tune, and that it is more convenient and practically as effective to do without it or replace it by a choke coil. Owing to the symmetry of the circuit the positive H.T. supply lead does not

really demand the insertion of a radio-frequency choke coil, but this and most other arrangements can be used more effectively on the shortest wavelengths when such a choke is used. Very little knowledge is available as to the behaviour of chokes at very high frequencies. A useful design, as shown in Fig. 2, consists of from 100 to 150 turns of No. 47 S.W.G. copper wire wound at uniform spacing on a three inch former of ebonite of American white-wood one inch in diameter.

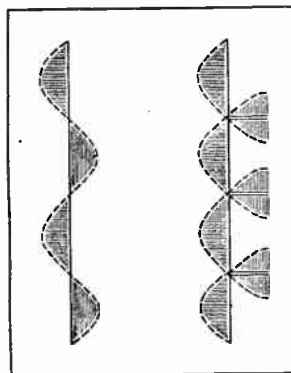


Fig. 5.—Diagram showing the use of phasing coils in an aerial two wavelengths long to give maximum radiation in a horizontal plane.

**Transmitting on Ultra-short Waves.—**

A single-valve transmitter constructed on the above lines with care taken to ensure that all dimensions between the valve and the tuned oscillatory circuit are as short as possible can be operated successfully at wavelengths down to 4 metres. With limited high-tension voltage increased output may be obtained by using two valves in parallel, but the two valves chosen must have closely similar characteristics. A more efficient method of connecting two valves to one oscillatory circuit is shown in Fig. 3, which is one of the circuits described by Eccles several years ago. In

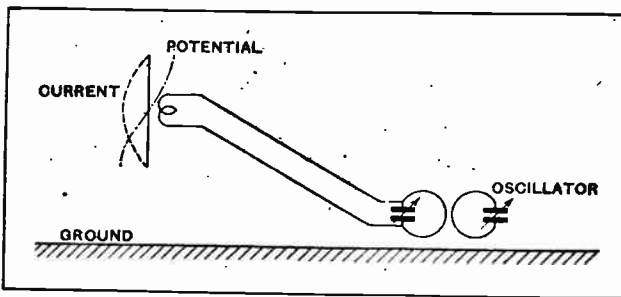


Fig. 6.—Inductive coupling to half-wavelength ungrounded aerial.

this diagram the solid line represents the series-fed Hartley circuit as used in the transmitter described above. The broken line shows the manner in which the second valve is connected. It will be seen that this circuit is really a double series-fed Hartley circuit, the two valves of which supply the oscillatory circuit alternatively. Each valve in such a transmitter may be tested individually under working conditions by converting the oscillator in succession into its two constituent single-valve circuits, and testing each in turn. Some readers may prefer to consider the two-valve circuit as one, operating on the familiar "push-pull" principle, with variable capacity coupling between the anode and grid coils.

**200 Watt Transmitter.**

A short-wave transmitter of 200 watts input designed to work on wavelengths between 5 and 30 metres with the circuit arrangement of Fig. 3 is illustrated in the photograph, Fig. 4. The whole of the transmitter, less the direct-current supplies, is mounted on an American whitewood panel as shown. The valves are placed on opposite sides of the panel in order to shorten, as much as possible, the leads between them. Although the anode current is really fed in at a constant potential point of the oscillatory circuit it is desirable to insert choke-coils in the high-tension supply leads in order to ensure that no high-frequency power loss occurs in these leads. Various sizes of condenser have been tried for coupling the anode of one valve to the grid of the other, and the most suitable has been found to be a variable condenser having a maximum capacity of about 50 micro-microfarads. The main tuning condenser should preferably have a somewhat smaller capacity.

The coils forming the inductance for such a transmitter may be constructed either of copper rod about  $\frac{1}{8}$  in. diameter, or of aluminium tube of a larger size.

The dimensions of the coils are so small that the ohmic resistance is not very important, but it is desirable to have a substantial size of conductor in order to secure rigidity, and so avoid slight changes in wavelength due to vibration. The variable condensers employed may be constructed conveniently from the standard low-loss transmitting type with some of the plates removed and additional spacing washers inserted. Every effort should be made to obtain a very low minimum capacity, if the shortest wavelengths are aimed at.

A similar type of transmitter, employing two 250-watt valves will be found described and illustrated in the paper published in *Experimental Wireless* referred to above. It may also be recalled that a portable transmitter employing two valves arranged in the push-pull connection of Fig. 3 was described in *The Wireless World* about a year ago.<sup>1</sup> In this case, however, the minimum wavelength was about 30 metres, and two L.S.5A valves were employed, capable of handling a power input of 20 watts.

**Valve Requirements for Transmitters.**

Valves intended to deal with power at very high frequencies must have special design features not essential for those working at lower frequencies. The first feature desired is low self capacity and mutual capacity of the electrodes. This means that the leads to the electrodes should be brought out of the glass envelope as far as possible from one another. This separation of the leads, however, is limited by the inherent increase in inductance due to their greater length.

Several years ago Franklin drew attention to the possibility of the glass envelope melting as a result of the heat generated by eddy currents in metallic deposits which occur on the inside of the glass during evacuation of the valve. In certain types of transmitting valves

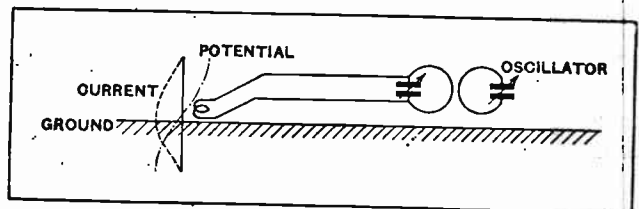


Fig. 7.—Inductive coupling to grounded quarter-wave aerial.

it has been customary to use copper foil screens on the outside of the envelope to avoid breakdown from this cause. Large dielectric losses may also be experienced in those portions of the glass which lie within the high frequency field between the grid anode. The envelope should, therefore, be of as great dimensions as is consistent with short leads from the electrodes. The neck of an ordinary transmitting valve is in a concentrated part of the field and punctures were very common at this point when valves were first used on short wavelengths. The field may be reduced by continuing the grid mesh beyond the ends of the anode. This construction concentrates the radio-frequency field between the grid and anode, and so reduces that which reaches

<sup>1</sup> *The Wireless World*, October 10th, 1928, page 501.

**Transmitting on Ultra-short Waves.—**

the glass walls of the valve. It is also advisable to thicken the leads to the electrodes at the places where they enter the glass.

**Aerials and Signalling Arrangements.**

The portable transmitter referred to above was connected to a short aerial through a variable coupling condenser from one end of the oscillatory circuit, an earth connection being taken to the centre point of the inductance, at which point the high-tension direct current is also supplied to the circuit. While this method may still be employed for wavelengths below 30 metres,

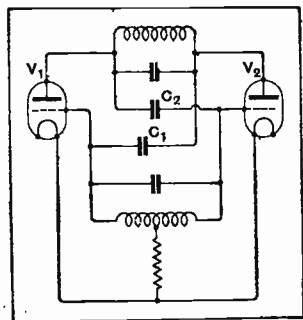


Fig. 8.—Circuit diagram of an alternative push-pull oscillator employing tuned circuits in both anode and grid circuits.

it is found that when the wavelength is less than 10 metres only a very short aerial is available if the difficulties of phasing in alternate half wavelengths are to be avoided. For example, on a wavelength of 5 metres a 30ft. aerial is about two wavelengths long, and the distribution of current therein will be as shown in the left-hand side of Fig. 5, where the distance of the wavy line from the vertical line indicates the magnitude of the current, and the shading and the side of the aerial on which it is placed indicates the direction of this current. It is seen from this diagram that there are two equal loops of current of each of the two opposite directions, and there will thus be no field due to the whole current in a direction perpendicular to the aerial. From this it results that there will be no radiation from such an aerial in the horizontal plane, although there will be some radiation in other directions. By inserting suitable inductances in the aerial the distribution of current in successive portions of the aerial may be altered as indicated in the right-hand diagram of Fig. 5. It is now seen that throughout the length of the aerial the currents are all in the same direction, and will thus assist each other in producing strong radiation in the horizontal plane. This is the method successfully employed at the Marconi beam stations, where aerials of several half-wavelengths in height are employed.

In order to avoid the complications arising from the use of phasing coils in the above manner it is convenient in experimental work on very short waves to employ short, straight aerials the length of which corresponds to either a half or a quarter of the working wavelength. In the former case the aerial should be supported at a suitable distance above the ground, the ends being insulated, since these are the points of high potential variations. The aerial may be energised by inductively coupling the oscillator to a point near its centre, as indicated in Fig. 6. In the case of the quarter-wave antenna, this should be connected either to earth or to a suitable counterpoise at its lower end, at which point the maximum current will be obtained (Fig. 7). For efficient radiation on very short

wavelengths the antenna should be situated in as open a space as possible. In the radiated field objects act as reflectors when their linear dimensions are comparable with the working wavelength. The buildings associated with a short-wave station are usually such that they give rise to an appreciable amount of scattering and loss. The only method of diminishing the loss of useful radiation in this manner is to place the aerial at some distance, two or three wavelengths, from any buildings and supply energy to it from the transmitter by means of a transmission line. Such a line may be formed either of a pair of straight, parallel Lecher wires, or of a twin conductor comprising an inner wire surrounded by a concentric metallic sheath. In either case the line should be such that it has maximum current loops at each end, which is obtained when the length of the line is an integral number of half wavelengths. A line of fixed length may, however, be effectively varied by tuning it with variable condensers at one or both ends, as indicated in Figs. 6 and 7, which show the principles of feeding half- and quarter-wave aerials through transmission lines. A Lecher wire transmission line may be conveniently formed of two copper wires of about No. 16 or 18 S.W.G. stretched parallel at three or four inches apart, and at a distance of at least a foot from all other bodies except their supports. The wires are short-circuited at each end and adjusted either by length or by varying the condenser to obtain maximum current at each end.

A half-wave antenna may conveniently consist of two telescopic brass or aluminium tubes supported at the centre. This antenna is tuned by altering its length, the current being observed on a suitable thermal ammeter inserted at its middle point where the current is a maximum. Owing to the fact that the radiation resistance of a half-wave antenna is in the neighbourhood of 80 ohms, the actual ohmic resistance of the antenna, including the ammeter, is not of serious importance. In a recent experiment the replacement of an antenna of 1/2 in. brass tube by a No. 30 S.W.G. Eureka wire only reduced the current by 30 per cent. On account of this high effective resistance the tuning of a half-wave antenna is not very sharp. Since, however, the radiation resistance is the predominating factor limiting the current, the efficiency of such an aerial is very high, and practically all the energy supplied to it is converted into useful radiation.

The variable condensers in the Lecher wires form a useful method of altering the current in the aerial without disturbing the balance between the two valves of the oscillator. The Lecher wires are useful in addition for measuring the wavelength, which can be carried out approximately by running a shorting wire bridge along

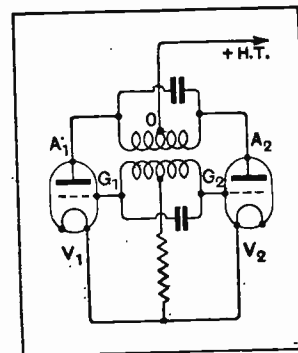


Fig. 9.—Circuit of Fig. 8 with the coupling condensers omitted. The necessary coupling is obtained by the mutual inductance of the tuned circuits.

**Transmitting on Ultra-short Waves.—**

the wires. This alters the current in the aerial except when the bridge is at a potential node on the wires. The positions of consecutive potential nodes are one half-wavelength apart, and can be determined to within about 1 cm. An alternative method of locating these potential nodes is to bridge the wires with a small thermo-galvanometer to determine the positions of maximum current. In either case these positions can be determined with fair accuracy, since at the points in question there are practically no radio frequency potentials, and body capacities will therefore have little

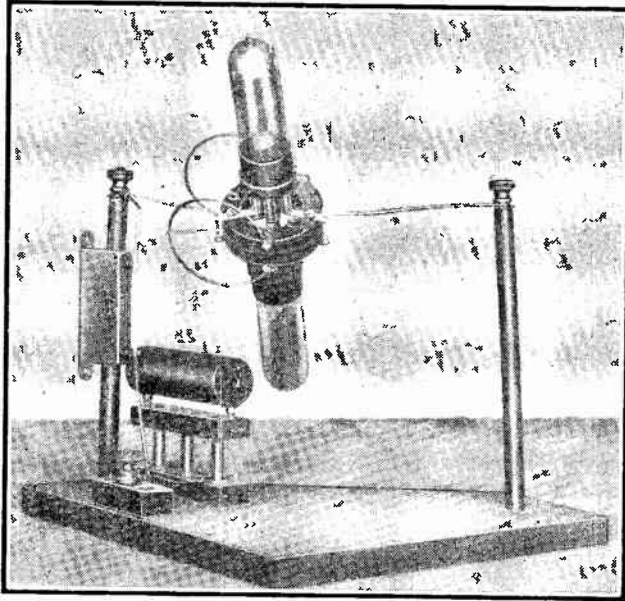


Fig. 10.—Two-valve oscillator using the circuit of Fig. 9 and operating on a wavelength of 1.8 metres.

effect. The whole Lecher wire system should, however, be erected as far as possible from all other bodies in order to avoid spurious effects due to the proximity of these at potential antinodes on the wires.

**Signalling.**

Signalling with low-power short-wave transmitters may be carried out by using a suitable key in the high-tension supply as with the portable set already referred to, or by short circuiting a small coil placed near the tuned oscillatory circuit. The tuning of a receiver at wavelengths of the order of 5 metres is so sharp that the change in the frequency of the transmission brought about by the latter method is sufficient for the signal to become inaudible in the receiver when the coil, coupled to the tuned circuit, is short-circuited. An alternative method of keying for signalling purposes is to attach one terminal of a transmitting key to one wire of the Lecher system, and simply to operate the key by means of a long handle. The closing of the key contacts adds a small lumped capacity to the Lecher wires, which is sufficient to change the heterodyne note in the receiver. Keying by this method produces extremely clear signals and does not alter the load on the transmitter to any appreciable extent.

**An Oscillator for Extremely Short Waves.**

In the two-valve "push-pull" circuit described above, and illustrated in Fig. 3, grid leaks  $R_1$ ,  $R_2$  were employed to fix the D.C. potentials of the two grids. A suitable value for the resistance of these leaks has been found to be 0.5 megohm, although this value is not so important as the self-capacity, which should, naturally, be kept as low as possible. It has been found that for low-power work leaks of the deposited metallic-film type are suitable. A consideration of Fig. 3 will show that the circuit will oscillate just as well if the grid leaks are replaced by any circuit which has a high impedance at the frequency of the oscillator. For example,  $R_1$ ,  $R_2$  may be replaced by chokes, the D.C. potential of the grids being fixed by a suitable resistance in the common lead from the filament to the common point. Another method of having a high impedance between the two grids is to replace  $R_1$  and  $R_2$  by a tuned circuit, as shown in Fig. 8, which is another of the two-valve balanced circuits first described by Eccles and Jordan. The connection to the filament, in this case, is made to the middle point of the inductance. Suitable choke coils may be of the single-layer solenoid type described above in connection with the circuit details relating to Fig. 2.

In the double-valve oscillator of Fig. 3 the condensers  $C_1$  and  $C_2$  act as retroaction condensers from the anode of one valve to the grid of the other. In the circuit in Fig. 8, however, these condensers are not required, as the mutual inductance between the anode and grid coils may be made to provide the necessary retroaction. The diagram of such a circuit is given in Fig. 9. This type of oscillator has the disadvantage that there are two circuits to tune, and that it is difficult to vary the coupling between the grid and anode coils when working on very short wavelengths. At very high frequencies the electrostatic coupling between the grid and anode coils may become important, and this coupling is of opposite sign to that intentionally introduced by the magnetic induction. With the two-valve oscillator using the circuit shown in Fig. 9 it has been found possible to obtain oscillations at various wavelengths down to a lower limit at about 1.5 metres. This limit is really set by the dimensions of the valves and the time taken by the electrons to travel from filament to anode inside the valve. Fig. 10 shows a view of a two-valve oscillator which operates on a wavelength of 1.8 metres. Two short-path receiving valves are mounted on low capacity holders "back-to-back." The inductances are formed of loops of No. 16 S.W.G. copper wire about 2 in. in diameter, and all subsidiary connecting wires are reduced in length to the minimum, and no tuning condensers are used.

The high tension feed is through a piece of No. 47 S.W.G. Eureka wire which acts as a choke and fuse combined. A choke coil is included in the grid lead, while a condenser of 0.01 microfarad capacity is provided.

It is, of course, very difficult to obtain any appreciable output from such oscillators, and when an attempt is made to increase the power by the use of larger valves it is usually found that the minimum wavelength attainable increases.

# The NEW KIT SETS



Home Constructors' Receivers

Seen

at

Olympia.

**W**HAT is a "Kit" set? Strictly speaking, this description should be applied only to complete sets of parts for receiver construction, but it has, very conveniently, been extended to cover circuit arrangements sponsored by various manufacturers who, although they issue descriptive literature, do not supply all the necessary components. This scheme offers what is, in some cases, an important advantage; existing pieces of apparatus in the possession of the constructor may be used.

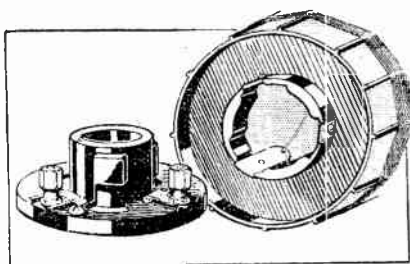
Indications are not lacking that the building of sets in this way, involving as it does nothing beyond the assembly and wiring of a few readily

obtainable parts, is increasingly popular, and the Olympia Exhibition showed that an infinitely greater diversity of kits are now available than at any previous time. Last season's sets have undergone modifications in

signed specifically for this form of supply for their filament and anode circuits.

The purpose of this article is briefly to describe the principal features of sets that are either entirely new this autumn or that have undergone considerable modification, and no attempt will be made to treat anything but the main features of the various designs: detailed descriptions and test reports will, no doubt, in most cases, come at a later date.

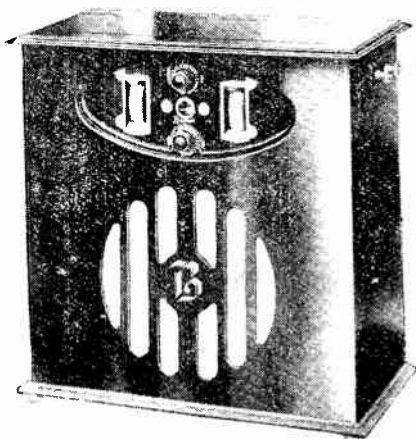
The Brown sets, recently introduced by the well-known firm of loud speaker manufacturers, are typical of present-day tendencies in several respects. Four distinct models are available; two for battery feed and two for mains supply. Each type is



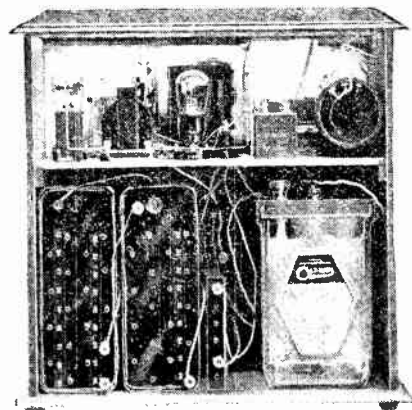
Non-reversible mountings for interchangeable coils in the Brown receivers.

much the same way as have complete commercial receivers, and there has been a distinct tendency to improve their performance, to simplify their operation, and to render their construction even easier than previously.

With one or two exceptions, all the sets offered are three-valve H.F.-det.-L.F. combinations; indeed, it is becoming more and more apparent that this excellent circuit arrangement is regarded as a standard one for meeting average requirements. Perhaps the most striking innovation is the introduction of kits for A.C. mains operation—not simply ordinary battery sets arranged to be more or less capable of working with an H.T. eliminator, but receivers de-



Brown three-valve set, complete with loud speaker.



Interior view of Brown kit set, showing how batteries are mounted behind the loud speaker.

**The New Kit Sets.—**

available with or without a built-in cone loud speaker. In every case there is ample room inside the containing cabinet for batteries or mains unit. The circuit arrangement embodies a single H.F. amplifying stage (screen-grid valve), grid detector, and an output valve coupled by means of a Brown Type A low-frequency transformer. Reaction is provided, and the tuning condensers are controlled by edgewise dials.

Interchangeable coils, wound on large ribbed bakelite formers, are used. These coils are provided with

switches operated through rods projecting through the panel.

**A New Departure.**

The "1930 Cossor Melody Maker" has been completely redesigned, and bears but little resemblance to its prototype. It will be generally agreed that the majority of home constructors' difficulties are in some way associated with the H.F. stage; here a bold attempt has been made to remove possible causes of trouble by supplying all the apparatus associated with this part of the receiver — coils, tuning condensers, reaction

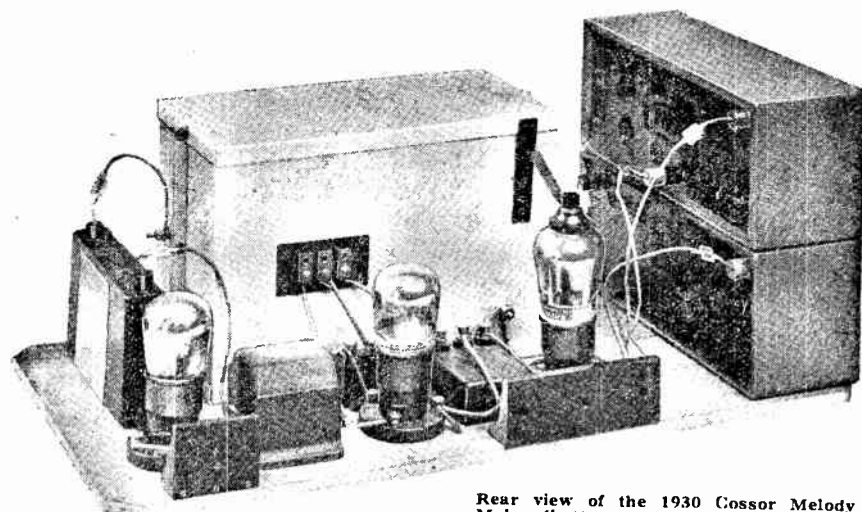
inside the cabinet. Advantage has been taken of the fact that this method of construction lends itself to "ganging" of the two tuned circuits, and consequently we find that they are controlled by a single knob.

The circuit arrangement embodies the conventional H.F.-det.-L.F. combination, but double-wound transformers are used as H.F. couplings. As the H.F. unit is ready wired when purchased, it will be appreciated that the work remaining for the home constructor is considerably lightened, and is still further simplified by the provision of such refinements as a spring connector for the H.F. valve anode terminal and an aerial series condenser moulded into the terminal strip. Waveband changing is effected by a three-position switch which also controls the filaments.

Another distinct model for A.C. mains operation is supplied; it differs from the battery set only in details, and includes a factory-made power unit which fits the space inside the cabinet occupied normally by the H.T. battery. Directly heated A.C. valves are used in this set.

**Ferranti Sets.**

The Ferranti "Screened Grid Three" has been modified in details, and now includes a volume-control resistance connected across the primary of the L.F. transformer; separate decoupling resistances and condensers have been replaced by the new anode feed units, in which the two components are combined.

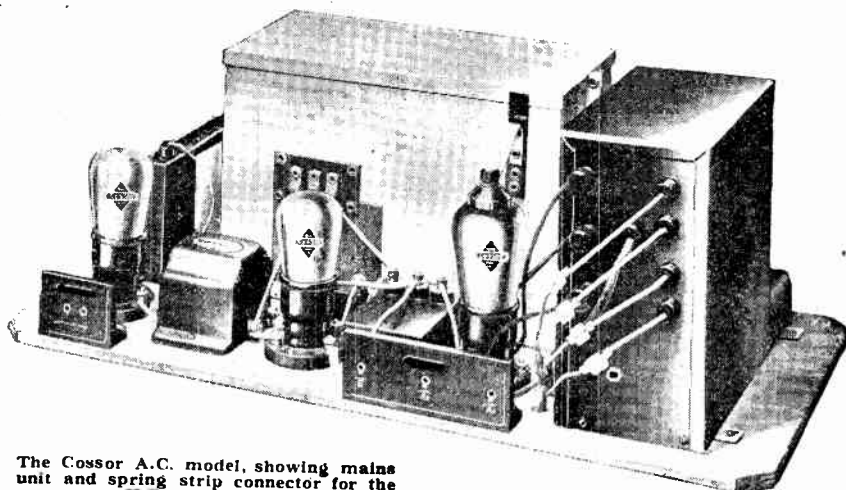


Rear view of the 1930 Cossor Melody Maker (battery model) removed from its containing cabinet. Note the screened H.F. unit.

a particularly good form of bayonet catch mounting, of which the studs look as if they should be entirely free from that annoying form of trouble due to intermittent contact. The aerial-grid coils have three separate aerial tappings, brought out to sockets mounted on the former itself in such a way that an adjustment of coupling may readily be made to suit varying needs in the matter of selectivity. It should be added that the coil mountings are so arranged that they cannot possibly be inserted incorrectly in their holders.

The new "Bullphone" kit sets are supplied with bakelite panels, into which are moulded the necessary holes for securing the various components. The "Nightingale Three" is a detector-2-L.F. receiver with transformer coupling, while the "Screened Grid Three" embodies an H.F.-det.-L.F. circuit. The dual range coils used have built-in

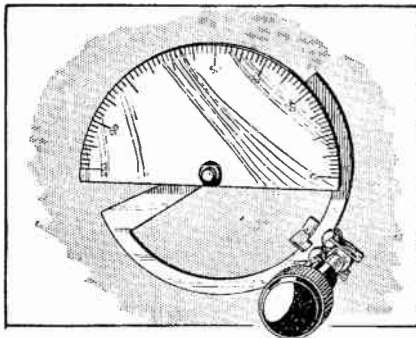
condenser, wave-range switch, etc. — as a complete manufactured and wired unit, contained in a two-compartment screening box for mounting



The Cossor A.C. model, showing mains unit and spring strip connector for the H.F. valve anode.

**The New Kit Sets.—**

Tuning condensers of 0.0005 mfd. are now used.



Reduction gear drive for the ganged tuning condensers of the new Cossor kit set. A system of friction wheels operating on a metal arc is employed.

A new kit set, with one H.F. stage and anode bend detection followed by two L.F. amplifiers with push-pull output has been introduced. A pick-up jack is fitted, with contacts so arranged that insertion of the plug will switch off the H.F. valve filament, insert the pick-up in the detector grid circuit, and also short-circuit one of two feed resistances connected in series with the detector anode, thus increasing its H.T. supply voltage, and consequently making this valve act as an amplifier without alteration of its grid bias.

Since it was reviewed in these columns, the Formo "S.G.3" has not been altered to any extent, although a minor improvement has been effected by fitting tuning dials of a new pattern.

**The Lewcos "Chassis."**

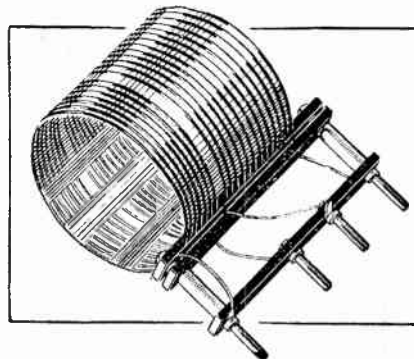
The Lewcos "Kit Assembly" is so nearly a complete receiver in itself that it might perhaps be described as a chassis rather than as a kit. With the exception of three variable condensers and an on-off switch, it comprises all the components of a conventional H.F.-det.-L.F. receiver. All these parts are mounted on a bakelite base, and are completely wired. Transformer coupling is used for both H.F. and L.F. stages. By fitting sockets for indirectly heated valves and a link for making the necessary alteration to the heater or filament circuit, the set is made suitable for either battery or A.C. mains operation.

An unusual method of waveband changing is used in the Lewcos set; the blocks carrying the aerial-grid and intervalve coupling coil assemblies are mounted in guides so that they can be moved bodily by means of push-rods: the connections of the coils are changed through contacts mounted on the underside of the movable bases.

**A Kit Set Brought Up to Date.**

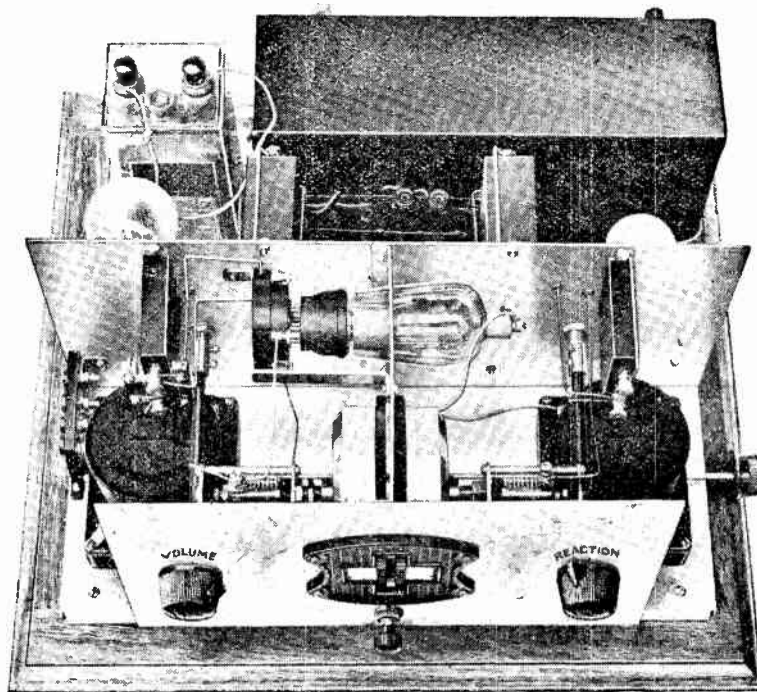
The Lissen H.F.-det.-L.F. set is substantially unchanged, but provision is now made for operating it in conjunction with A.C. or D.C. high-tension supply units which may be mounted inside the cabinet. A revised model for frame aerial operation has been introduced; a special cabinet, with a frame built into its lid, is supplied, and more complete screening for the H.F. valve plate circuit components is provided. A short-wave kit set is another new

The new Lotus kit sets, supplied in forms suitable for both battery and A.C. mains feed, have several inter-



A Lissen short-wave coil.

esting features. Both models are similar and embody the conventional circuit: they are assembled on a metal chassis with transverse and lateral screens on which many of the



Interior view of the Lotus kit set (battery model) showing arrangement of semi-ganged tuning condensers.

production, for which a series of special coils, a choke and short-wave tuning condenser have been designed. The set, which covers all wavelengths between 10 and 200 metres, comprises a reacting detector followed by two L.F. stages.

principal components are mounted in the factory before the kits are dispatched.

Dual-range coils with built-in switches are employed: these switches are "ganged," and are operated through a knob projecting

**The New Kit Sets.—**

through the side of the cabinet. It is observed that decoupling is provided. There is space for batteries or mains unit on the base-board at the back of the cabinet, behind the lateral screen.

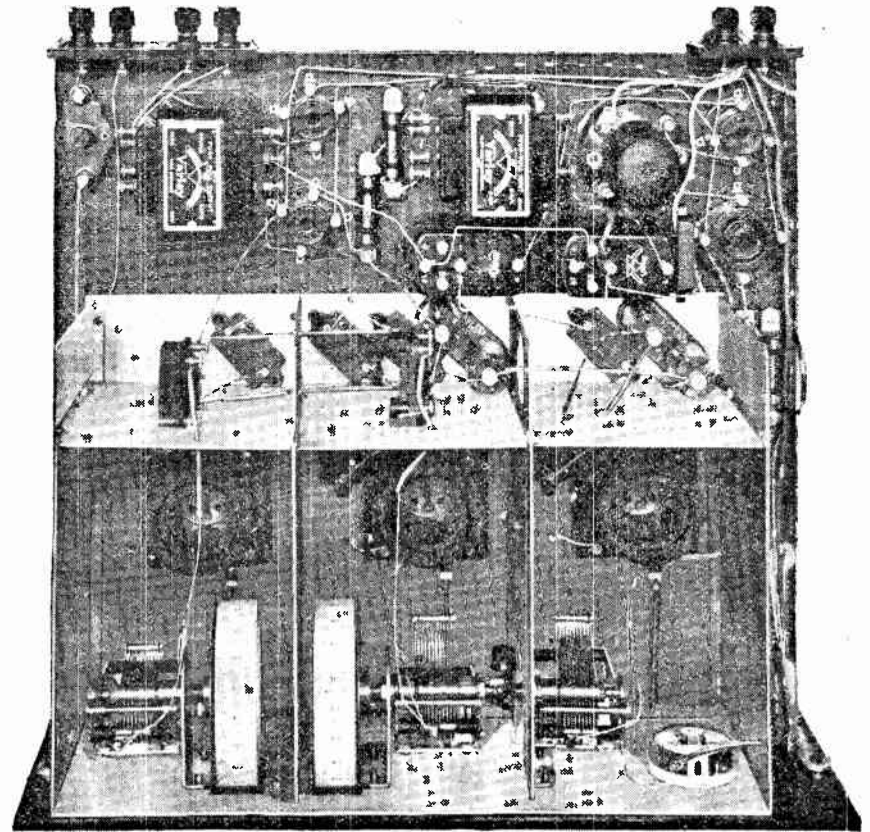
Volume control, in the case of the battery set, is effected through a rheostat in the H.F. valve filament circuit, while in the A.C. set a potentiometer feed for the screening grid serves a similar purpose. Indirectly heated valves are used in the latter receiver.

In both models provision is made for using a gramophone pick-up and the edgewise condenser dials are mounted side by side so that they can readily be rotated together, thus providing simultaneous tuning of the two circuits over parts of the scale.

**An Entirely New Range.**

Mullard kit sets for this season are entirely new. The first is the "Orgola Three," with a tuned grid H.F. amplifier and grid detector with reaction, followed by a pentode with transformer coupling. The two tuning condensers are ganged, with a "trimmer" across the aerial-grid coil; it is noted that lucid and helpful instructions are given regarding the proper use of this adjustment.

Reaction control is on the differential system, and, as provision is made for altering the inductive relation of the feed-back coil with re-



Plan view of the Mullard "Orgola Senior"; a six-valve receiver with two H.F. stages and push-pull output.

spect to the grid winding, it should be possible so to arrange matters that regeneration is particularly well under control. Continuously variable

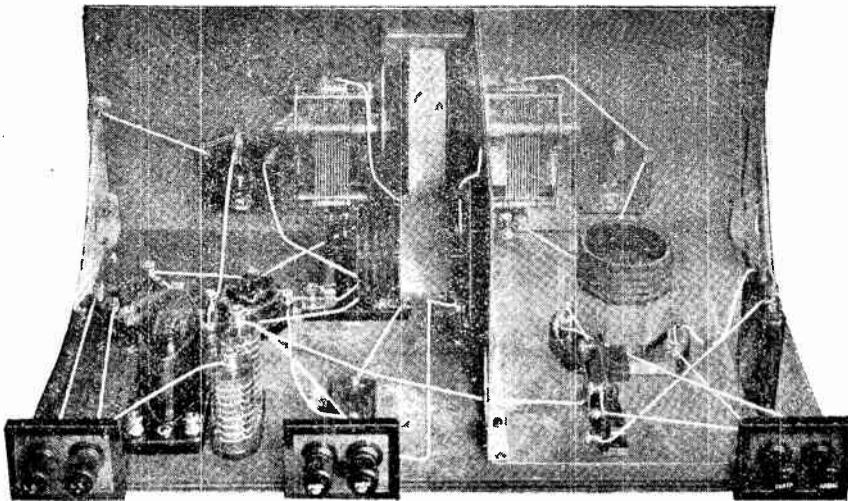
aerial coupling, adjustable within wide limits, is also provided.

The design provides for connection of a pick-up in the detector grid circuit, and a switch is connected so that it may be put into operation in the easiest possible manner.

All the above applies also to the A.C. model, which uses indirectly heated valves. In addition, it has a bias cell for the H.F. valve, and the usual alteration is made to the low-tension circuit. This set is provided with H.T. current by a Mullard eliminator, and a special low-voltage transformer is supplied for feeding the valve heaters.

**An Ambitious Product.**

A six-valve kit set—the "Orgola Senior"—has also been evolved by the Mullard firm; there is little doubt that this is the most ambitious receiver yet produced in "kit" form. It embodies two H.F. stages, anode bend detector, and two L.F. amplifiers with push-pull output. The high-frequency valves are coupled by the

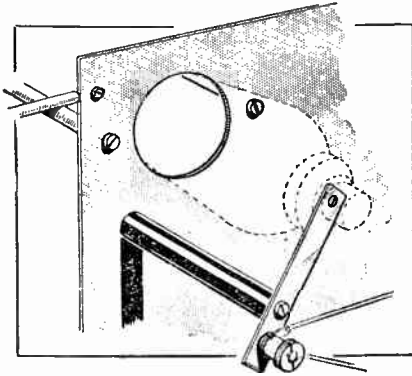


Rear view of the Mullard "Orgola" three-valve set. The detector grid coil is mounted on the vertical screen.



**The New Kit Sets.—**

parallel-feed method and their condensers are ganged; as there is a separate condenser for the aerial-grid circuit, the total number of tuning controls is reduced to two, and there is no reaction. Decoupling is provided in the anode circuits of detector and first-stage L.F. amplifier.



Details of the rigid H.F. valve anode connector in the "Music Magnet."

Volume control is effected by dimming the H.F. valve filaments, and there is also a variable condenser feed for the aerial coupling in order that overall selectivity may be under control. Screening is, of necessity, somewhat elaborate, and it is observed that the valves are so mounted that they are unaffected by the field of the inductance coils. Precautions are taken to prevent the application of H.F. voltages to the L.F. amplifier, and stabilising resistances of 100,000 ohms are inserted in series with the output valve grids. Wave-range switches are included in the coils, and a gramophone pick-up is connected in the same way as in the case of the three-valve set.

Both the "Orgola" and the "Orgola Senior" receivers may be fitted into a gramophone cabinet complete with turntable, pick-up, and built-in loud speaker; full instructions for thus converting the receivers into radio-gramophones are issued.

**A Well-designed "Music Magnet."**

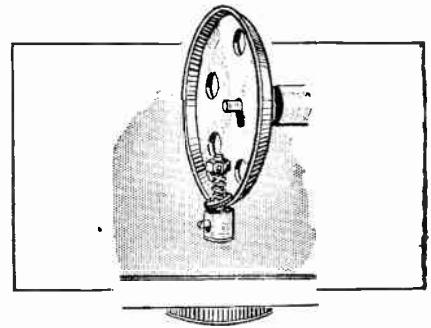
At the first glance one is apt to form the impression that the new Osram "Music Magnet," already known to readers of our "Kit Constructors' Notes" section, has not been altered to any great extent, but a more careful examination shows

that attention has been devoted to almost every detail of its design. The arrangement of the filament switch has been modified; this, taken in conjunction with the provision of an H.T. fuse, should render the set completely immune from risk of filament burn-outs. The drive mechanism of the gang condenser has been redesigned, and the coils have been altered considerably, with the result that H.F. losses have been reduced.

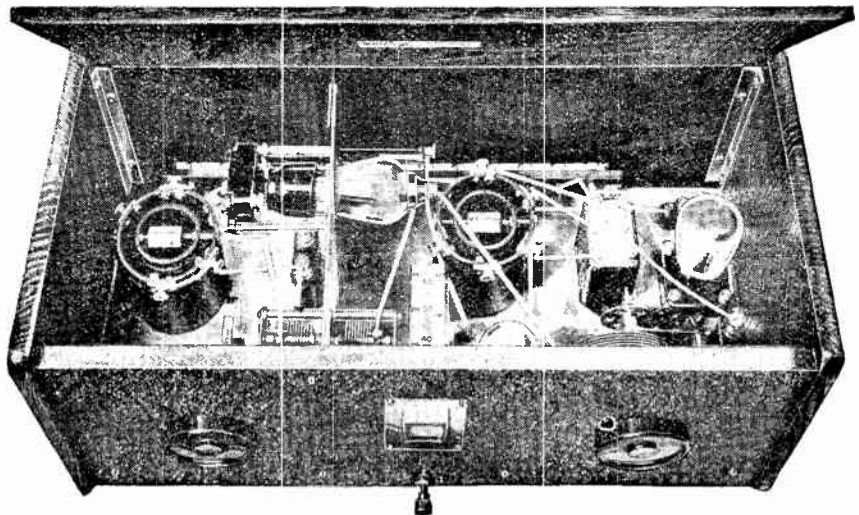
**Wavelength Calibration.**

Perhaps the most important modification is the provision of a condenser scale calibrated directly in wavelengths—as far as is known, this is the only kit set with this refinement.

altogether, a most interesting set. It is now supplied complete with an oak cabinet in sections ready for assembly by the constructor.



The friction-driven crown wheel through which the double condenser of the "Music Magnet" is operated.



The new Osram "Music Magnet," with single knob tuning and calibrated wavelength scale.

Other modifications include a new L.F. transformer with high-permeability core, and an improved form of grid condenser and leak assembly:

The requirements of the home constructor living near a high-power station are catered for in an interesting and unconventional manner by the Varley Regional R.D.3 receiver, for which special components and an instructional leaflet are supplied. There is little risk in hazarding a guess that this set is the forerunner of a type that is bound to be popular in the near future. It embodies a detector with two low-frequency stages—clearly here is its principal feature of interest. The tuned aerial coil is coupled by means of a variable condenser to a tuned filter circuit. This set should have at least as good selectivity as the average receiver with a stage of H.F. amplification.

**"THE 1930  
EVERYMAN FOUR"**  
will be described fully  
in next week's issue.

WIRELESS THEORY  
SIMPLIFIED

By S. O. PEARSON, B.Sc., A.M.I.E.E.

Part III.—Alternating  
Currents.*(Continued from page 390 of the  
previous issue.)*

**A**N alternating current, as the name implies, is one which flows first in one direction and then in the opposite direction alternately round a circuit, the reversal taking place at regular intervals. It will be remembered that a direct current was represented by a continuous stream of electrons moving in one direction round and round a closed circuit, being driven by a constant electromotive force. In the case of an alternating current the electrons representing it are rushing backwards and forwards round the circuit, and therefore the electromotive force driving them must also be periodically reversing or alternating.

A direct current was likened to a continuous stream of water flowing through a hose pipe connected to a tap which supplied the necessary driving pressure, and we can extend this analogy to meet the case of an alternating current. Imagine the hose pipe removed from the tap and then having its two ends connected to the opposite ends of a cylinder in which a double-acting piston moves backwards and forwards. Such an arrangement is shown in Fig. 1. The whole thing—hose pipe and cylinder—are assumed to be full of water without any air bubbles. As the piston moves from left to right it forces water out of the right-hand end of the cylinder, through the pipe and back into the left-hand end. When the piston comes to the end of the stroke all the water comes to rest, and then, when the piston begins to move from right to left, the flow of water in the pipe reverses. In this arrangement we have an alternating current of water.

Now an alternating current of electricity (A.C.) follows very similar laws. There is a driving or electromotive force which keeps on reversing and so forcing the electrons backwards and forwards round a closed electric

circuit. The alternating electromotive force is set up by some sort of generator, or by a microphone. An alternating current generator may be looked upon as a sort of electron pump which forces electrons backwards and forwards round an external circuit just as the cylinder pump forces the water backwards and forwards through the hose pipe.

**Frequency.**

It is necessary to know several things about an alternating current in order to define it fully or make any calculations relating to it. For instance, it is necessary to know how many times the current reverses its direction every second and how it varies from instant to instant. It is usual to consider the current as positive when flowing one way round the circuit and negative the other way round. It is quite immaterial which direction we choose as positive provided that, once having made our choice, we adhere to it.

The variation of the current from the time it starts from zero and passes through one complete sequence of positive and negative values back again to zero, is referred to as *one cycle*, and the time of one cycle in

seconds or fractions of a second is called a period. The *frequency* or *periodicity* is the number of cycles passed through in one second, and thus the frequency is expressed in cycles per second. The standard commercial frequency of A.C. supply systems in this country is 50 cycles per second. Audible sounds are represented by a whole range

of frequencies from about 25 cycles per second to 10,000 cycles per second or more according to the individual. Radio frequencies range from about 20,000 cycles per second up to several millions—a wavelength of 300 metres corresponds to a frequency of 1,000,000 cycles per second or 1,000 kilocycles per second, the wavelength being inversely proportional to the frequency.

An alternating current may vary from instant to instant according to any law or without any apparent law, but it is usual for the time of one complete sequence

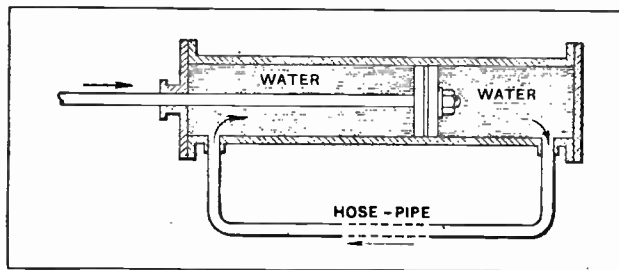


Fig. 1.—Cylinder pump and pipe arrangement illustrating the action of a closed alternating current circuit.

**Wireless Theory Simplified.—**

of positive values to be equal to the time of a complete sequence of negative values. These two sequences are called the positive half cycle and negative half cycle respectively. These names also apply to alternating electromotive forces and magnetic fluxes.

**Sine Wave of Alternating Current.**

If a graph is plotted showing the variation of current with time, the curve takes the form of a wave which may be any shape but is periodic—that is, it keeps on repeating itself as time progresses. Such a wave is shown in Fig. 2.

The simplest alternating current to deal with both in practice and in theory is one which gives a sine wave when all the successive values are plotted as a

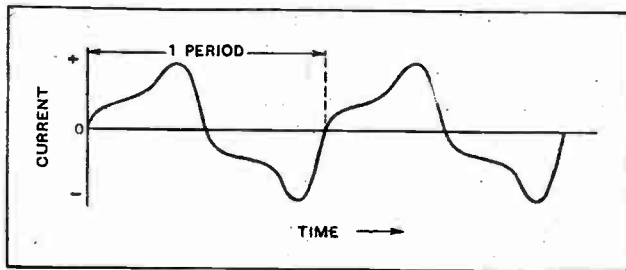


Fig. 2.—Showing how an alternating current can be represented as a graph.

graph to a time base, and this law is always assumed when working out alternating current problems unless otherwise stated. A sine wave of current is shown in Fig. 3.

**The Effective Value of an Alternating Current.**

The first thing we notice about the curve is that it is symmetrically placed about the base or zero line—that is to say, the positive half waves are exactly balanced by the negative half waves, and therefore the average value of the current taken over any whole number of cycles is equal to zero. It is clear then that to express the value of an alternating current in amperes we must adopt some means of comparing it with a direct current as regards its useful effects. For instance, either an alternating current or a direct current will produce heat if passed through a resistance wire, and it is on this basis that the strength of an alternating current in amperes is defined. The useful or *effective value*, as it is called, is defined as the value in amperes of the steady direct current which would have the same average heating effect in a given fixed resistance. This means that an alternating current whose effective value is 1 ampere will liberate heat in a given resistance at the same average rate as a direct current of 1 ampere in an equal resistance, i.e., the power in each would be the same. It is necessary to say *the same average rate* because the heat is given to the resistance by the alternating current in little pulses, the power falling to zero every half cycle as the current passes through its zero values.

If we know the shape of the alternating current wave

it is an easy matter to determine its effective value. Assume any wave shape for the present, and let  $i$  be the value of the current at any one instant. Then in a resistance of  $R$  ohms the power at that instant will be  $i^2R$  watts (see Part II, last issue). Let  $I$  be the effective value or the value of the direct current which has the same average heating effect. Then from the definition above—

$$I^2R = \text{mean value of } i^2R \text{ over a whole cycle.}$$

$$I^2R = (\text{mean value of } i^2) \times R$$

or  $I^2 = (\text{mean value of } i^2);$

and taking the square root of each side, the effective value is—

$$I = \sqrt{\text{mean value of } i^2} \text{ amperes.}$$

Putting this result into words: the effective value of an alternating current is equal to the root of the mean value of the squares of all the successive instantaneous values, and is often abbreviated to **ROOT MEAN SQUARE** value or **R.M.S. value**. *Virtual value* is another name frequently employed.

**Effective Value of a Sine Wave.**

Referring again to the sine curve of Fig. 3, it will be noticed that the current starts from zero and builds up to a maximum positive value which we have denoted by  $I_m$  in the figure, then falls to zero again, and once more builds up to the maximum value  $I_m$ , but this time in the reverse direction, being now negative. This maximum value  $I_m$  is called the amplitude of the current.

But the amplitude is not the useful or effective value of the current, and it behoves us to find what relationship exists between the effective value and the maximum value. To do this consider a sine wave of current which builds up to a maximum value of 1 ampere in each direction. Such a wave has been drawn to a suitable scale in Fig. 4, and is shown by curve (1). If we now divide the base line up into, say, 20 equal parts and measure the vertical distance from the centre of each part to the curve itself, we get the values of the current corresponding to the various instants de-

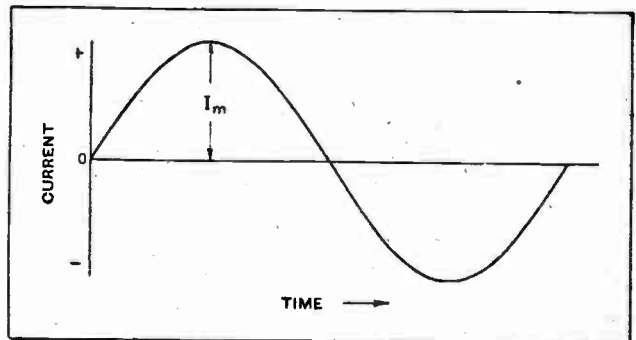


Fig. 3.—Simple sine wave of current.

picted by the centres of the 20 equal intervals. We require the *root mean square* value of the current, and so the next thing to do is to square each of the current values so obtained, i.e., multiply each value by itself and plot the figures thus found as a new curve to the same base line. If the sine curve (1) is accurately

**Wireless Theory Simplified.—**

drawn, it will be found that the new current squared curve (2) shown shaded will be another sine wave of half the wavelength or double the frequency. Note that even over the negative half cycle the current squared is still a positive quantity, because when two negative quantities are multiplied together the product is positive—the old saying that “two negatives make a positive,” etc.

It will be seen that the new curve (2) is not symmetrically placed about the base line, as is the case for

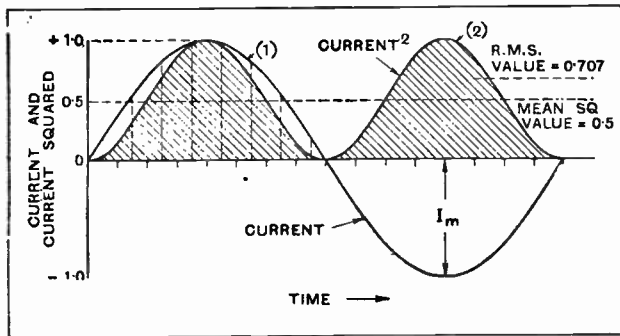


Fig. 4.—Diagram for showing that the R.M.S. value of a sine wave is 0.707 of the maximum value.

the current curve. In fact, the new curve is so disposed that at its lowest points it only just touches the base line, so that its centre line falls at a height above the base line just equal to half the maximum height.

**PERILS OF THE PORTABLE.**

A portable owner who switched on his set in a Birmingham street has been fined 10s. for drawing a crowd which caused obstruction.

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**“Q” CALL WITH A KICK IN IT.**

Among a collection of new Morse abbreviations suggested by the amateur transmitters of America is the following: QLF: Say, OM, send with your LEFT foot now.

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**SUN SPOTS MISFIRE.**

Despite the recent prediction of Professor Stetson, astronomer at Harvard University, that the present month would be a bad one for wireless reception owing to sunspots, listeners are failing to note any reduction in signal strength. It seems that a sunspot means nothing to Brookman's Park.

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**LISTENER'S LICENCE CANCELLED.**

To Mr. A. Britton, of Fishponds, Bristol, apparently belongs the unenviable distinction of being the first listener to have his licence suspended by the Post Office for having caused interference by oscillation.

It is well known, of course, that the Post Office reserves the right to take action of this kind, a statement to this effect being printed on each licence issued; but the interesting point now arises whether the offender is doomed never again to hear a B.B.C. programme on his

Therefore, the *mean square* value is equal to  $\frac{1}{2}$  in this case where the maximum value of the current is 1 ampere.

Thus if the maximum value of the current is  $I_m$  amperes, the *mean square* value will be  $\frac{1}{2}I_m^2$ , and the *root mean square* (R.M.S.) value is the square root of this, namely:—

$$\text{R.M.S. value} \quad I = \sqrt{\frac{1}{2}I_m^2} = \frac{I_m}{\sqrt{2}}$$

or

$$I = 0.707 I_m$$

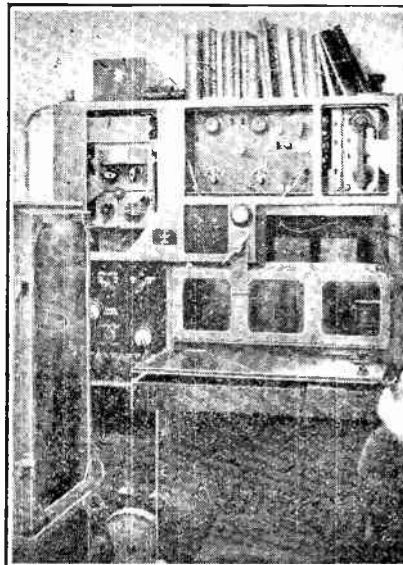
This is a very important result—it means that for a sine wave the effective value is 0.707 of the maximum value of amplitude, or, conversely, the maximum or peak value is  $\sqrt{2}$  times or 1.414 times the effective value. The same rules apply to alternating electro-motive forces and potential differences.

Alternating current ammeters and voltmeters are always calibrated to read directly in effective or R.M.S. values.

The relationship between the effective value and maximum value for a sine wave has been arrived at by graphical means without the use of mathematics; but even so there may be some who will at first find a little difficulty in following the reasoning. This need not cause any misgiving, as the work to follow will be based, not on the particular reasoning referred to, but on the result, namely, that the ratio of the effective value to maximum value for a sine wave is 0.707.

(To be continued.)

## CURRENT TOPICS.



WIRELESS WITHOUT WEIGHT. The radio cabin on the R. 101, Britain's new airship, which is undergoing preliminary trial: this week. Note the aluminium case containing the apparatus.

own receiver or whether a limit is set to the period of penance. A statement regarding the P.M.G.'s powers in this direction would be welcome.

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**B.B.C. ESCAPES CRITICISM.**

The recent drought is said to have been exceptional in that no one attributed it to wireless.

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**NEW B.B.C. OUTPOST.**

The B.B.C.'s new receiving station at Tatsfield, Surrey, is now in use and the apparatus at Keston is being dismantled.

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**AMATEURS UNITE AT MANCHESTER.**

In connection with the Manchester Wireless Exhibition, which opens at the City Hall on Wednesday next, October 16th, the Association of British Radio Societies is organising a National Radio Convention. The plans include several social functions, discussions on amateur topics, and visits to the Exhibition and other places of interest in the Manchester area.

The Convention will be open to members of any radio society. Those wishing to attend are invited to apply for particulars to Mr L. A. Gill, Secretary of the Association, Hope House, South Reddish, Stockport.

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**LECTURE BY DR. N. W. McLACHLAN.**

Under the auspices of the Association of British Radio Societies, Dr. N. W. McLachlan, M.I.E.E., F.Inst.P., will lecture on “The Ideal Loud Speaker” at a

meeting in the Albert Hall, Peter Street, Manchester, on Monday, October 28th, at 7.30 p.m. The lecture will be followed by demonstrations in tone compensation and control for electric gramophones.

**POST OFFICE AND SICK "PIRATES."**

In a letter to an enquirer, the Post Office states that during the past four years 3,230 prosecutions have been undertaken against infringers of the Wireless Telegraphy Acts. In taking legal proceedings, adds the Post Office, full consideration was given to the circumstances of each case, including the age of the offender and any special factor such as his ill-health.

**BRITISH COASTAL WIRELESS: A DANE SPEAKS OUT.**

Captain G. Mikkelsen, a Danish navigator, has made a statement deploring the lack of wireless facilities in North Britain, writes a correspondent. "Along the coasts of Norway, Sweden, Denmark and the Faroe Islands," says the captain, "there are wireless stations to aid navigators, but when proceeding round the north coast of Scotland and the Orkney and Shetland Isles, valuable time is lost. In foggy weather the navigator must take his observations from the sun or rely on the chart before taking the dangerous passages on this coast."

It is possible that the worthy captain has overlooked the existence of the beacon station at Wick, which is extensively used by ships skirting the northern coast of Scotland.

**CALIBRATION SIGNALS FROM GERMANY.**

In view of the increasing congestion of the ether and the consequent necessity that transmitting stations should not depart from their allotted wavelengths, it is essential that means should exist for their exact calibration.

For some time past the German high-power transmitter at Koenigswusterhausen has broadcast at regular periods calibrated waves for the benefit of Europe in general, and of its own country in particular. These special transmissions take place on the 14th and 15th day of each month, according to the following schedule:—

Time.	FIRST DAY.	Metres.	Signal.
06.00-06.05	345	870	A
06.15-06.20	333	900	O
06.30-06.35	323	930	G
06.45-06.50	257.5	1164	J
07.00-07.05	256	1170	K
07.15-07.20	250	1200	P
07.30-07.35	248	1210	X
07.45-07.50	243	1235	Y
08.00-08.05	238	1260	Z
08.15-08.20	207.5	1444	
	SECOND DAY.		
06.00-06.05	538	557	A
06.15-06.20	429	700	O
06.30-06.35	353	849	G
06.45-06.50	284	1055	J
07.00-07.05	276.5	1084	K
07.15-07.20	273.5	1097	P
07.30-07.35	267	1124	X
07.45-07.50	260.5	1152	Y
08.00-08.05	233	1288	Z
08.15-08.20	217.5	1380	
08.30-08.45	224	1340	Q

At the beginning of each transmission a short tuning signal is sent out, and is followed by the call-sign in Morse, as given in the fourth column. In the event of any unforeseen interruption taking

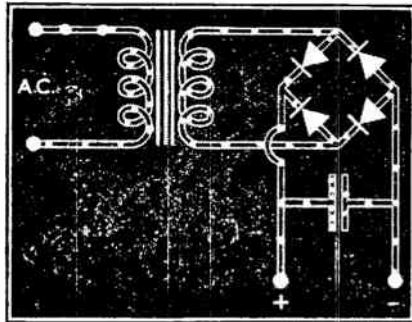
place, in order that the time schedule should not be completely upset, the "missing" signals are specially broadcast at the end of the transmission and an announcement made to that effect.

Again, should the 14th or 15th day of the month coincide with a Sunday or holiday, the transmission of the calibrated signals is postponed until the following day.

As these signals are accurately measured, the broadcasts are regularly used by both German telegraphy and telephony transmitters to check their wavelengths, and should also prove of use to amateurs for the calibration of medium- and long-wave wireless receivers.

**ANIMATED WIRELESS DIAGRAMS.**

Secretaries of radio societies will be interested in a clever film, entitled "Rectification," which has been produced by the Westinghouse Brake and Saxby Signal Co., Ltd., to demonstrate the action of electric currents in circuits employing the



ANIMATED CIRCUITS. A "still" taken from the film "Rectification," showing how the current flows in the "bridge" method of obtaining full-wave rectification.

Westinghouse metal rectifier. It is expected that this film will be included in the series of lectures which will be given by the Westinghouse Company to a selected number of radio societies.

Much more clearly than the simplest book of words, the film shows the difference between alternating, direct, half-wave and full-wave rectified currents. Working circuits are shown of half-wave rectification using the Westinghouse H.T.3 rectifier, full-wave rectification with the H.T.1 type, and voltage doubling rectification with the H.T.4 type.

The moving diagrams, of which a specimen is shown herewith, were drawn in the same manner as "cartoon" films, forty separate pictures being necessary for a complete cycle of operations.

**TRIPLE RADIO FUSION IN U.S.**

Over 700 American wireless patents have come under a single control as the result of the merger between the three radio concerns, Kolster, Earl and Freed-Eisemann. The new organisation is the second largest of its kind in the United States, the Radio Corporation of America coming first.

**THE INVENTOR'S FRIEND.**

Inventive minds will find much to interest and encourage in *The Inventor*, the official journal of the Institute of Patentees, which makes its first appearance this month. The journal sets out "to promote the burgeoning of new ideas."

**U.S. TO AUSTRALIA VIA BRITAIN.**

The British Post Office switched Australia through to America by wireless telephone on September 25th when the new short-wave radio telephone service between England and Australia was linked up with the Atlantic telephone service.

Speech from New York passed over land wires to the short-wave transmitting centre of the American Telephone and Telegraph Company in Lawrenceville, New Jersey, thence by radio to the short-wave receiving station of the British Post Office at Baldock, Herts, and thence by wire via London to the Post Office transmitting station at Rugby. From there a direct radio link carried the speech to the receiving station of Amalgamated Wireless of Australia and by wire to Sydney. The path of speech from Australia was again to Baldock, thence through London to Rugby and onward via the American Company's short-wave receiving station at Netcong, New Jersey, to New York.

Conversation was carried on successfully over a distance of 15,000 miles. It is probable that the England-Australia telephone service will soon be open for commercial use.

**PREMIER'S U.S. SPEECH ON SHORT WAVES.**

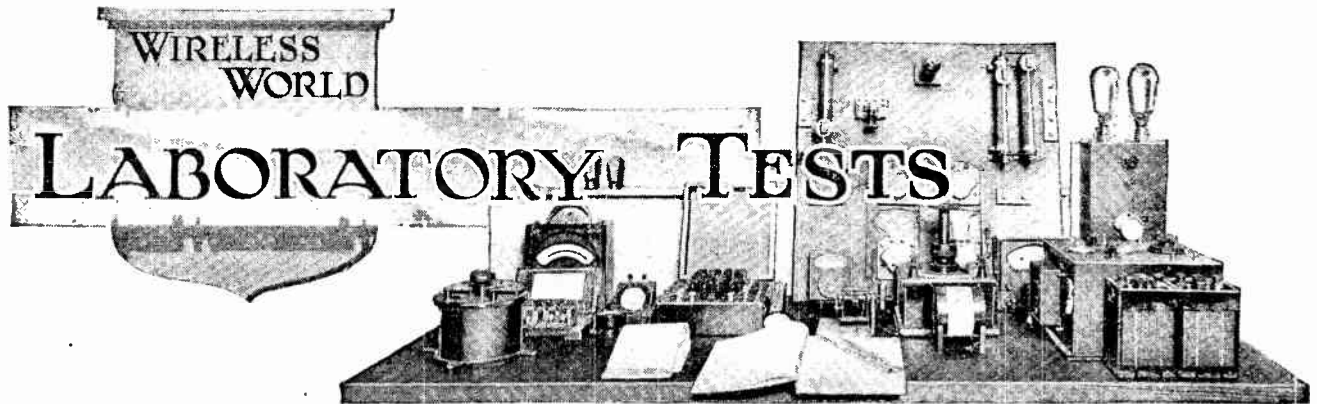
As stated in *The Wireless World* in July last, the American National Broadcasting Company's short-wave stations will be used to relay the speeches of the Prime Minister during his visit to the United States.

On Friday next, October 11th, Mr. MacDonald's speech at a dinner to be given in his honour by the Council of Foreign Relations at the Ritz-Carlton Hotel, New York, will be relayed all over America. We understand that the transmission will also go out from 2XAD, Schenectady (19.56 metres), 2XAF, Schenectady (31.48 metres) and 8XK, Pittsburgh (35.25 metres). The speech will begin at 9 p.m. (2 a.m. G.M.T.).

**A "B.B.C." FOR CANADA.**

A chain of high-power broadcasting stations across Canada is recommended in the report of the Royal Commission recently appointed to investigate Canada's wireless problems. It is also recommended that a State-owned corporation should be set up, similar to the B.B.C., and that funds necessary for the operation and maintenance of the service should be obtained from licence fees and programmes sponsored by advertisers, together with a Federal Government subsidy of \$1,000,000 annually for five years.

As a nucleus of the broadcasting chain, it is suggested that seven 50-kilowatt stations should be erected to give reliable service over the populated areas of the Dominion.



## A Review of the Latest Products of the Manufacturers.

### MODIFICATIONS TO STANDARD WET BATTERIES.

Readers will be familiar with these batteries since we have published test reports from time to time on various sizes. The latest improvements take the form of attention to details, the fundamental principle being the same as discussed in our reviews. To facilitate the initial assembly, and also ease the replacement process, the zincs and sacs are now supplied in the form of a cartridge which drops into the glass container. These are made for Nos. 3 and 4 size jars. A further improvement is the provision of a cork stopper, with a centre hole to clear the carbon rod. This is to prevent evaporation and, incidentally, creeping of the electrolyte, and replaces the earlier method of covering the top of the fluid with oil. It is a far better seal and results in a more workmanlike finish than was possible with the earlier models.

The cartridge, complete with cork, for the No. 3 size jar, costs 5d. each, and for the No. 4 size the price is 7d. Spare jars cost 2d. for No. 3 size and 2½d. for the No. 4 size. It is not essential to purchase new jars as the cartridges can be used with the ordinary No. 3 and No. 4 size containers.

The makers are the Standard Wet Bat-



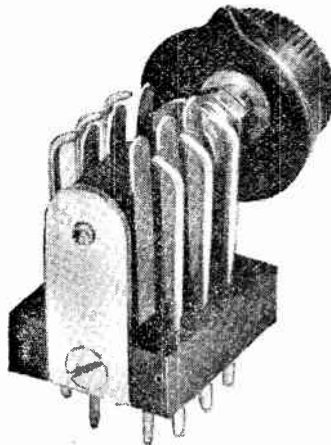
New cartridge-type zinc and sac for Standard Wet H.T. batteries.

tery Co., 184-188, Shaftesbury Avenue, London, W.C.2.

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### DETEX SWITCHES.

Since the advent of the screened valve the switching from medium to long waves has become a fairly simple matter, and



A feature of this Detex switch is the provision of a delayed action contact for filament or H.T. control.

many new multi-contact components have been developed. Where space behind the panel is limited, the Detex change-over switch should be found a useful asset, as this component takes up very little panel space. A single-hole fixing bush is fitted.

The body of the component consists of a machined ebonite block, and this supports the contacts and bearings for the operating spindle. A point of particular interest is the provision of one contact having a slight lag behind the others. This is so arranged to be the last contact to "make" and the first to "break."

The wiring of a receiver can be arranged so that the H.T. circuit is always the last to be completed and the first to be broken when switching off. This feature assures that the H.T. blocking condensers will not be left in a charged state.

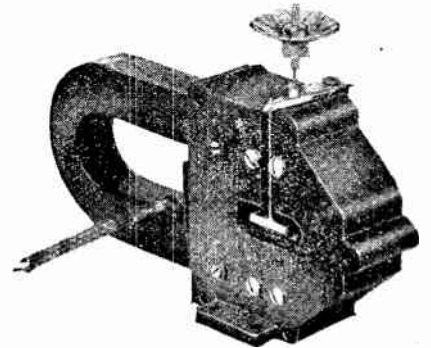
These change-over switches are made by Detex Distributors, Ltd., 66, Victoria Street, London, S.W.1, and prices have been fixed as follows: Two-pole, 3s. 6d.; 3-pole, 3s. 9d.; 4-pole, 4s.; 5-pole, 4s. 3d. and 6-pole, 4s. 6d.

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### "ISOMONA" LOUD SPEAKER UNIT.

This is a balanced armature movement for incorporating in cone-type loud speakers and consists of a massive permanent magnet fitted with two laminated pole-pieces shaped to concentrate the flux at each end of the armature. This is disposed centrally in the air gaps and fixed at its centre. The polarising coils, of which there are two, are disposed either side of the fulcrum with the armature passing through their centres.

The spindle, carrying the cone, is attached to the centre of a short stiff reed, one end of which is rigidly fixed while the free end is connected by a thin rod to one extremity of the vibrating armature.



"Isomona" cone loud speaker unit; a balanced armature movement.

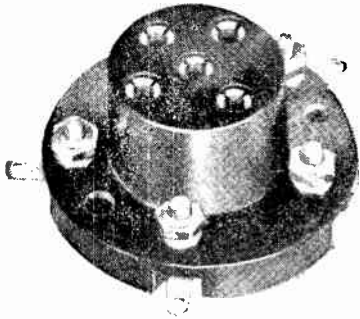
The pole-pieces, coils and armature are encased in a black crystalline-finished aluminium cover built up from two castings clamped together. A lug on each casting is provided for fixing purposes, four screws being supplied.

These units are supplied by Messrs. Haw and Co., 20, Cheapside, London, E.C.2, and the price is 21s.

**WEARITE 5-PIN VALVE HOLDER.**

This valve holder is fitted with five sockets, four being disposed as usual, and the fifth situated centrally with respect to these. It has been placed on the market by Messrs. Wright and Weaire, Ltd., 740, High Road, Tottenham, London, N.17, to meet the requirements of the new 5-pin A.C. valves, but it can be used also with the ordinary 4-pin type, thereby facilitating easy change of valves for experimental purposes.

The body is made from moulded material, and the sockets are split to ensure a good electrical contact with the pins on the valve. Soldering tags, in addition to terminals, are provided, these being fixed by small screws to the base of the sockets.



Wearite 5-pin A.C. valve holder.

The terminals are clearly marked by appropriate letters moulded into the material, and two screw holes are provided for fixing purposes. The price is 1s. 3d.

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**YOUNG'S "DRI-POWER" ACCUMULATORS.**

These accumulators, which are available in various types, including car-starter batteries and cells for wireless purposes, have their plates embedded in a gelatinous substance saturated with acid. Since there is no loose liquid they are unspillable, and the smaller sizes are particularly suitable for use in portable sets. Generally the employment of a solid electrolyte leads to a loss in ampere-hour capacity for any given size of battery, but the makers of the "Dri-power" cells claim that this disadvantage has been satisfactorily overcome.

Furthermore it is claimed that a special process of manufacture enables the cells to be roughly handled, in the electrical sense, without seriously impairing the life of the battery. To test this statement we subjected a sample 2-volt cell to a period of heavy discharges and charging at a higher rate than normal.

Subsequently a discharge curve was taken of the cell after a normal charge, the rate of discharge being approximately 2 amps. at the start. The voltage was maintained at a good level during this test, and it was found that the ampere-hour capacity returned to normal after a short period of normal charge and discharge. Since an accumulator can often be seriously damaged by the treatment it receives when first put into use, this test

would appear to confirm the makers' claim that these cells are very robust and will not deteriorate if subjected to periods of rough handling.

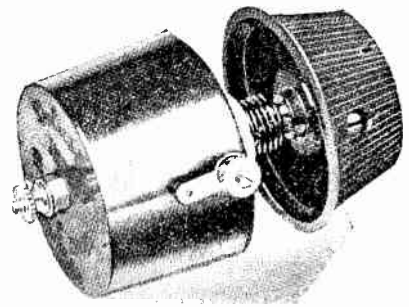


Young "Dri-power" 2-volt L.T. accumulator with solid electrolyte.

Two-volt cells in glass containers and filled with "Dri-power" solid electrolyte are available in 20-, 30- and 40-ampere-hour sizes, the prices being 14s. 6d., 16s. 6d. and 18s. 6d. respectively. These are supplied fully charged. High tension units of 24 volts each in glass containers and with solid electrolyte are available also at £1 10s. each. These have a milli-ampere-hour capacity of 7,500 at a discharge rate of 15 mA or 5,000 mA-hour capacity at 50 mA discharge.

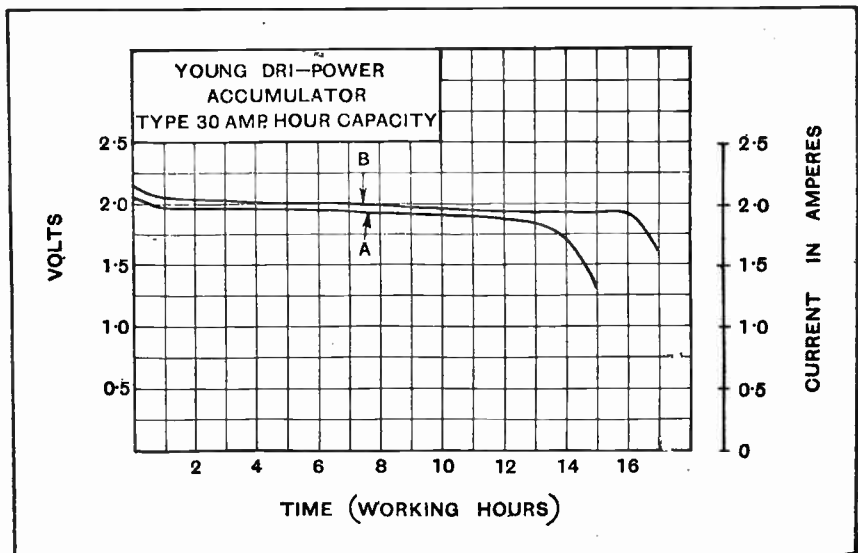
type, 50 to 500,000 ohms; medium resistance type, 2,000 ohms to 2 megohms; and high resistance type, 10,000 ohms to 10 megohms, function on the compression principle. The ingredients and quality of the resistance material has been, it is claimed, the subject of much experiment since the constancy of these resistances depends on the use of a mixture which will not pack when compressed, but returns to its original volume when the pressure is released.

Practical tests show that the resistance can be set at any given value, and it will keep this value for a long period. We did not subject the sample to the passage of heavy currents, but to that which would



Harlie "Universal" type Volustat.

pass normally when the component was used as a volume control. The measured maximum and minimum values of the



Discharge curve of Young "Dri-power" accumulator. Curve "A" taken after a period of over-charge and discharge. Curve "B" shows normal life on one charge after a period of normal treatment and recuperation.

The makers are the Young Accumulator Company (1929), Ltd., Burlington Works, Rigault Road, Fulham, London, S.W.6.

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**HARLIE VOLUSTAT.**

These variable resistances, which are made in three ranges, namely, Universal

sample tested were found to be 720,000 ohms and 43 ohms respectively. Nominally these are 500,000 and 50 ohms, this being the "Universal" model.

The makers are Messrs. Harlie Bros., Ballham Road, Lower Edmonton, London, N.9, and the price of all three types is 7s. 6d. each.

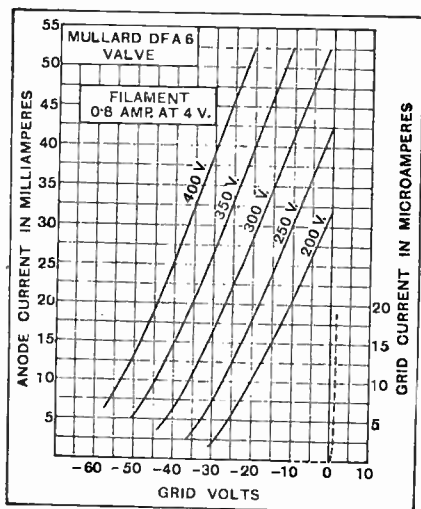


## Mullard D.F.A. Power-Amplifying Valves.

THE three valves dealt with under this heading are the D.F.A.6, D.F.A.7, and the D.F.A.8. Each requires 4.5 volts across the filament, and consumes 0.85 amp. of current. Since a 6-volt accumulator will normally be used, a fixed resistor of about 1.8 ohms, connected in the positive L.T. lead, will be necessary to absorb the excess voltage. The maximum plate potential is 400 volts in each case. The D.F.A.6 and D.F.A.7 are power output valves, the principal difference being in the grid swing that can be handled by each without causing grid current to flow.

### D.F.A.6.

The particular function of the D.F.A.6 is an output valve in an amplifier designed to operate a moving-coil loud speaker. Its rated characteristics, measured at 100



Average values under normal working conditions; A.C. resistance, 4,630 ohms; amplification factor, 5.7; mutual conductance, 1.23 mA/volt.

volts H.T. and zero grid bias, are A.C. resistance 4,500 ohms, amplification factor 6.4, and mutual conductance 1.45 mA. per volt. The sample tested, however, did not show such a good mutual conductance

under these conditions, the figures obtained being, A.C. resistance 5,900 ohms, amplification factor 5.7, and "slope" 0.97 mA. per volt.

Under working conditions, i.e., with 400 volts on the anode and minus 40 volts grid bias, an improvement in the efficiency of the valve was recorded the A.C. resistance dropped to 4,630 ohms; the amplification factor remained the same, but the mutual conductance improved to 1.23 mA. per volt. From the figures obtained it is possible to calculate the maximum undistorted power, in watts, that the valve may be expected to deliver to the loud speaker. This, of course, must be based on the relationship between the impedance of the speaker and the A.C. resistance (or impedance) of the valve. Assuming that the loud speaker impedance is equal to, or only slightly greater than, the A.C. resistance of the valve and that there are no other factors likely to modify the results, an undistorted output of approximately 1.4 watts should be available. This is sufficient to operate a good moving-coil loud speaker at something approaching full volume.

The following tabulated matter gives an indication of the anode current at various anode potentials and optimum grid bias, and will be a useful guide when choosing an output choke or transformer.

### D.F.A. 6.

Anode Volts.	Grid Bias.	Anode Current.
200	- 18 volts	12.5 mA.
250	- 22 "	15.5 "
300	- 27 "	19 "
350	- 34 "	22.5 "
400	- 40 "	25 "

### D.F.A.7.

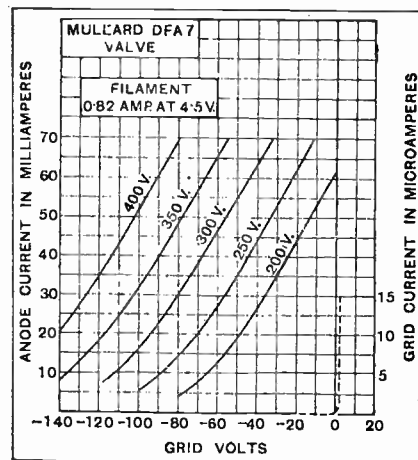
Like the D.F.A.6, this is a terminal valve and should be employed in the output position when very big grid swings have to be accepted in the last stage. With

the maximum plate potential a grid bias of the order of 120 volts should be used. Its measured characteristics at 100 volts H.T. and zero grid bias agreed very closely with those given by the makers. These values did not alter materially under working conditions, as will be seen from the following table.

### D.F.A. 7.

Conditions.	A.C. Resistance, Ohms.	Amplification Factor.	Mutual Conductance.
Maker's rating 100 v. H.T. zero G.B. ...	2,850	2.4	0.85 mA/V.
Measured at 100 v. H.T., zero G.B. ...	2,860	2.3	0.80 mA/V.
Measured at 400 H.T., 120 G.B. ...	2,570	2.2	0.85 mA/V.

Subject to the same conditions as mentioned with regard to the power output from the D.F.A.6, the maximum undistorted power given by the D.F.A.7 will be of the order of 3.4 watts.



Average values under normal working conditions; A.C. resistance, 2,570 ohms; amplification factor, 2.2; mutual conductance, 0.85 mA/volt.

### D.F.A.8.

Although this is a power amplifying valve, in that it is designed to operate with a high anode potential, it does not come within the



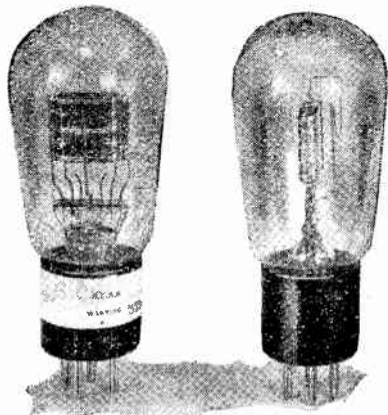
**Valves we have Tested.—**

category of super-power valves, since it will neither accept a very large grid swing nor deliver much power in terms of output watts. Its particular use is as a penultimate valve in an amplifier operating from a single H.T. source of the order of 400 volts. Its characteristics are given as 15,000 ohms

Measurements made with a specimen D.F.A.8 at 100 volts H.T. and zero grid bias gave the A.C. resistance of the particular sample tested as 28,000 ohms. The amplification factor was found to be 20, and the mutual conductance 0.7 mA. per volt. Tested under normal operating conditions with a high anode potential and suitable grid bias the average values were found to be: A.C. resistance 20,000 ohms, amplification factor 22.2, and mutual conductance 1.12 mA. per volt.

A resistance-capacity intervalve coupling would appear to be the most suitable arrangement to adopt, since power resistances capable of passing a current of the order of 5 to 10 mA. are readily obtainable. The following table shows the anode current at various grid potentials with different values of anode voltage.

The valves in this class are not "gettered," the required vacuum being obtained by pumping for a long period. Each specimen was tested for reverse grid current, but not the slightest trace was to be found. The inside of the glass

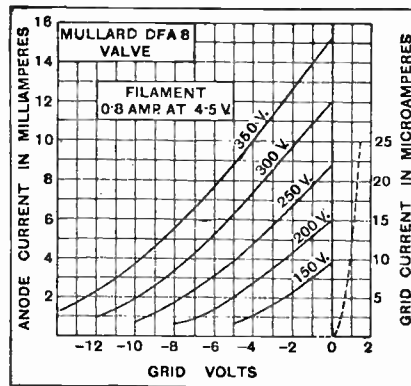


Typical examples of valves of the D.F.A. series.

A.C. resistance, 19.5 amplification factor, and 1.28 mA. per volt mutual conductance.

**D.F.A. 8.**

Anode Volts.	Normal Grid Bias (Amplifier).	Anode Current in mA.
200	- 4½ volts	2.4
250	- 6	3.1
300	- 7½	3.8
350	- 9	4.5



Average values under normal working conditions; A.C. resistance, 20,000 ohms; amplification factor, 22.2; mutual conductance, 1.12 mA. volt.

bulb is quite clear and the electrode assembly can be easily examined. Vertical "hairpin" filaments are used, the grid and anode being of the familiar "flattened" type.

## A CONVENIENT EARTH FOR FLAT-DWELLERS.

### Using the Metal Conduit for the Electric Light Wiring.

ACCORDING to the "Regulations for the Electrical Equipment of Buildings," published by the Institution of Electrical Engineers, and adopted as standard by all reputable contractors, the greatest resistance that is permissible between any part of the metal casing through which the wires are run, and earth, is two ohms. This regulation is intended to ensure that if through the failure of the insulation on some part of the wire within the casing, the casing itself becomes momentarily "live," the resulting current to earth shall be great enough to blow the protecting fuses immediately. There is thus no risk of shock to anyone who may touch the casing within the building, while earth leakage, which is one of the bugbears of the power-station engineer, is not permitted to persist.

#### Water-pipe Earth Not Always Satisfactory.

From the point of view of the user of wireless apparatus this careful earthing of the casing also has its merits. Few dwellers in flats can bury large copper plates in the garden for their earth connection, for if they have a garden at all it is usually paved. The usual alternative of a water-pipe is satisfactory enough, provided that the water-pipe chosen goes direct to earth, and not merely to a cistern, but it often involves leads that straggle untidily through several rooms and a landing.

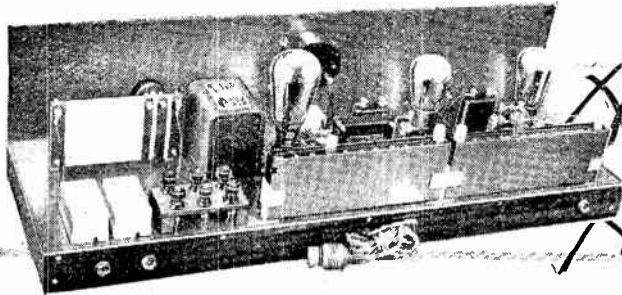
There is also the difficulty of making good connection to a water-pipe covered with several coats of paint.

Where electric light is installed it is naturally available in the room which contains the wireless receiver, so that only a comparatively short lead will be necessary if it is decided to earth the set to the casing. Connection may be made to the casing by removing one of the set-screws used at the joints between lengths of the tubing and getting the paint off it by soaking it for a few hours in an egg-cup full of turpentine. It can then be cleaned up with emery-paper and returned to its position, screwing down the earth-wire from the set under its head.

#### Freedom from Machinery Noises.

To judge from a limited experience of this method of earthing on a recently installed A.C. system, there are no disadvantages, from a purely wireless point of view, in its adoption; in particular, noises derived from rotating machinery and carried up to the set by the electric light wires do not appear to be accentuated appreciably. As for the D.C. resistance, a measurement between the casing and a water-pipe, both situated on the top floor of a three-storey building, showed it to be only a shade over half an ohm. It may therefore be regarded as a highly satisfactory earth.—A. L. M. S.

# A=C Eliminator for the



# All-Electric Amplifier

## Design of Rectifying Equipment, including Field Excitation.

By A. P. CASTELLAIN, B.Sc., A.C.G.I., D.I.C.

ALTHOUGH the "All-electric Amplifier" recently described in this journal<sup>1</sup> was intended for operation from D.C. mains or from batteries, a prophetic instinct on the part of its designer led him to state that with fairly simple modifications the instrument might be run from A.C. mains with a suitable eliminator. Subsequent requests from a large number of readers have shown that there is a strong demand for an A.C. eliminator capable of giving satisfactory service with this amplifier, and the object of this article is to describe two circuits which can be thoroughly recommended.

of giving a total D.C. output of 150 milliamps. Since the difference in cost between these two alternatives is so small, the two U.75/300s costing together 30s. as compared with 22s. 6d. for one UU60/250, it is really worth while catering for the greater output, which may come in useful at a later date. The circuits for the two arrangements are shown in Figs. 1a and 1b.

The transformer included in these circuits is the standard Met.-Vic. type AB with a separate 4-volt winding for feeding the heaters of the valves in the amplifier, in addition to the normal 4-volt winding for the rectifying valves. With the two single-wave rectifiers this eliminator will supply a loud speaker with a 20-watt 200-volt field besides feeding the amplifier.

For those readers who desire to use a higher H.T. voltage to obtain a greater power output, an eliminator incorporating a gas rectifier can thoroughly be recommended. Such a rectifier will supply up to 250 milliamps. at 400 volts.

Although it is quite possible to use valves of the L.S.5 class in the first stage of the amplifier, it will probably be found more convenient, in order to

obtain an amplifier free from hum on A.C., again to use an indirectly heated cathode valve, such as the AC/HL, for the first stage. Fig. 2 shows the circuit of an eliminator designed with this object in view. The output valve may be an L.S.5a, an L.S.6a, or several of these in

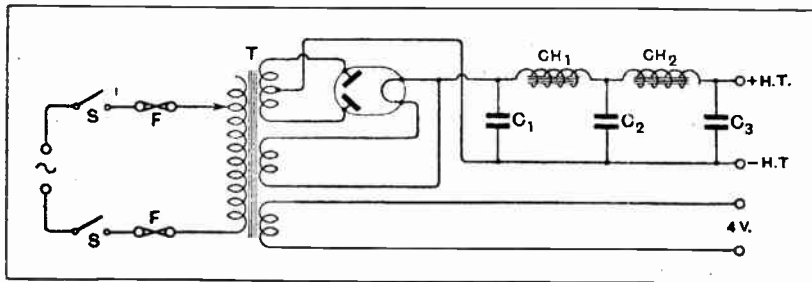


Fig. 1a.—Eliminator using a single full-wave rectifying valve.

For normal home use on A.C. supply an amplifier and eliminator using 200 volts H.T. with Mazda A.C. valves (which have indirectly heated cathodes) will give results as to volume and quality exactly equivalent to those obtainable with the all-electric amplifier as described for use on D.C. mains. In the amplifier the valves should be the AC/HL, AC/P, and AC/P1 in the first, second, and third stages respectively. For the eliminator there are two alternatives, depending on whether it is also required to supply the field current for a moving-coil speaker.

Where the amplifier alone has to be considered, the full wave rectifier UU60/250, capable of supplying 60 milliamps. D.C., will be sufficient, while if a 200-volt moving-coil speaker is to be used it will be necessary to use two single-wave rectifiers U.75/300, capable

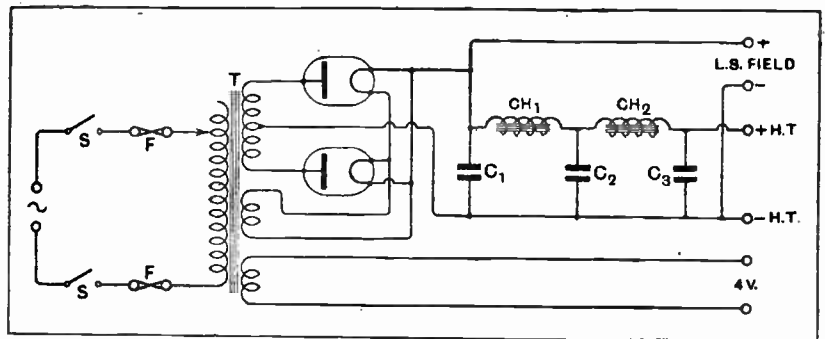


Fig. 1b.—An A.C. unit with two half-wave rectifying valves for feeding the loud speaker field as well as the valves in the amplifier. C<sub>1</sub> is 6 mfd., C<sub>2</sub> and C<sub>3</sub> 2 mfd., 750 volt D.C. test. CH<sub>1</sub> and CH<sub>2</sub> are Ferranti B1 chokes. The condenser and choke values apply to Fig. 1a.

<sup>1</sup> June 19th and 26th, 1929.

**A.C. Eliminator for the All-Electric Amplifier.—**

parallel. The mains transformer is not quite a standard article, but any good transformer manufacturer will be able to make it up at a cost of about £4 or £5.

The gas rectifier requires barretters (*i.e.*, series resistances in the form of spirals of iron wire enclosed in bulbs containing gas) in order to prevent arcing over, and as the filament is very thick and takes some time to come up to its final temperature, a separate switch should be used for connecting up the output to the amplifier. Thus the method of procedure in starting up is to apply the main switch  $S_1$  (Fig. 2), which lights the rectifier filament and the filaments of the amplifier valves; after a moment or two the output switch  $S_2$  is

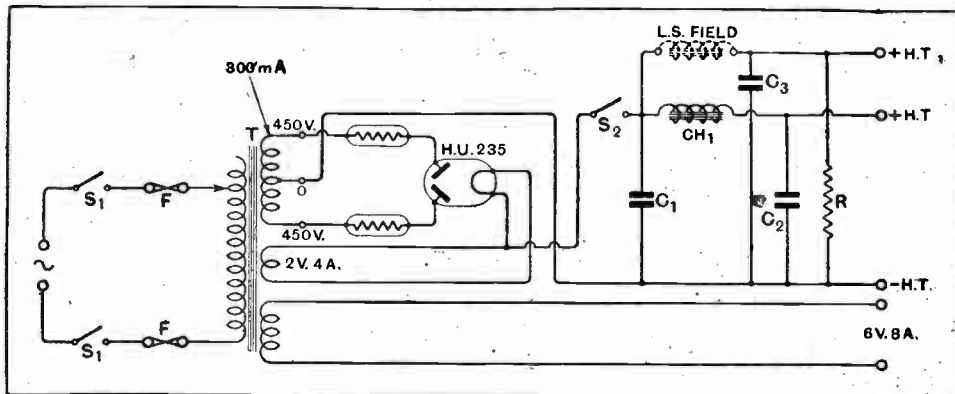


Fig. 2.—Circuit with provision for supplying the field of a 20 watt 200 volt loud speaker. A gas rectifier is employed. CH<sub>1</sub> is an E. 166 Rich and Bundy choke. C<sub>1</sub> 6 mfd.s., C<sub>2</sub> 2 mfd.s., 1,500 volt D.C. test.

closed and H.T. and field current are, therefore, supplied. In the circuit diagram, Fig. 2, provision is made for supplying the field of a 20-watt 200-volt loud speaker, the loud speaker field winding being used as an auxiliary choke for the first valve, which was an AC/HL.

**The September "Call Book."**

The Radio Amateur Call Book for September has now been issued. The list of amateur call-signs in all parts of the world, which has been revised and brought up to date, occupies 106 closely printed pages. It includes the latest Australian and New Zealand stations, the Dutch East Indies, and the revised Swedish call-signs.

The publishers earnestly request the help of transmitters in correcting and adding new calls to the list, and amateurs in Great Britain are asked to send particulars of new stations identified or alterations in addresses to Mr. F. T. Carter, Flat A, Gleneagle Mansions, Streatham, London, who is their British representative and from whom copies of the Call Book may be obtained.

Other useful features of the book are the revised "Q" code, International Prefixes, a list of about 1,400 short-wave stations arranged in order of frequencies, and a map of the United States, showing the boundaries of the various Radio districts.

**Broadcasting in Siam.**

Experimental short-wave broadcasting is being carried out by the Royal Siamese Post and Telegraph Department from their stations in Bangkok. HS1PJ transmits on a wavelength of 16.9 metres with an input of 20 kilowatts on Sundays from 12.00 to 14.30 and 18.00 to 20.00 G.M.T. The low-powered station HS4PJ transmits on 37 metres on Tuesdays from 13.00 to 15.00 and 18.00 to 20.00, and on Fridays from 13.00 to 15.00 G.M.T. Announcements are made in English, French, German, and Siamese, and reports of reception will be much appreciated by the Engineering Service, Royal Post and Telegraph Department, Bangkok, Siam.

**TRANSMITTERS' NOTES AND QUERIES.**

**English Amateur in Capetown**

Mr. E. R. Cook (G6UO), whose station near Gainsborough was well known to British amateurs, is now in Capetown, where he intends resuming his experimental transmissions on the 20- and 40-metre wavebands. He will use about 600 volts of rectified A.C. on the plate and raw A.C. on the filament of an L55 valve, giving an input of about 25 watts, and hopes to get into touch with his friends in the Northern hemisphere.

**Short-wave Stations.**

We have received, through the courtesy of the Federal Radio Commission, Washington, D.C., a list of radio stations of the world transmitting on frequencies above 6,000 kilocycles (or wavelengths below 50 metres), and comprising about 3,000 stations arranged in order of frequency. The information given includes the call-sign, locality, nature of service and power; also, in many cases, the countries with which any particular station is in regular communication. The nature of service is indicated by letters similar to those used in the "Berne Lists" (*e.g.*, PG=station open to public correspondence, FX=station carrying on services between fixed points), with several additions such as E for Experimental and RBC for Relay Broadcasting. In the case of American stations the name of the company or individual responsible for their working is also given.

The particulars have been compiled partly from the records of the Federal Radio Commission, partly from the lists

published by the International Telegraph Union, and from information furnished by the Tropical Radio Telegraph Co., and by various administrations.

The list we have received is in type-script and is, presumably, an advance copy of one to be published by the Radio Division of the Department of Commerce at Washington. If this is the case, we feel sure it will be warmly welcomed by amateurs in this country. It is stated that an endeavour will be made to prepare monthly supplements or correction sheets.

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**Heard in Australia.**

We have received, through the courtesy of G2XV, the following list of the European stations heard by Mr. R. Roberts at his station at Box Hill, Victoria, Australia, during July. The strength of signals is given, according to the "R" code, in brackets:—

- G5BY (R4), G2XV (R4), G5BZ (R4), G6NH (R3), G2AX (R2), G6WT (R2), G2BM (R2), G5ML (R3), G5YX (R3), F8FR (R4), F8DA (R3), F8FK (R4), F8RKO (R3), ON4EA (R4), ON4FL (R3), ON4HP (R4), ON4FT (R3), D4YT (R4), OZ7Y (R4), CT1BX (R3).

Mr. Roberts states that during July European signals are best received between 2200 and 2300 and between 0600 and 0700 G.M.T.

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**TRADE NOTES.**

The Marconi's Wireless Telegraph Co., Ltd., Marconi House, Strand, London, W.C., announce a change in their telephone number. This is now Temple Bar 4321.

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A change has been made recently in the telephone number of Messrs. A. C. Cossor, Ltd. This is now North 5900 (20 lines).

## BROADCAST



## BREVITIES

By Our Special Correspondent.

### Two Important Ceremonies.—2LO's Last Lap.—A Musical Sensation.

#### A Foundation Stone Ceremony.

Early this year I suggested that the laying of the foundation stone of "Broadcasting House" should be the occasion of a public ceremony. It now seems that the suggestion will be carried out early in the New Year and, although no definite arrangements have been completed, it is not unlikely that the stone will be "well and truly laid" by one of the most popular members of the Royal Family.

#### A Send-off for the Regional Scheme.

*The Wireless World* has already pointed out that an event of such importance as the inauguration of the Regional Scheme is deserving of more than ordinary publicity. At first it seemed as if the B.B.C. would be content to insinuate the high power transmissions into the ordinary broadcasting periods with an air of apology for disturbing the service. However, some of the old 1922 spirit still bubbles up at intervals, and Savoy Hill has decided that the Scheme is to be given a good send-off in January when the Brookmans Park twins begin simultaneous transmissions. An impressive "S.B." will be staged, in which the inaugural speech will be given by a celebrity of special eminence; indeed, it is hoped that the fateful words will be pronounced by the Prime Minister himself.

#### 2LO's Last Lap.

One of the most surprising phenomena connected with the opening transmissions from Brookmans Park has been the apparent increase of signal strength from 2LO. I have noticed this especially during the transmission of the Promenade Concerts, and others report the same experience.

It would not surprise some of us if the disclosure were made that Brookmans Park is transmitting at periods other than those officially announced. Possibly, of course, the older station is developing a sprint over the last lap.

The Regional Station will take up the entire London programme at the beginning of next week.

#### Unique Newcastle.

When all six regional stations are functioning listeners in the Newcastle area will possess the unique distinction in the British Isles of still being out of the

reliable service range of the new transmitters. So Newcastle will continue to have its own station. For a brief spell in the near future, however, the district will have to forfeit the individuality of local programmes, 5NO being allocated on October 31st next the national common wave of 288.5 metres. From then until the Moorside Edge station is complete (at the end of 1930) Newcastle listeners must submit to a regime of outside programmes.

If they are wise, they will accept the temporary setback in respectful silence, in anticipation of the delights of the future.

#### Personalities at the Microphone.

Mr. H. G. Wells will be heard by 2LO listeners on October 21st in a contribution to the series of talks entitled "Points of View."

On November 9th the speech of the Prime Minister at the Lord Mayor's Banquet will be relayed by 2LO and 5XX.

#### FUTURE FEATURES.

##### London and Daventry.

OCTOBER 14TH.—"Points of View" (8) by Deau Lage.

OCTOBER 15TH.—Speech by General Dawes at Hull Civic Week Banquet, S.B. from Hull.

OCTOBER 16TH.—"Captain Brassbound's Conversion," by Bernard Shaw.

OCTOBER 17TH.—A Norwegian National Programme.

OCTOBER 18TH.—A Delius Festival Concert.

##### Daventry Experimental (5GB).

OCTOBER 15TH.—Programme of Plantation Songs.

OCTOBER 17TH.—Selections from the Operas.

OCTOBER 18TH.—"Smoke Rings," a bachelor retrospect by Dorothy Eaves.

##### Cardiff.

OCTOBER 14TH.—A Welsh Programme.

##### Manchester.

OCTOBER 14TH.—Gems from Italian Opera.

OCTOBER 16TH.—Speeches at opening of sixth Manchester Radio Exhibition.

OCTOBER 17TH.—Halle Concert.

##### Glasgow.

OCTOBER 14TH.—An Hour with Tchakovsky.

OCTOBER 19TH.—"Jinju' the Kirk," a Scots comedy, by T. M. Watson.

##### Aberdeen.

OCTOBER 19TH.—A Gaelic Concert.

##### Belfast.

OCTOBER 19TH.—Speeches at Laying of Foundation Stone of New Law Courts.

#### The Manchester Radio Show.

Speeches at the opening ceremony of the sixth Manchester Radio Exhibition will be relayed from the City Hall for the benefit of Manchester listeners on October 16th, beginning at noon.

#### A Present for "P.P."

The large-hearted staff at Savoy Hill are now putting their pennies together for a handsome presentation to Captain Eckersley, who terminated his appointment as Chief Engineer on September 30th. There seems to be some doubt as to what would be an acceptable present, but I am authoritatively informed that it will not be a wireless set.

#### A Musical Sensation.

One of the best indications that the National Symphony Orchestra (which begins broadcasting on October 25th) will aspire to something above the ordinary standard of broadcast orchestras is the news that its leader will be one of the best known solo violinists of to-day. It is rare indeed for a soloist of rank to take up orchestral work, and I am sure that the forthcoming disclosure of the name of this artist will not only cause a lifting of brows among the high brows, but a big advance in the prestige of the National Symphony Orchestra.

The first concert will be given at the Queen's Hall on October 25th, Sir Henry Wood conducting.

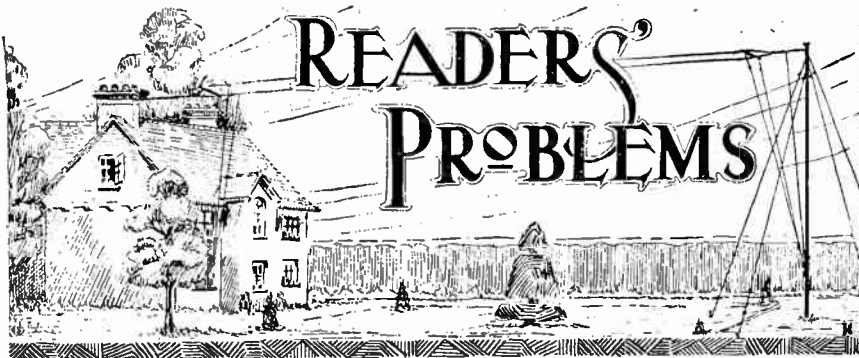
#### Football Broadcasts Begin.

The first running commentary of the season on a soccer match will be heard by 2LO and 5XX listeners on Saturday next, October 12th, when the second half of the Arsenal v. Derby County game will be relayed from Highbury at 4.15 p.m.

#### Archbishop of York and Broadcast Education.

Public opinion can veer round with surprising rapidity, an instance of this being the changed attitude to broadcast education. Although opposition is still strong, a large section of the public is taking an interest in the plans of the Central Council for Broadcast Adult Education, the new chairman of which is the Archbishop of York. It is hoped that His Grace will be able to preside for the first time at the next Council meeting on Wednesday, October 23rd.

# READERS' PROBLEMS



## "The Wireless World" Supplies a Free Service of Technical Information.

The Service is subject to the rules of the Department, which are printed below; these must be strictly enforced, in the interest of readers themselves. A selection of queries of general interest is dealt with below, in some cases at greater length than would be possible in a letter.

### Modifying the "Kit Set."

In this neighbourhood we are not normally troubled by interference, due to the fact that we are remote from any transmitting station. In these circumstances, do you consider that it would be permissible to modify the "Wireless World Kit Set." by omitting the separately tuned aerial circuit, and, if so, will you give me a diagram showing how it can be altered?  
T. M. S.

There is no real reason why you should not omit the tuned aerial circuit, but it should be realised that, apart altogether from the question of selectivity, the general performance of the receiver will be adversely affected, but only to a small extent.

We assume that you wish to retain the feature of waveband switching, and give in Fig. 1 a circuit diagram showing how the necessary alterations may be made. A tapping to the aerial connection should be made at the 12th turn from the end, marked x, of the short-wave grid

coil L, while a similar connection may be made on the long-wave coil (L<sub>1</sub>) at the 35th turn.

### Choke Filter or Output Transformer.

I am building a four-valve set consisting of one H.F. stage, detector, and two L.F. stages. I intend to use an ordinary cone loud speaker, but am uncertain whether it is better to use an output transformer or choke filter output circuit.  
D. M. P.

Both of these instruments would give you the same results from the musical point of view, as we assume, in the absence of information to the contrary, that the loud speaker you propose to use is not designed to be employed in conjunction with a step-down transformer. From the point of view of stability, however (more especially if you intend to use a battery eliminator), we think that it would be preferable to use a choke filter output circuit.

### A Temporary Makeshift.

I am thinking of building the "Record III" receiver. As A.C. power will not be available for some weeks in my district, would it be possible for me to use battery-operated valves in the receiver for the time being?  
H. S. H.

You do not make it quite clear in your letter whether your idea is to use the ordinary type of valves made for battery use, or whether you intend to operate A.C. valves from batteries. If the latter is the case, you can, of course, operate the set entirely from batteries, but it must be pointed out that the filament current taken by the set is naturally very heavy, and therefore it would not be an economical proposition from the point of view of accumulator charging; apart from this, you would have to use an accumulator of generous ampere-hour capacity to enable it to be discharged at a relatively high rate without injury. This would rule out many of the ordinary accumulators now in use.

If you intend to use ordinary battery-

operated valves, we would inform you that this plan is quite feasible, but you will have to temporarily alter the filament wiring and probably make some adjustment in the matter of the primary turns on the H.F. transformer. Needless to say, results will be comparatively poor to those obtained when using the A.C. valves for which the set is specially designed.

### Copper or Tin P

I notice that in many of your set designs published last year copper or aluminium screening boxes were adopted. Am I correct in assuming that these are to be used in the "New Kilo-Mag Four" and the "Record III"?

L. T. P.

It will, of course, be quite in order for you to use copper or aluminium screening boxes, and, indeed, a copper box is the best to use, but tinned iron, which was actually used in one of the receivers to which you refer, is for all practical purposes equally as good.

You must not expect, however, that by using copper you will obtain better results.

### A Fuse Question.

I have recently inserted a safety fuse in my "Everyman Four" receiver; this consists of a small flash-lamp bulb connected between H.T.— and L.T.—. Although the set has been functioning well for some time, I find that this lamp speedily burns out.

N. C. J.

The total plate current consumption of this set, if built as described, is well under 20 milliamperes, and the bulb should not, therefore, burn out. We think that you have not provided us with sufficient information, and are possibly using an arrangement of two valves of the LS5A type in the last stage, and in this case it would be perfectly normal for the bulb to burn out, if (as we suppose) it is of the special type now available for use as fuses in sets not employing heavy H.T. current.

If you let us have some more information we will endeavour to assist you further.

### RULES.

- (1.) Only one question (which must deal with a single specific point) can be answered. Letters must be concisely worded and headed "Information Department."
- (2.) Queries must be written on one side of the paper, and diagrams drawn on a separate sheet. A self-addressed stamped envelope must be enclosed for postal reply.
- (3.) Designs or circuit diagrams for complete receivers cannot be given; under present-day conditions justice cannot be done to questions of this kind in the course of a letter.
- (4.) Practical wiring plans cannot be supplied or considered.
- (5.) Designs for components such as L.F. chokes, power transformers, etc., cannot be supplied.
- (6.) Queries arising from the construction or operation of receivers must be confined to constructional sets described in "The Wireless World" or to standard manufacturers' receivers.

Readers desiring information on matters beyond the scope of the Information Department are invited to submit suggestions regarding subjects to be treated in future articles or paragraphs.

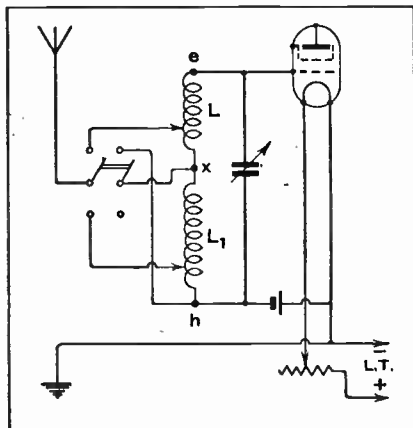


Fig. 1.—Modified H.F. grid circuit of the "Wireless World Kit Set," showing how provision may be made for an "aperiodic" aerial coupling with waveband switching. Lettering corresponds with that in the original circuit diagram.

**Building an Eliminator.**

Can you give me a circuit diagram for an eliminator which would be suitable for operating a five-valve receiver?

W. M. D. M.

You have omitted to state whether your mains are A.C. or D.C., but we can in either case refer you to an instrument which is quite suitable for your receiver.

In the case of A.C. we should advise you to make the instrument described in our issues dated December 12th and 19th, 1928, and in the case of D.C., we should advise you to construct the instrument described in our issue of August 28th, 1929.

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**An A.C. "Kit Set."**

Will you please give me a few words of advice as to how the "Wireless World Kit Set" may be modified for use with indirectly heated A.C. valves throughout? I take it that the general design need not be altered; but I understand that it will be necessary to rearrange the filament circuits; it is about this part of the receiver that I should particularly welcome your advice.

S. H. T.

The design of this receiver lends itself readily to modification for A.C. mains operation, and we think that the circuit diagram given in Fig. 2 will convey all the necessary information to you.

You may find it necessary to make a slight adjustment to the number of primary turns of the H.F. transformers—this depends on the characteristics of the

vides a positive bias; in this matter you should be guided by the advice given by the makers of the valve.

In cases where an attempt is made to attain the maximum overall magnification, it is sometimes advisable to connect a condenser of about 0.005 mfd. across each half of the potentiometer, which is shunted across the secondary of the heater transformer.

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**A Two-valve Question.**

Hitherto I have not had electric light mains available, but have recently moved into a new house in which D.C. at 110 volts is supplied. My set is a detector and L.F. fitted with a choke filter output circuit, and hitherto I have operated it successfully using 2-volt L.T. accumulator and five 20-volt H.T. units in series. This has given me satisfactory results, the volume being moderate, but ample for my purpose. I obtain the same results using batteries in my present house, but desire to use the household mains for H.T. supply as my H.T. units are now over three years old, and do not hold their charge for as long as they did. I should be glad if you could tell me what precautions I should take in order to avoid "motor-boating." I have already purchased an eliminator. J. F. J.

You do not give us any technical data concerning the particular eliminator you have purchased, but the type of

having twoappings, one of which is intended for the detector valve.

We would point out that as your mains are only 110 volts, you will not get enough voltage on your last valve to give you undistorted results unless you are content with comparatively little volume. We should advise you to use one of your accumulator units in series with your eliminator. It should be connected between the H.T.— terminal of the eliminator and the H.T.— terminal of the set. If your existing units do not hold their charge for long, it is advisable to purchase at least one new 20-volt unit to use in this position. If two are purchased you can arrange to charge one while the other is in service.

Naturally, we presume that you have an up-to-date receiver, but if not, you must remember that it is necessary to use fixed condensers in aerial and earth leads.

For further information, we would refer you to an article appearing on page 529 of our May 22nd, 1929, issue.

o o o o

**Special Screening Cabinets.**

Will you please tell me if there is any real reason why conventional screening boxes should not be used in the construction of recent Wireless World sets, for which the new design of metal cabinet is specified? I ask the question because I have a large collection of copper boxes with well-fitting lids.

W. M. P.

If the screening provided by your boxes is as thorough as that of the cabinets used in the construction of the sets to which you refer, there is no reason why they should not be used with satisfactory results. All the new sets are on entirely straightforward lines, and, provided adequate means are taken to ensure sufficient isolation of the various circuits, it matters not at all how this end is attained.

o o o o

**The Range of a "1-v-1" Set.**

I live about 160 miles from Daventry, and on account of Morse interference depend almost entirely on the long wave station for consistent reception. I am thinking of replacing my det.-2 L.F. set with an H.F.-det.-L.F. three-valve receiver with anode bend detection and transformer coupling. The set will be fed entirely from A.C. mains, and the most efficient modern valves will be used; do you consider that this circuit arrangement should provide really adequate volume with a reasonable margin of safety?

W. J. R.

In answering queries of this sort, we can only assume that your local receiving conditions are not abnormal, and, this being so, it can be stated quite definitely that a well-designed modern three-valve set, with a reasonable aerial and efficient valves, will give an output sufficiently great for average requirements. The efficiency of a modern H.F. stage is so high that it is quite conceivable that you will find it necessary to reduce sensitivity in order to prevent detector overloading.

A 48

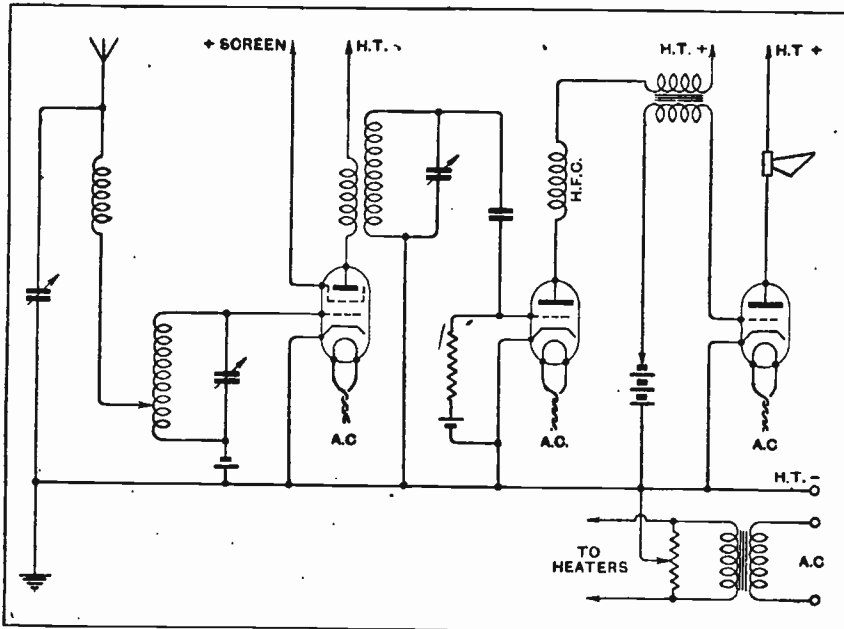
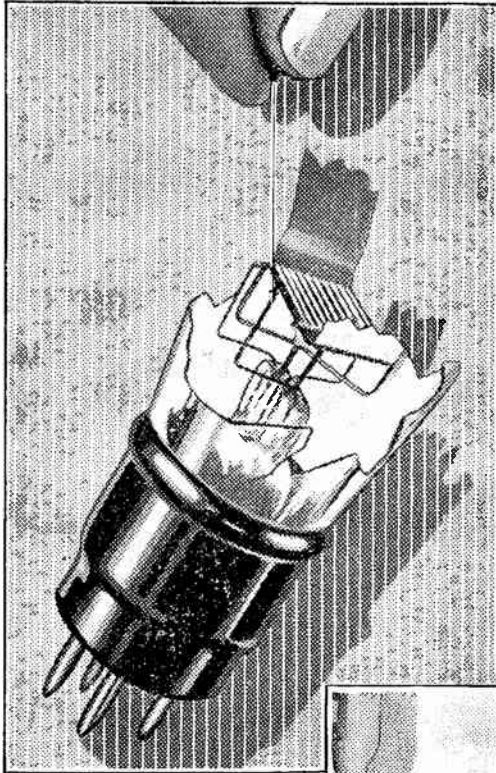


Fig. 2.—Skeleton circuit diagram (omitting waveband switching, reaction, by-pass condensers, etc.) of the "Wireless World Kit Set," modified for use with A.C. valves.

valves used—but, apart from this, no basic modification of the design will be necessary. It will be observed that a single cell is connected in the detector-grid circuit in such a way that it pro-

vides a positive bias; in this matter you should be guided by the advice given by the makers of the valve. In cases where an attempt is made to attain the maximum overall magnification, it is sometimes advisable to connect a condenser of about 0.005 mfd. across each half of the potentiometer, which is shunted across the secondary of the heater transformer.

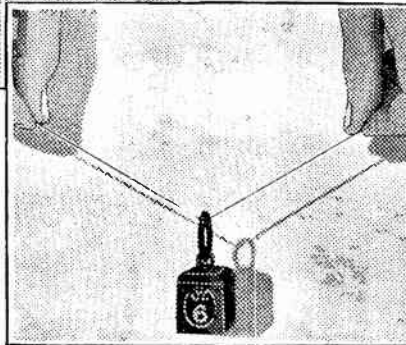
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It has a solid tungsten core that is actually tougher than steel. And this core carries a thick, highly emissive coating. By a special Cossor process, core and coating are combined into a filament of enormous strength and pliability. Because of its pliability the NEW Cossor filament cannot become brittle. And because it cannot become brittle it will not break. Even after 1000 hours use the NEW Cossor filament will easily bear the weight of the whole valve. Not only in its filament but in its design, in its construction and in its method of manufacture the NEW Cossor is a wonderful stride forward in Valve development. Try the NEW Cossor in your Set—you'll get a new thrill from Wireless.



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**3-VALVE** All-wave Receiver, latest type, powerful perfect; £4.—V. Taylor, 57, Studley Rd., Stockwell, London. [027]

**RECEIVERS** for Sale.—Portable 5-valve, suit case type, complete, as new, perfect; £9/17/6.—Taylor, 57, Studley Rd., Stockwell, London. [032]

**NATIONAL** Portable, mouth old, perfect, equal new £13/10; Amplion R.C.1 speaker, little used, 55/- Osram valves, D.E.L.612, D.E.H.612, D.E.S.B., D.E.S. new condition, 6/- each.—Horspool, 47, Church St. Southwell, Notts. [639]

**BURNDIPT** 7-valve Superhet, 1926-27, £15; Burndipt Ekhogrand 5-valve, £15; Burndipt Ethelphone IV, £7; Marconi amplifier for V2, 35/-; James Scott and Co., Radio Engineers, Danfermline. [032]

**MARCONIPHONE** Straight Eight Receiver, complete with coils for 230-550 and 700-1,900 meters, valves and grid bias battery, Lucas Milar 52-amp-hour accumulator, with cover case carrying strap, Ferranti trickle charger for 200-250v 50 cycle A.C. mains; £31/10.—Box 3282, c/o The Wireless World. [644]

**COSSOR** S.G.3, latest model, nil electric, for 200-240 A.C., used few hours only; cost £15, first cheque £13/10 secured; also latest Osram music magnet S.G.3, with new H.T. battery, accumulator and blue spot speaker, in oak cabinet, cost £15, perfect, first cheque £12/10 secured; money refunded if not satisfied.—Box 3298, c/o The Wireless World. [647]

**WESTERN ELECTRIC** Detector and Tuner Set £4; also Power amplifier, same make, £5.—Box 3361, c/o The Wireless World. [650]

**6-VALVE** Solo-dyne 3, condenser control, mahogany cabinet 2 eliminators, Philips and Ebo, giving 300 volt output, spare valves and accessories perfect condition; £25; eliminators separate, £10.—Box 3362, c/o The Wireless World. [651]

**PHILIPS** 3v. All Mains, A.C. 240v., £23, sell £15; B.T.H. Ivce Kellogg moving coil loud-speaker A.C. 240v., £40, sell £25; Ferranti L.S., sell 19/6.—Saul, 8, Ansell Rd., S. Lytham, St. Anne's. [649]

**SAMSON-COTTON** (Americau) 8-valve Superhet with English valve holders, complete with Bodin frame aerial, battery leads and five new valves, in perfect order; offers.—Col. Kennard, 2, Adelphi Terrace London, W.C.2. [648]

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**EPOCH.**

**EPOCH** Moving Coil Speakers Greatly Improve the Results of all Receivers from 2 valves upwards. [60]

**SCIENTIFIC DEVELOPMENT Co.**, 51, Fishergate Preston.

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**SCIENTIFIC DEVELOPMENT Co.**, 51, Fishergate Preston. Tel.: 1364. [66]

**MULLARD-COLLINGWOOD** 8-valve Super Hetodyne Receiver, built to specification, complete with valves, frame aerial and Sterling Magnavox speaker; £12.—V. B., 10, Parsifal Rd., Hampstead, N.W.6. [66]

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**Receivers for Sale.—Contd.**

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**MOVING** Coil Speakers.  
**ALL** Mains Power Units.  
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**1929** Cossor Melody Maker, 240 volt A.C., Cossor eliminator, Celestion C12 mahogany loud-speaker, complete with all accessories, for immediate installation; 18 guineas.—Conway, Highview, Summit Close, Wake-man's Hill Av., Kingsbury, N.W.9. [6499

**ULTRADYNE** Superhet for Sale, in walnut case, professionally wired, finest components, 1 1/2 flow motion condensers, Ferranti push-pull last stage, fitted for gramophone pick-up, frame or out-door aerial, in perfect order, complete with frame and with 4-volt valves, last 2 P.M.254; £13, or near offer.—Write S., c/o A. Munn, Stationers, etc., Cambridge. [6517

**MARCONI** Portable, £18/18 model 55, unused; first £16.—"Radio," Montclair, Blackwood, Mon. [6520

**PHILIPS** All Mains 2-valve, complete, brand new, shop soiled only; list £12/10, accept £10/10; first cheque secures; guaranteed perfect and unused.—Goldham, 16, Hurligh Rd., Sutton. [6519

**FIVE-VALVE** Portable, new H.T., spare accumulator, Mullard valves, turntable, beautiful tone; £10.—"Spero," Chaldon Common, Caterham. [6558

**NEW** All-Wave Four, with additional loose coupled tuned aerial circuit as in regional receiver, oak cabinet, 30in. panel, 3 Cydon variable condensers, Ormond dials, 2 Sifam milliameters fitted on panel, 0.5 m.a. and 0.50 m.a., complete with Bercliff coils and valves, brand new and a really fine set; what offers?—Box 3386, c/o *The Wireless World*. [6556

**ALL** British Six, in perfect condition, oak cabinet, complete with valves and long and short wave-length sets of coils, royalties paid, wonderful range, power and tone quality, highly selective without loss of tone; a bargain at £25.—Box 3385, c/o *The Wireless World*. [6555

**BURDEPT** Screened Four, latest mode, oak double door cabinet, valves, leads.  
**MAGNAVOX** Moving Coil Speaker, in large oak cabinet, baffle, 6-volt field winding.  
**HIGH** Tension Eliminator from A.C. Mains, 100 to 250, giving various voltages from 50 to 210.  
**TRICKLE** Charger from A.C. Mains, from 100 to 250, charging 2-, 4- or 6-volt accumulator.  
**OLYMPIA** Accumulator, 6-volt, 40 hours actual, Burdept automatic power control unit.  
**THE** above Outfit is as New and Reproduction is Wonderful; cost £59 a few weeks ago, will accept first £40; seen and heard by appointment.—Tray, 3, Maida Hill West, London, W.2. Paddington 535. [6552

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**MARCONI** Model 51, 6 valves, 3 S.G., det. and 2 R.C. stages, frame aerial, extremely powerful and lective; "The Wireless World," September, 1929, rates; Expensive but of superlative performance; perfect condition; cost £60, accept £25, bargain.—Box 387, c/o *The Wireless World*. [6581

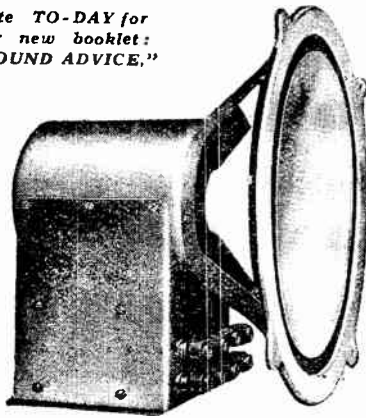
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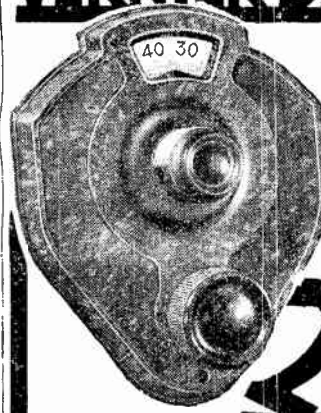


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 This wonderful speaker was pronounced by all at Olympia as the most realistic reproducer there. **ORDER AT ONCE.**

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**G.D.E.S.** Accumulator Hire and Maintenance Service (5 mile radius).—98, Cherry Orchard Rd., Croydon. [6374

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**OLYMPIA** Accumulator, 120v., new 1928, wants connecting; 30/-.—23, Rotherwood Rd., Putney. [6513

**E.H.** Lincencs.—New Sale machine, can and case, formers, etc., for sale, cheap; p.c. for details.—Bland, 1, Roderick Rd., Hampstead. [6485

**EPOCH.**  
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**EPOCH**—Watch Epoch grow!  
 [6021

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**TANTALUM** Electrode Strips for H.T. Rectifiers, suitable for A.C. mains eliminators; 2d. each, or set of 8, 1/-.—1,7, Dalton St., West Norwood, S.E.27. [0308

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**PHILIPSON'S** Safety Eliminators are Described and Illustrated in our booklet "Radio Power." Have you had your copy?—Write to-day to  
**PHILIPSON'S** and Co., Ltd., Radio Engineers, Astley Bridge, Bolton. 'Phone: 2038. 'Grams: Safety, Bolton. Est. over 50 years. [0318

**TRANSFORMERS** and Chokes for Battery Eliminators, and for all wireless purposes, receiving or transmitting; enquiries invited.—Chiefter Bros., 244, Dalston Lane, London, E.8. [6138

**UNIFLEX** H.T. Eliminator Kit, giving 15 milliamps, 120 volts; 30/- the kit of parts, already mounted on baseboard, with complete instructions for simple connecting.

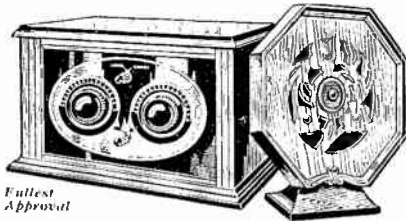
**THIS** New Improved Uniflex Model is the Finest Value in England, and includes shielded mains transformer, with terminals, heavy choke, 3 Hydra condensers, tested 500 volts D.C., Loewe vacuum resistance and clip, valve holder, panel already drilled with three sockets fitted for negative, 60 volts, and 120 volts; all the components mounted on a wooden base board and neatly boxed, with full instructions and picture diagram, ready for assembling in a few minutes.

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**FULL** Particulars and Diagram Free; dealers write for terms.—Liverpool Radio Supplies, Uniflex Works, 64, Myrtle St., Liverpool. [6231

**ATLAS** Eliminators, D.C. £1/17/6, A.C. £3/17/6; Nesper trickle chargers, 29/6. 'Phone Gerrard 6268 for demonstration.—Greatrex and Co., 184, Regent St., London. [6451

**NIATPER** H.T. Rectifiers, the rectifiers par excellence, cheap, reliable, highly efficient, unharmed by temporary overload or high voltage surges, rectifying units to pass up to 2 amperes; 10/6; guaranteed 7 days' trial against cash.—Box 3365, c/o *The Wireless World*. [6470



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All Mains Drive for A.C.; 4 Infinitely variable tappings—zero-200 volts; 1 Fixed tapping 200 volts; 100 milliamps output from each tapping; Westinghouse Full-Way rectification throughout; Low Tension—Full ampere output on each tapping for 2, 4 or 6 volts. Complies with I.E.E. regulations. **GUARANTEED NOT TO HUM.** French polished solid mahogany cabinet. Price £14 Cash or easy terms 25/- per month.

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**RADIOVOLT LTD.**  
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Mention of "The Wireless World," when writing to advertisers, will ensure prompt attention.

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**TANTALUM** and Lionium for A.C. Rectifiers; make up your own inexpensive chargers; blue prints for H.T. and L.T., 1/- each; Lionium electrodes fitted with terminals. 2.3 amps. and 5.8 amps.—Blackwell's Metallurgical Works, Ltd., Speke Rd. Works, Garston, Liverpool. Phone: Garston 980 (2 lines). [6282]

**AUSTIN** Power Transformers and Chokes Command Success in Any Eliminator, appreciated by every user. H.T.3 and H.T.4, 16/-; H.T.1, 17/-; H.T.2, 20/-; A.3, 12/-; A.4, 15/-; any output supplied to 1/2 K.V.A., low resistance chokes up to 100 H., from 12/6; guaranteed free advice, stamp.—Austin Mills, St. Albans Av., Heaton Chapel, Stockport. [6410]

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**PHILLIPS** L.T. Trickle Charger, as new, without valve; 25/-—Riches, 96, Landor Rd., Stockwell, S.W.9. [6512]

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**EPOCH**—Something new in trickle chargers.

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**SAVAGE**, 146, Bishopsgate, London, E.C.2. Phone: Bishopsgate 6998. [6406]

**M.L.** Converter, B.X. type, 6-volt, in perfect condition; £5, or offer.—"Kintore," Brampton Grove, Kenton, Middlesex. [6535]

**5 A.C.** Eliminators, 20 volt 60 cycles, or 110v.; 17/6 each.—Franks, 42, St. George's St., London, E.1. [6534]

**REGENTONE** W.I.B. A.C. Eliminator (Westinghouse rectifier), 200-250 volts, gives 120v., 18 m.a., new condition; cost £4/19/6, sell £3/7.—F. M., 74, Shirley Park Rd., Croydon. [6530]

**SPECIAL** Offer.—4 mfd. condensers, 4/3; 2 mfd., 2/9 (all 500 volt test); Fuse bulb and holder, 9d.; Heayberd transformers for H.T.3 rectifier, 15/-; all types Westinghouse rectifiers, Heayberd transformers, Pye chokes, etc., actually in stock; sent you carriage paid per return on receipt of remittance.—Coldham, Radio Engineer, 16, Burreleigh Rd., Sutton, Surrey. [6518]

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**ARTCRAFT** Radio Cabinets are Britain's Best Value. [0313]

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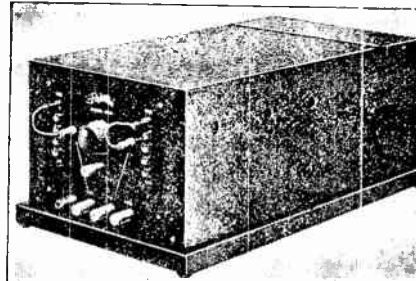
**ARTCRAFT** Radio Cabinets are Britain's Best Value. [0309]

**The FULL BEAUTY**

of radio or gramophone reproduction is not possible without L.S.A., or similar valves, in the output stage. The Model R.K. is designed for supplying the I.T. for sets and amplifiers using valves of this type. L.T. (Raw A.C.) for the filaments of four A.C. Valves can be supplied at an extra cost of 15/- and an additional output of 4.25v. to 5.25v. can also be fitted for the filaments of up to three L.S.A. valves at a further supply extra charge of 15/-. This unit embodies an standard continuously variable H.T. tapping for the Receiving Grid of Screened Grid valves and two variable H.T. tappings for the early and intermediate stages, whilst the fixed tapping is for use with the output valves.

H.T. Smoothed Output: 360 volts at 65 m.a. Complete with 2 "Phillips 505" Valves (Full-wave rectification) Price £13:15

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Selston,  
NOTTS.

0309

Cabinets.—Contd.

**SUPPLIERS** of "The Wireless World" Cabinets.—Metal cabinets for the new Kilo-mag Four, "Wireless World" Record Three (suppliers of "The Wireless World" cabinets), and "Wireless World" kit sets, each compartment soldered and electrically sealed with brass gauze, 2 polished copper screens for S.G. valves, complete with oak base, exquisite Jacobean finish; terms, cash with order; price 57/6; prices for any type of copper screening boxes or screens on application.—Blyth and Woolfenden, Sheet Metal Workers, Hochdale. [6253]

**ARTCRAFT** Radio Cabinets are Britain's Best Value. [0310]

**KAY'S** Cabinets, the greatest range of pedestal cabinets in the kingdom; original creative designs at prices 50% lower than elsewhere; quotations for specials by return; delivery at short notice guaranteed; moving coil, portable, baffie, vignette, radiogram, electric pick-ups, television, etc.; illustrated lists free.—H. Kay, Wireless Cabinet Manufacturer, Mount Pleasant Rd., London, N.17. Phone: Walthamstow 1626. [6461]

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**FINEST** American Types, astonishing value, special offer oak cabinets, hinged lid, baseboard, highly polished, take 12in. x 6in. panel; sample, carriage paid, 6/6; trade discounts for quantities.—Mag-Radio, 112, Warstone Lane, Birmingham. [2665]

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**EPOCH**  
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**EPOCH** Cabinets for Moving Coil Speakers. [6023]

**"WIRELESS WORLD"** Metal Cabinets, finest value offered; new Kilo Mag and Record III, with oak base, 45/-; cabinet for "Wireless World" kit, finished as above, 35/-. See advert. under Coils.—Stott. [6540]

**WE** Can Supply any size Cabinet, maximum 21x7x10, in oak at 10/- carriage paid; also many attractive Consol models.—The Cabinet Co., 138, High St., E.1. [6576]

**WARRICK** RADIO can supply a solid figured oak cabinet, hand french polished, with artistic fretted front with old gold gauze, complete with baffle board and screws, to take any cone chassis on the market, size 17in., moulded top and bottom, solid 1/2in. oak throughout, price £1, carriage and packing 2/6; can also be supplied with chassis fitted to take any unit, price £1/7/6.—Warrick Radio, Hornchurch, Essex. [6550]

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COILS, TRANSFORMERS, ETC.

**100-OHM** Decoupling Resistances for "Wireless World" Circuits; 1/6 each, post free.—Groves Brothers, St. Mary's Place, Shrewsbury. [6232]

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**THE** Fact that Our Decoupling Resistances are Used in "Wireless World" circuits is a Proof of Their merit; improved model now available.—Groves Bros.

**GROVES** BROS.' Decoupling Resistances are Obtainable from Most Factors and Dealers, but if you difficulty send direct to above address. [6305]

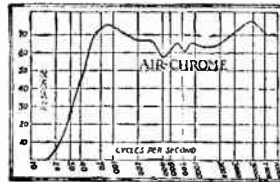
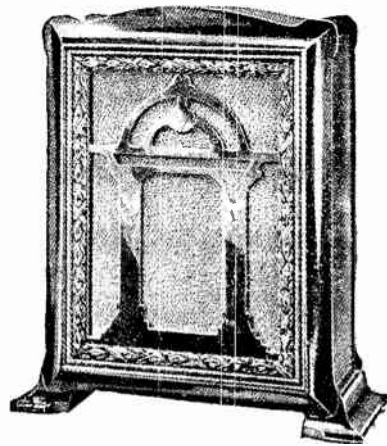
**RECORD** III Coils, 44/-; new Kilo-mag four, 40/-; S.G. Regional, 37/6.—Radiograph.

**FOREIGN** Listeners Four, 6 coils, 50/-; Europa portable, 21/-; Europa III, 18/6.—Radiograph.

**G.** Multiple Portable, 22/6; Everyman four 30/-; interchangeable Everyman and cones, 72/6.—Radiograph.

**ITZ** Wire 7/40, 1/6 per dozen yards; 27/42, 2/6 dozen yards.—Radiograph.

**EDFERN'S** Deep Ribbed or Beool Tube, 5d. per inch; slotted for winding, 1/6 extra; any coil, or wire supplied to "Wireless World" specifications.—Radiograph, Station Rd., New Inns, Handsh, Birmingham. [6273]



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Coils, Transformers, Etc.—Contd.

**TRANSFORMERS**.—Any outputs wound to specification; metal rectifier transformers from 11/9 cannot be beaten; enquiries invited.—Townsend, Greenwood Terrace, Branley, Leeds. [6344]

**WIRELESS WORLD** Kit Set, coils and switches wired and mounted ready for fitting, coupling rod and knob; 63/-; trade enquiries solicited; liberal discounts.—Porter, Wellowgate, Grimsby. [6466]

**KILO-MAG** Four, set of coils, 45/-; Record III, set of coils, 42/6; coils for all published circuits, wound exactly to specification; output transformers, wound to match your valve, 21/-; all standard ratio in stock; moving coil loud-speakers: 6 volts 1/2 amp., complete with output transformer, £4; mains, full voltage, ditto, £4/5; A.C. mains, complete with full rectifying equipment and output transformer, £6/6.—Porter, Wellowgate, Grimsby. [6467]

**R.I. Varley** Power Transformer, 200-240 A.C. to 375-0-375, 1, 5.5v. and 7.5v. for U8 valve; £2.—R. J. Mew, Endowed School, Hampton Wick, Middlesex. [6502]

**SIMMONDS** BROS.—Bercliff coils, Record Throo, 50/- pair; new kilo-mag, four, 50/- set; foreign listeners four, low, 30/-; long wave, 37/-; screened grid Regional, 40/-; Mullard S.G.P. dual range coils, 30/- pair; Bercliff standard coils, for new all-wave four, standard four, A.C. three, Everyman four, etc., 63/6 set of 4, with bases; the same coils for the Lodestone series ("Wireless Magazine"), 65/9 set of 4, with bases; Titan unit, 15/-; decoupling resistances, 600 ohm, 1/6; 1,000 ohm, 2/-; all "Wireless World" and similar coils in regular production by the leading specialists; lists free; trade supplied.—Simmonds Bros., Shireland Rd., Smethwick, Tel.: Smethwick 751. [6314]

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**EPOCH**—See the new range of Epoch A.C. mains transformers.  
**EPOCH** [6459]

**NEW** Kilo Mag Coils, full set, 37/6 only; metal cabinets as specified, 45/-—Stott.

**FOREIGN** Listeners Four, full set 6 coils, 47/6; screening boxes, 5/- each.—Stott.

**RECORD** III, set of coils, 39/6; 600 and 1,000 ohm decoupling resistances, 1/3 each.—Stott.

**"WIRELESS WORLD"** Kit, coils and switches, complete, 37/6; metal cabinets as specified, oak base, 35/-—Stott.

**FINEST** Value; enquiries invited for all "Wireless World" special parts at keenest prices; trade supplied.—Stott, 63, Syke Rd., Rotherham. [6539]

**BRAND** New Pair Lewcos Aerial or H.F. 6-pin Coils, 220-550 metres, with bases, 10/-; pair Lewcos linearcular coils, 1,000-2,000 metres, 7/6.—A. Lindsay, 105, Byres Rd., Partick, Glasgow. [6536]

**FACTORY** to User.—Buy your coils direct and save pounds; sample prices: New Kilo-Mag Four coils, 30/- the set; Record III coils, 30/- the set; Kit coils, 40/- set, with switches; Foreign Listeners Four, 40/- set of 6; Titan units, 10/-; 600 ohm resistances, 1/-; finest quality goods; absolutely no risk; 7 days' approval against cash, if not satisfied your money returned in full without quibble, or use "Wireless World" deposit system.—Whitmore Wireless, the New Firm, back 32, Cape Hill, Smethwick. [6583]

DYNAMOS, ETC.

**CRYPTO** Motor Generator, 240 A.C. to 350v., 0.25 amp. D.C., only 6 months use, voltage regulator 0 to 350v.; £7, or nearest.—H. J. Mew, Endowed School, Hampton Wick, Middlesex. [6509]

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**EPOCH**—A dynamo is not required for the new models Epoch moving coil speakers. [6025]

GRAMOPHONE PICK-UPS, ETC.

**B.T.H.** Electric Gramophone Motor (A.C. or D.C.), little used, perfect; first 24 secures.—1, Mannheim Rd., Bradford, Yorks. [6492]

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**EPOCH**—For gramophone pick-ups, Epoch moving coil speakers; no mains or batteries required. [6026]

**COLUMBIA** Gramophone, £3/15 model, bought December, 1928, used few times only since; also 5 good 10in. records, absolutely perfect; lot £2/5.—Elliot, 71, Salisbury Road, High Barnet. [6554]

**CELESTION** Woodroffe Pick-up, £2/15; Varley automatic arm, 25/-; both brand new.—1, Mannheim Rd., Bradford, Yorks. [6547]

**B.T.H.** Pick-up and Tone Arm, 38/-; Oram Music Magnet kit, £8; P.M. H.T. unit, £4/5; Magnavox X core, No. 200, £5; all absolutely latest type, unused and unpacked; carriage paid.—Rawnsley, South View, Guiseley. [6523]

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**EPOCH Steals Another March in Moving Coil Design!**  
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**EPOCH.**—No more trouble due to leather, rubber, or other substance tightening up or slackening, according to weather.  
**EPOCH.**—The last little kink of the model 66 curve definitely flattened out!  
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**EPOCH Model 99P.M.** Establishes a New Slogan; no mains or accumulator, and no diaphragm suspension either.  
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**EPOCH.**—But that is not all.  
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**EPOCH.**—It is American or Continental in outward appearance only.  
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**EPOCH.**—20 times as sensitive as an ordinary moving coil speaker for the same input.  
**EPOCH.**—Created a great sensation at Olympia.  
**EPOCH.**—The management had to regulate our demonstrations to give the Band and other exhibitors a chance to be heard.  
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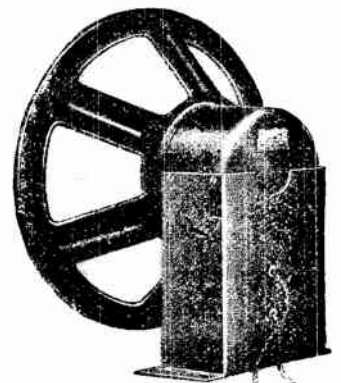
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**Loud-speakers.—Contd.**

**COIL Drive Speakers, Goodman's;** call any date between 12.30 p.m. and 1.30 p.m. during the City luncheon hour, and hear any of our products demonstrated.—Goodman's, 27, Farringdon St., E.C.4. [1009]

**I'** You are in London Call and See Goodman's Coil Drive and Reed Units before purchasing elsewhere.—Goodman's, 27, Farringdon St., E.C.4. [10090]

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**L.D.C.,** Doncaster, writes: They are without equal.

**GOODMAN'S** Cone Chassis Assemblies, the cones fitted to which are unique, by reason of Goodman's exclusive doping processes, can be fitted with any cone unit in 2 minutes; new model, 13/6; enthusiastic users write:

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**ILLUSTRATED** Lists Post Free from Goodman's, 27, Farringdon St., London, E.C.4. [10066]

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**WHY** is the Webson B.S.7 Moving Coil Loud-speaker used by manufacturers of high grade radio-gramophone sets?

**BECAUSE** the Webson B.S.7 is designed and made for the use of musical critics to whom only the finest possible reproduction is good enough.

**HAVE** you heard a Webson Moving Coil Speaker? If not, to do so will be a revelation.

**SEND** for Personal Broadcasts, post free, from Star Engineering, Disbury, Manchester. Phone: Disbury 1785. [6352]

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**BECAUSE**, to ensure that the driving rod of unit is registering in perfect alignment with apex of cone diaphragm.

**BECAUSE** it will Relieve Reed and Driving Rod together with cone mounting, of all undue side stress and chatter.

**BECAUSE** it will Allow For a Much Finer Adjustment, making the whole assembly more efficient, the reed vibrations being positively applied to the cone without any loss caused through imperfect mounting, no matter how minute, thus increasing tone volume and action.

**THE** Above Points are More than Two-fold in the Case of Double Diaphragms of Any Type, and in this type of speaker the device is a necessity; easily fitted to any make of unit; price 2/6, c.o.d.; terr. available.—Weedon and Co., 80, Lonsdale Av., London, E.6. [630]

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**HEAR** All the Loud-speakers Advertised, then compare and buy a

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**DONOTONE,** the best loud-speaker. [56]

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**SUPERLING** Primox Loud-speaker, perfect condition, £3, genuine bargain.—Advertiser, "Etrusca Teignmouth, Devon. [6

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Loud-speakers.—Contd.

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**SELHURST RADIO Moving Coil Speakers** are of Proved Efficiency and recognised as the best obtainable. Sold direct from address below, or from dealers in 10 countries. 14 day approval.

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**SAW** a fellow the other day thrashing his Baby-seven up Newlands Corner in the teeth of a gale. Four up. Some people habitually overload everything, from their incomes to their H.T Batteries.

No H.T. Battery, not even a Hellesen, will give long service when grossly overloaded.

The secret of obtaining a long life of perfect reception from an H.T. Battery is, firstly, to get a Hellesen Battery, and, secondly, to see that you get a Hellesen of a capacity commensurate with the size and power of your set. If in doubt, get the larger size. It is a wrinkle that must have saved me pounds.

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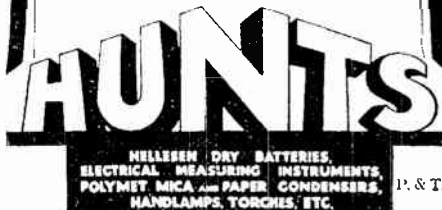
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**EPOCH** by Deferred Payments.

**EPOCH.**

**EPOCH**—Any responsible householder can obtain any type Epoch moving coil speaker by easy terms; no references, no interest.—Particulars from Mr. Laerson, 110, Cannon St., E.C.4. [5518]

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**CELESTION** C12, practically new, cost £7/12, perfect reproduction; £3/10.—Audibert, St. Nicholas Cliff, Scarborough. [6546]

**MARCONI** 6v. M.C. Chassis, perfect, cost 6 guineas January; accept £3/15.—Reynolds, 47, Midhurst Rd., West Ealing, London. [6533]

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**WE** are so sure of A.P. Valves that we will send you the type required on 3 clear days' approval against cash order, and will accept risk in transit.

**WRITE** To-day for Full Data of the A.P. Family of Remarkable 4-electrode Valves.

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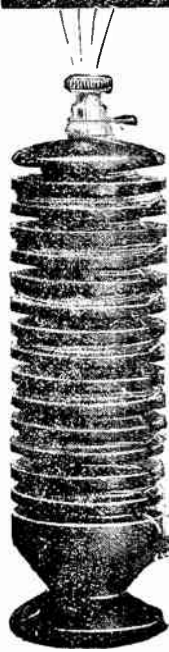
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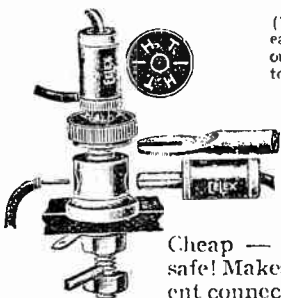
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**SUPER Microphones**, highly sensitive, watch shape; will pick up faint sounds, whispered words, quiet conversation from considerable distance, strongly amplify and transmit speech, music, piano, gramophone, orchestra, clock chimes, through loud-speaker; best microphono for making defectophone, deaf aid, loud-speaking telephone, radio amplifier, electric sound detector, experiments, each microphone guaranteed more sensitive than any other type known; fitted with a 3ft. silk flexible connecting cord, 6/6; microphone transmitter for same, 2/-; small 10 ohms car-piece for use with super-microphono in place of transformer, 6/-.—Below.

**A WHISPER Amplified to a Roar from Your Loud-speaker**, watch ticking amplified to the noise of hammer blows, by connecting above sensitive microphone to any valve set, through microphono transformer or gramophone pick-up.—Below.

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**TWO Mullard D.U.10 Rectifiers**, new, bought erroneously, space limited 22/- pair.—Jaxton, Princess Rd., Bournemouth. [6490]

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**OFFERS Wanted for £6/10 Moving Coil Speaker**, 6v. in £3 cabinet, and 6/60 Exide accumulator; cash or exchange.—68, Ryland Rd., Erdington, Birmingham. [6561]

**MARCONIPHONE** Famous 75, and Amplion A.C.3 cone speakers, cost £3/15 each; complete set Igranite Xilos and C.T. plug in coils, and Lewcos S.P. H.P. transformers; McMichael output filter; Sifton pocket meter; sacrificing these and other components under half cost price; all perfect.—Owner, 17, Salisbury Rd., Richmond, Surrey. [6525]

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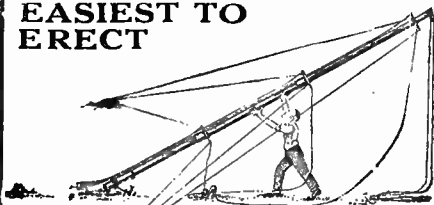
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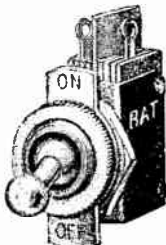
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All Above Goods Guaranteed, cash with order, or a.c.o.d., all goods 3 days' approval from date of delivery; all letters answered.—Galpin, Binfield Heath, near Henley-on-Thames. [6543

TERRAN Short Wave H.F. Choke, shielded! Incorporates small by-pass condenser, chokes perfectly from 17 to 60 metres, no peaks; only 4/6, post free.—Teregan Radio Co., 106, Lord St., Southampton. [6545

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ARE You Interested in Making up Your Own Loud-speaker? Write for our free lists; we can supply you with anything from a cone centre to a complete moving coil speaker; Gramo-radio speakers are our speciality.

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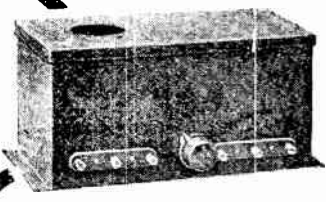
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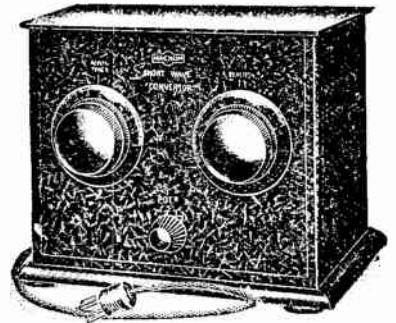
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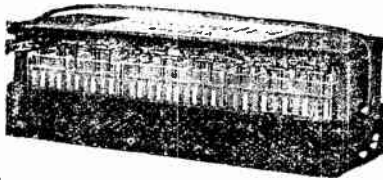
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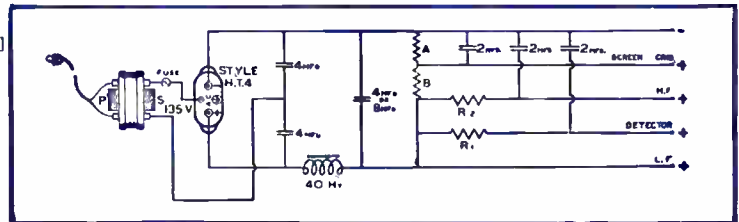
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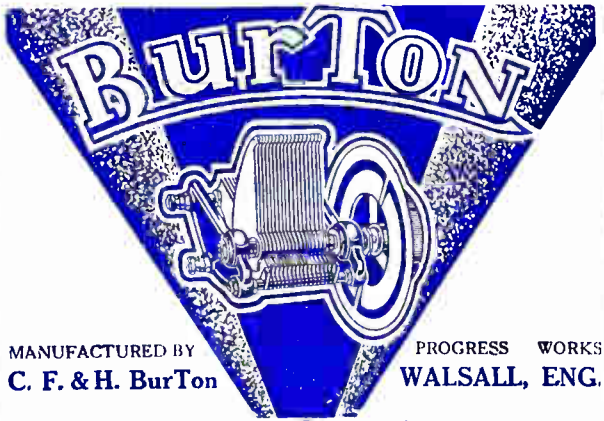
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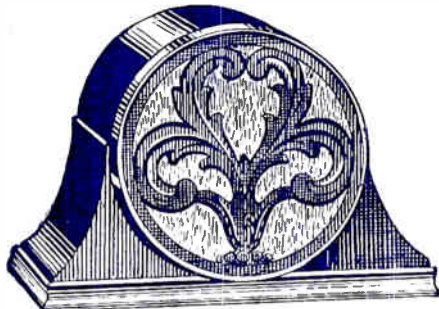


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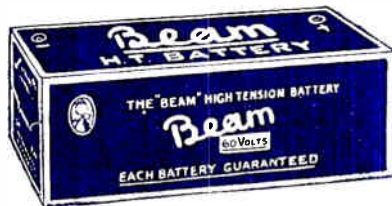
# THE HANDLING OF VOLUME



## "BEAM" LOUDSPEAKERS.

The "Beam" range of loudspeakers is undoubtedly to the fore in Tone, Appearance, Sensitivity and the successful handling of both small and great volume. The model shown is marvellous value and is of particularly attractive appearance. It will harmonise with any home surroundings.

**PRICE**  
**55/-**  
Complete with flexible lead.



## "BEAM" H.T. BATTERIES.

For silent and energetic work, "Beam" batteries are best. The composition of "Beam" batteries consist of thoroughly reliable elements which combine to give a perfectly steady flow of current over long periods. With "Beam" batteries you can always listen to distant stations without background noises.

The Smallest Component but

The Greatest Responsibility

## "BEAM" FIXED CONDENSERS.

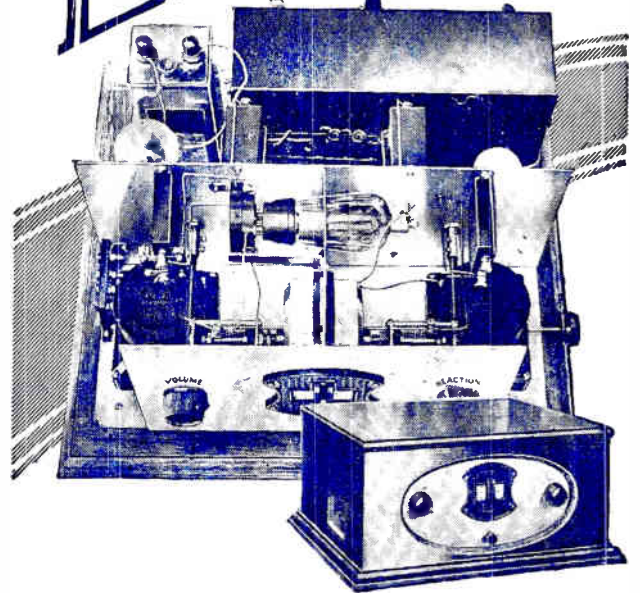
The responsibilities placed on this small but important component make it imperative that a reliable and perfectly constructed one is chosen and used. Specify "Beam" and you get a really good component. Supplied in all standard capacities.

"Beam" products are obtainable from all Dealers or direct.

**Beam Ltd.** 35, Farringdon Road,  
London, E.C.1.

Telephone: Holborn 7048.

Start Building this LOTUS set To-day!



Set builders—build and own the very latest radio development, the new 3-valve Lotus S.G.P. set. You can buy the kit for it and assemble it in a few hours and demonstrate to your friends the greatest range, power and selectivity of any set of the season. Start building the new Lotus S.G.P. to-day. The kit contains every unit you need except valves, cabinet and batteries, and can be bought at your nearest retailer's for the modest sum of £7-12-6. Diagrams and full instructions are enclosed.

# LOTUS

## 3-valve S.G.P. Set

Supplied with main components mounted and ready for immediate assembling. Prepared by the makers of Lotus components, Garnett, Whiteley and Co., Ltd., Lotus Works, Liverpool.

Send this coupon now!

To Garnett, Whiteley & Co., Ltd.,  
Lotus Works, Liverpool.

Please send me free copies of the latest Lotus booklets and instructions for building the Lotus 3-valve S.G.P. set.

Name .....

Address .....

W.W. 16/10/29.

Causton.

Mention of "The Wireless World," when writing to advertisers, will ensure prompt attention.

# SEE IT LYING THERE



## PRODUCT OF A FAMOUS FIRM

It has been designed by scientists, constructed by engineers and assembled by mechanics—a guarantee of excellence. For your radio there is no better transformer—hear its performance and you'll remember its name—The Mullard Permacore L.F. Transformer.

*The special core of high permeability makes the transformer exceptionally compact; the step-up ratio being 3:1.*

# Mullard MASTER·RADIO

PRICE  
**25**

Advert. The Mullard Wireless Service Co., Ltd., Mullard House, Charing Cross Road, London, W.C.2.

Arks. M.A.S.

Advertisements for "The Wireless World" are only accepted from firms we believe to be thoroughly reliable.

# They must be good - 3,000,000 Valveholders already sold!

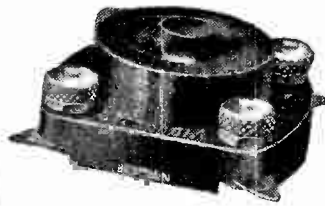
## CLEARER-TONE VALVEHOLDER



The original Clearer - Tone Valveholder, in face of considerable low price competition, has more than held its own and will be continued at

**2/-**

## VIBROLDER



The Benjamin Vibrolder was last season's most successful accessory, the self-aligning feature ensuring positive contact with all types of English 4-pin valves.

**1'6**

## 5-PIN VALVEHOLDER



Designed for use with the new 5-pin valve with centre leg. The Benjamin anti-microphonic feature is incorporated, and also patented contact, which ensures perfect contact when using either solid or split pin valves.

**1'9**



## Seen the new Switch ?

Some people say "Turn off the wireless"—and that's just what you do with this rotary switch. It's an attractive alternative to the usual pull and push type. All insulated, with indicating "On" or "Off" dial, pointer knob, terminals, and double contact. Suitable for use with panels up to 3/8-inch thickness. Quick make and break action . . . .

**1'9**

# BENJAMIN

## RADIO PRODUCTS

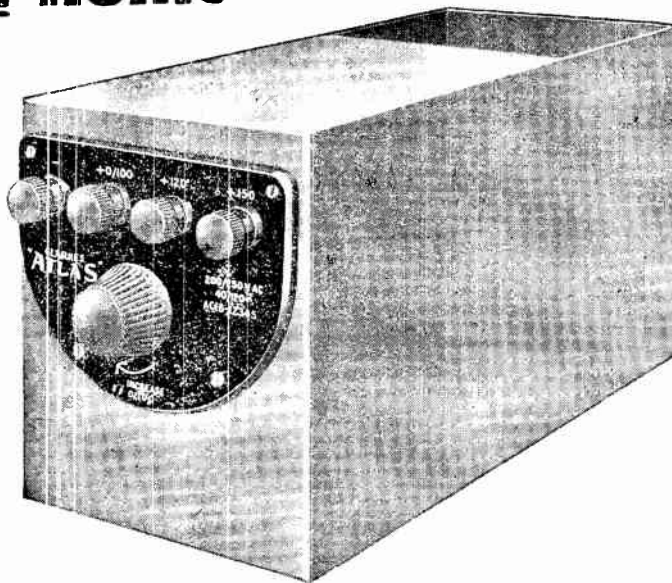
THE BENJAMIN ELECTRIC LTD., BRANTWOOD WORKS, TOTTENHAM, LONDON, N. 17

Mention of "The Wireless World," when writing to advertisers, will ensure prompt attention.

**10/-  
DOWN**

brings this **CLARKE'S "ATLAS"**  
super Eliminator into  
your home

*Scrap those  
H.T. Batteries  
& save money,  
time & trouble!*



Why tolerate the expense and trouble associated with H.T. Batteries?—you can never have perfect reception so long as you rely on Battery Supply for H.T. Get this wonderful A.C. 16 model—the difference will amaze you — increased selectivity, absolute clarity, and much greater volume—all the time. Using an A.C. 16 your set will give you as good results as an expensive All-Mains Set. A.C. 16 is the latest Model of the famous Clarke's "ATLAS" Range, made to accommodate any set from 1 to 5 valves, and is adaptable to any portable set when used in the home.

Model A.C. 16 is without doubt the finest Eliminator at the price that has yet been produced. It provides three Tappings, two of which are fixed, one giving 120 Volts and the other 150 Volts. The remaining Tapping is variable from 0/100 Volts. This Model specially caters for sets using Screen-Grid, Detector, and Pentode Valves, where critical adjustment of H.T. is necessary to obtain best results. Max. Out. 25 mA. Price 10/- down and nine monthly instalments of 10/- or **£4 10 0** Cash.

## Our Wonderful Offer to Radio Listeners

For 10/- down—less than the cost of a 100 Volt H.T. Battery—this super Eliminator is yours. The balance you pay in easy instalments, after which the cost for H.T. is finished with, except for the cost of current which is so small as to be negligible. It doesn't matter whether you are on Direct or Alternating current, there is a model in the Clarke's "ATLAS" Range to meet your requirements, any of which can be obtained on this easy payment system.

Full details are given in our new Folder No. 44. **SEND FOR IT NOW!**

Clarke's "ATLAS" Eliminators are made to provide maximum safety in working, and comply with the Institute of Electrical Engineers' Regulations, and the incorporation of the famous Anode Feed System ensures smooth running and entire freedom from "motor-boating."

**Post this Coupon NOW!**

Messrs. H. CLARKE & Co. (M.C.R) Ltd. (Dept. 3D),  
Atlas Works, Old Trafford, MANCHESTER.

Please send your Folder No. 44, along with details of your easy payment scheme.

NAME .....

ADDRESS .....

Post in  
unsealed  
or stamped  
envelope.

Please use BLOCK LETTERS

W.W.L.

Have you got  
the new idea?



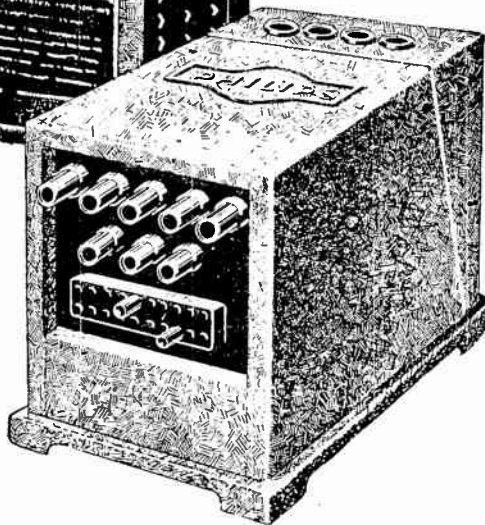
Are you still wasting money on battery replacements and accumulator recharging? Or have you got the new idea that Philips started, the idea of making your set All-Electric by adding a Philips H.T. Supply Unit and Trickle Charger? These Units save all expense and ensure that your set is always efficiently supplied with H.T. and L.T. Current.

Make your set as good as one of the latest design.... install Philips H.T. Supply Unit and Philips Trickle Charger.

Trickle  
Charger  
Type 1017  
£2-15-0



H.T. Supply Unit  
Type 3009  
£5-15-0



**PHILIPS  
H.T.  
SUPPLY  
UNIT**

*Make it All-Electric*

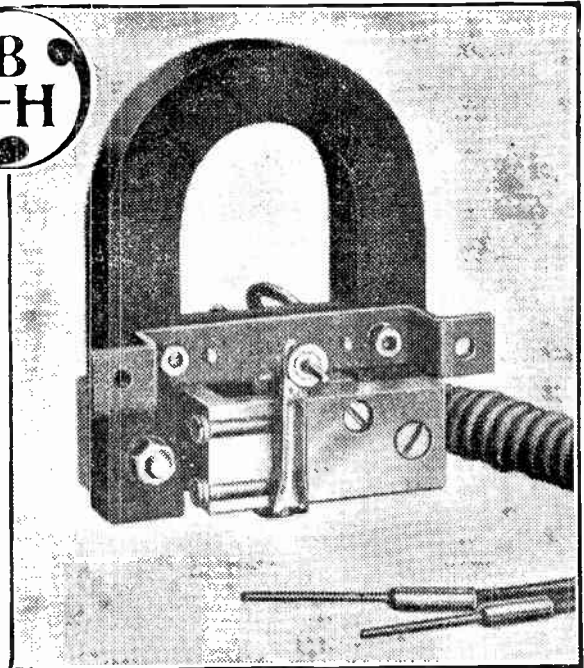
*Philips Radio, Philips House, 145 Charing Cross Road, London, W.C.2*

*Mention of "The Wireless World," when writing to advertisers, will ensure prompt attention.*

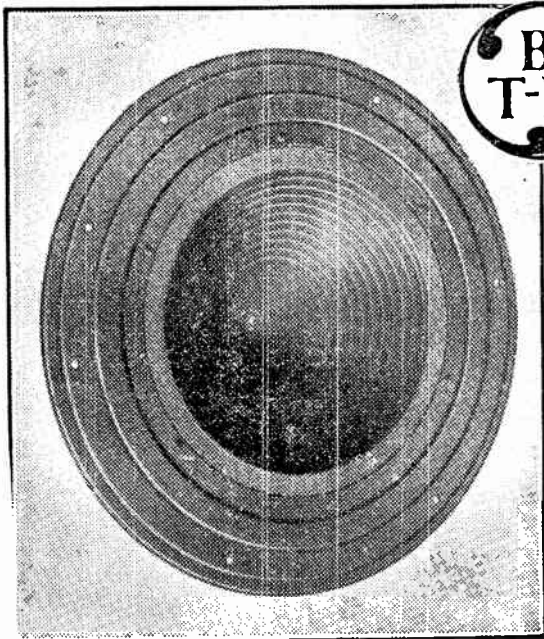
# BUILD YOUR OWN SUPER LOUD SPEAKER ♦♦ FOR 27/6

**CONE UNIT**

THIS wonderful unit gives excellent reproduction over the whole range of musical frequencies. It is constructed on the balanced armature principle and has a powerful permanent magnet system with a step-up mechanism for driving the cone.



PRICE 15/-



**ASSEMBLY**

THIS chassis has been produced for use in conjunction with the B.T.H. cone unit. A corrugated cone is used and not only does it vastly improve the response, but also prevents unpleasant paper rattle. It is supplied finished in our standard radio brown, ready drilled for baffle board mounting.

PRICE 12/6

**The EDISON SWAN ELECTRIC CO., LTD.,**

Head Office and Showrooms Ediswan Radio Division:

1a, NEWMAN STREET, OXFORD STREET, W.1. (Museum 9801.)

SHOWROOMS IN ALL THE PRINCIPAL TOWNS.

## EDISWAN RADIO PRODUCTS

W. 15.

# TANNOY

H.T. & L.T.

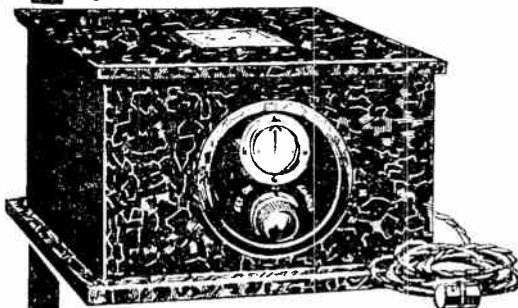
## Mains Units



Have you ELECTRIC LIGHT? then you can have "trouble-free" Radio, provided you use THE MASTER UNITS. "TANNOY" supply units are made to provide separately either H.T. or L.T. supply, or COMBINED H.T. & L.T. by means of the famous "TANNOY" combined units.

Remember that TONE and VOLUME rely to a great extent on the H.T. and L.T. supply use the best! "TANNOY" THE SIMPLE WAY TO MODERN RADIO.

- Type 12C H.T. (120v.) £2 17 6
- Type 16CH H.T. (150v.) £3 15 0
- Type L.W.A. 2, 4 or 6v. £2 12 6
- Combined Units for H.T. and L.T. from £5 12 6 (complete)

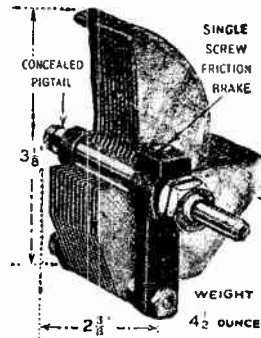


The TULSEMERE MFG. CO.,  
1-7, Dalton St., West Norwood, S.E. 27.  
Telephone: STREATHAM 6731.



"Have always held a leading position . . . production of thoroughly sound variable condensers . . ."—*Vide Press.*

### "1930" LOG (mid-line) CONDENSER



In four Capacities.

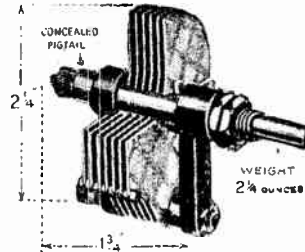
- 0005
- 00025
- 00025
- \*00015

**4/6** each

\* Double spacing of vanes for Ultra Short wave w.o.k.

### "MIDGET" Reaction CONDENSER

Capacity: •0002 mfd.

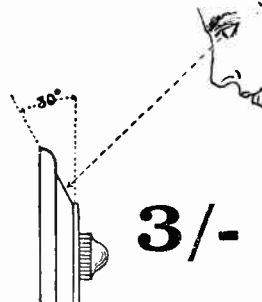


The FORMO "MIDGET" Reaction Condenser, like all other Formo Condensers, has incorporated the patented Formo internal "PIGTAIL," undoubtedly the finest collector or "Pigtail" yet devised, and thereby is absolutely noiseless in operation.

**2/9**

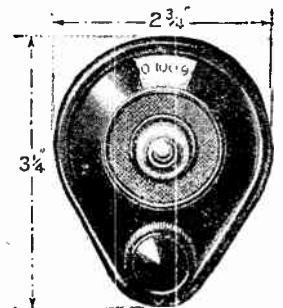
### The Finest VERNIER DIAL Obtainable.

MECHANICALLY PERFECT. POSITIVE BRASS CONTACT drive on SOLID BRASS SCALE, ensuring smooth movement, with absolutely NO BACK-LASH. ROBUST in Construction and Trouble Free. SMALL. EXTREMELY ELEGANT. EFFICIENT.



TUNING WITHOUT IRRITATING UNCOMFORTABLE CROUCH OR STOOP.

**3/-**



As pictorially shown, the scale and aperture are inclined at an angle of 30° from perpendicular, thereby permitting convenient unobstructed view of scale without need to crouch or stoop.

If unable to obtain from dealer please communicate with us. Full Catalogue sent post free on receipt of post card.

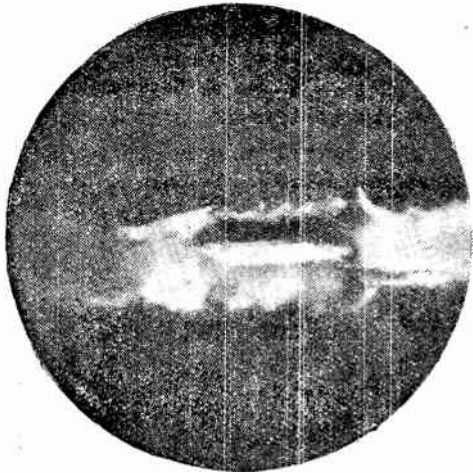
THE FORMO CO., CROWN WORKS,  
CRICKLEWOOD LANE, LONDON, N.W.2





# BEFORE YOU BUY-

## Remember "Tenacious Coating"---

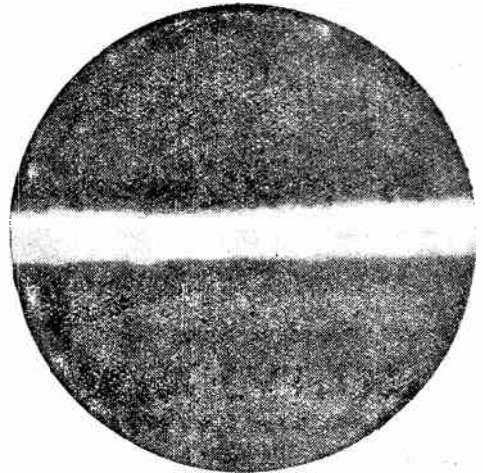
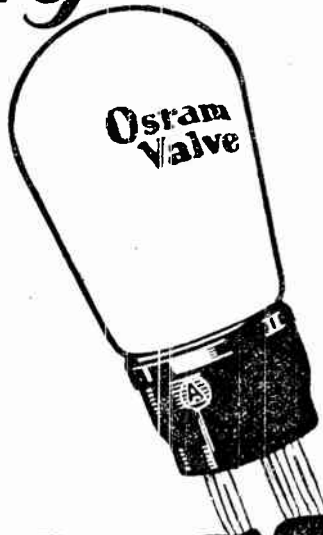


**A BAD Filament  
WITHOUT**

**"TENACIOUS COATING"**

This reproduction shows part of the filament of a badly coated valve before use, showing a serious gap in the coating. A gap such as this starts the valve off in its life with a poor performance. The valve then prematurely fails.

**WRITE** for booklet "OSRAM WIRELESS GUIDE" (1929 edition) giving full particulars of the full range of OSRAM VALVES with the "TENACIOUS COATING." Also helpful wireless information of importance to every listener. Sent post free.



**A GOOD Filament  
WITH**

**"TENACIOUS COATING"**

Reproduction from an untouched micro-photograph showing the coating typical of all OSRAM VALVES. Notice the absolute evenness of the coating. There are no gaps, the coating clings, so that the full benefit of the coating is maintained. The secret is the startling discovery of the scientific process of "TENACIOUS COATING."

# Osram Valves

with the

## "TENACIOUS COATING"

MADE IN ENGLAND. Sold by all Wireless Dealers.

Advt. of the General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2

Mention of "The Wireless World," when writing to advertisers, will ensure prompt attention.

# Get the Best from your Set— only the **GROSVENOR** can do it



The Battery with  
the New  
Vitalising Element

The wonderful new Vitalising Element ensures continuous and satisfactory service. No other battery can give you the same service. It's the new Vitalising Element unique to Grosvenor that does it. Fitted by all the Leading Set Makers after the most exhaustive comparative tests, and PROVED to be the best.

.66 v. from 7/6      99 v. from 11/6

THE GROSVENOR BATTERY Co., Ltd.,  
2/3, White Street, Moorgate, LONDON, E.C.2.

PATENTED

## GROSVENOR BRITISH MADE BATTERIES

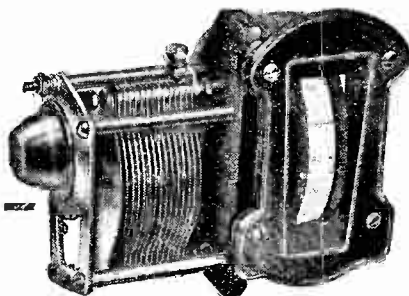
### POLAR BEHIND THE PANEL

The combination of Slow Motion and Direct Drive, as fitted to Polar Condensers, is the surest method of quickly bringing in evasive stations.

When building a set, its efficiency will show a marked improvement provided you put "Polar behind your Panel."

When buying a set you are assured of its efficiency if Polar Condensers are behind the Panel.

Polar efficiency reduces losses to a minimum and brings performance to the maximum. More than half of the Portable Set manufacturers in Great Britain standardise Polar Condensers. You can rely on their judgment.



**POLAR DRUM  
CONTROL  
CONDENSER**  
-0005 - - 15/-  
-00035 - - 14/9  
-0003 - - 14/6  
Complete with Escutcheon and Fixing Screws

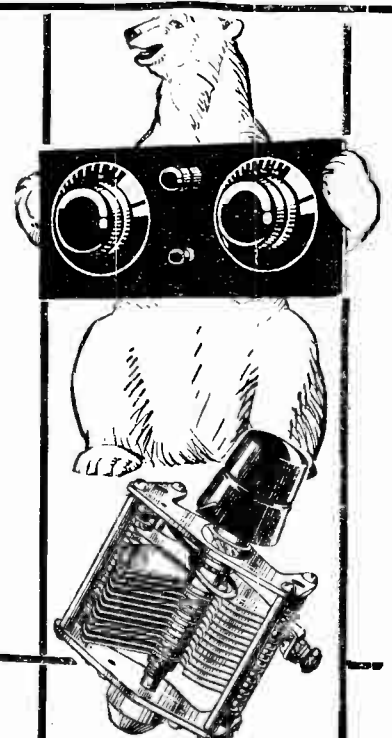
**POLAR O.J.  
CONDENSER**  
-00025 - - 10/6  
-00015 - - 10/3  
-0001 - - 10/-  
Prices include:  
Knob and Pointer.

OBTAINABLE FROM ALL DEALERS

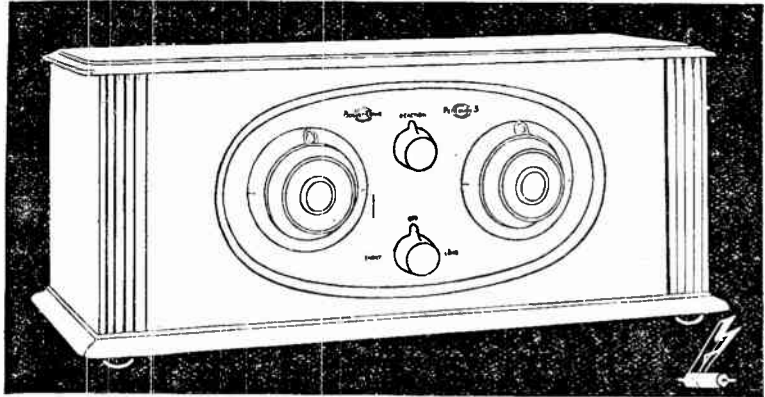
New Complete Catalogue Free on Request

**WINGROVE & ROGERS, LTD.**  
188-9, STRAND, LONDON, W.C.2

Works: Polar Works, Old Swan, Liverpool



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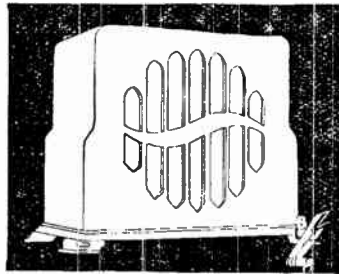
# AFTER DINNER STORIES

There should be no hitch over the wireless when you are entertaining your friends. No apologies and no regrets. And there won't be if your set is a Pentovox Three. If your guests want to hear the star after-dinner speaker, they really hear him. Without fuss and without distortion. The charm of the Pentovox Three is that you can enjoy the programme while forgetting all about the set. Built to Bowyer-Lowe standards, its price makes unequalled value among Screened Grid Threes. And you can buy it on easy monthly payments.

£ 10

Including valves and royalties.

Ask your Wireless Dealer about the comprehensive range of Bowyer-Lowe Sets and Components, or write for Illustrated Literature.



## THE SENIOR CONE REPRODUCER.

A beautiful instrument with natural lifelike tone and an extraordinarily wide range, from deepest bass to highest treble. In polished oak cabinet - - - - £5

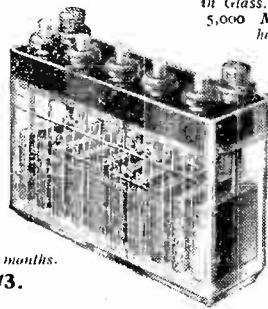
## THE JUNIOR CONE REPRODUCER.

A thoroughly efficient speaker, giving clear and faithful reproduction, and selling at a very attractive price: 35/-

THE **BOWYER-LOWE** CO., LTD.

In Association with  Recordaphones Ltd.

London Showrooms - - - ASTOR HOUSE, ALDWYCH, W.C.2.  
 Head Office and Works - - - RADIO WORKS, LETCHWORTH, HERTS.



P. & R. "R.H.T."  
in Glass. 10 volts.  
5,000 Milliampere  
hours.

Guaranteed 6 months.  
Price 6/3.

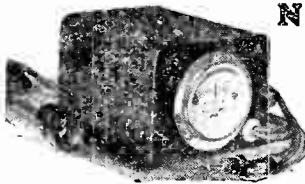
Type L.H.T.,  
filled with 10  
boards (as  
illustrated).  
Price 7/6.

## Get a Guaranteed H.T. Accumulator

Besides being a wonderfully efficient H.T. Battery, the Peto & Radford R.H.T. Accumulator—like all P. & R. batteries—is guaranteed for six months.

For purity of reception and general all-round efficiency tests have proved these batteries to be the best. The plates are sturdy, internal resistance is very low, the voltage remains absolutely steady under all variations in discharge, plug tappings may be taken without disturbing battery connections through hollow terminal tops.

## Charging will cost NOTHING



Charge your H.T. Batteries off the mains with the P. & R. Trickle Charger. For D.C. or A.C.

Simple. Safe. NO valves. No "hum." Constant voltage. Perfect reception all the time. Uses practically no current. Price complete for D.C. 29/9, or A.C. 49/9.

Send postcard for details of this and the range of P. & R. Batteries (H.T. and H.T.) to

PETO & RADFORD,  
93, Great Portland Street,  
London, W.1.

(Telephone: Lougham 1473.)

Glasgow  
Depot:  
45, Clyde  
Place.

**P AND R**

London Sales &  
Repair Depot  
107a, Pimlico Rd.  
S.W.1.

PETO & RADFORD  
ACCUMULATORS

The beginning and the end in  
POWER

T.R.: This announcement is issued by  
The National Accumulator Co., Ltd.

# DUBILIER FOR DURABILITY

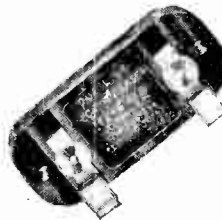
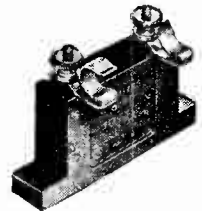


MICA CONDENSER  
Type 620

'0005 to '0009 .. .. 2/6  
'001 to '006 .. .. 3/-  
'007 to '009 .. .. 3/6

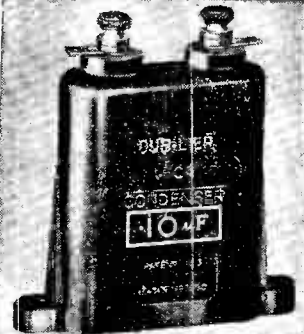
### PAPER CONDENSERS

'01 to '1 .. .. each 2/-  
'25 and '2 .. .. each 2/3  
'25 and '3 .. .. each 2/5  
'4 and '5 .. .. each 2/6  
'10 each 2/6 .. .. 2'0 each 3/6  
Prices of higher values on  
application.



MICA CONDENSER  
Type 610

'0005 to '0009 .. .. 2/6  
'001 to '006 .. .. 3/-  
'007 to '009 .. .. 3/6



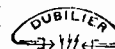
MICA CONDENSER  
Type B775

'01 - 4. - '1 - 8/6  
'5 - 37/6  
Intermediate Capacities at  
proportionate prices.

If unobtainable from your dealer, write  
direct to us, giving his name and address.

# DUBILIER FIXED CONDENSERS

Free for the asking—"A Bit about  
a Battery." There's a copy for  
you at your dealers.



Dubilier Condenser Co. 1925  
Ltd., Ducon Works, Victoria  
Road, N. Acton, London W.3

# BUILD YOUR OWN RADIO - GRAMOPHONE

**AND OBTAIN GLORIOUS QUALITY OF REPRODUCTION FROM  
RECORD OR RADIO.**

Since the public had the opportunity of hearing the wonderful results from the "C.A.C." Coupler at our Demonstration Room facing Olympia during the recent Radio Exhibition, we have been inundated with enquiries from all over the country for wiring diagrams incorporating this marvellous device.

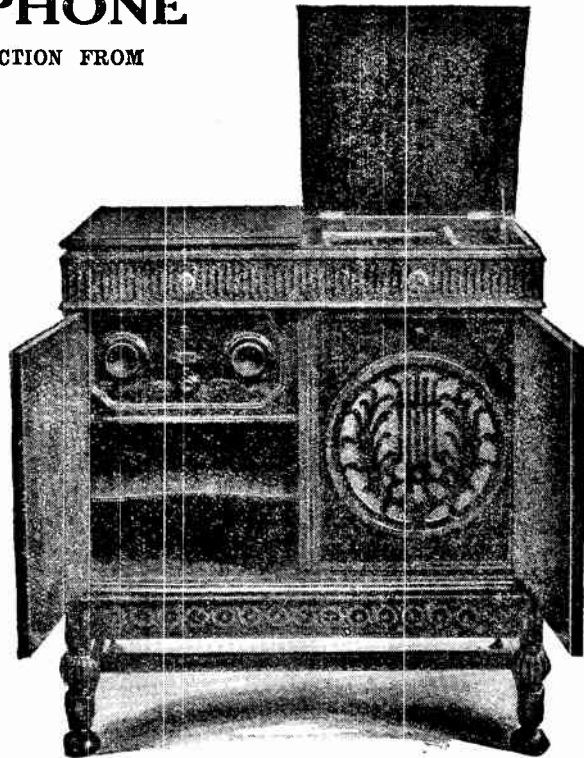
It is our intention, therefore, from time to time to give in these pages a variety of circuits to suit every individual requirement.

The secret of the wonderful quality of reproduction lies in the method of amplification employed exclusively by us, and which entirely supersedes any other known method, known as

## THE "C.A.C." LOW FREQUENCY COUPLER. THE HEART AND SOUL OF PERFECT REPRODUCTION.

All "G.R.A." instruments, from the small battery-fed receiver to the powerful Talking Film Amplifiers installed in many Cinemas throughout the country, embody exclusively this Low Frequency Coupler as the sole method of amplification.

We have sold thousands of these Couplers as a result of our Olympia demonstration, for not only do they give results which cannot be hoped for by any other method, but the actual construction of such an instrument as shown here is simplicity itself by the use of this component.



**PRICES :**

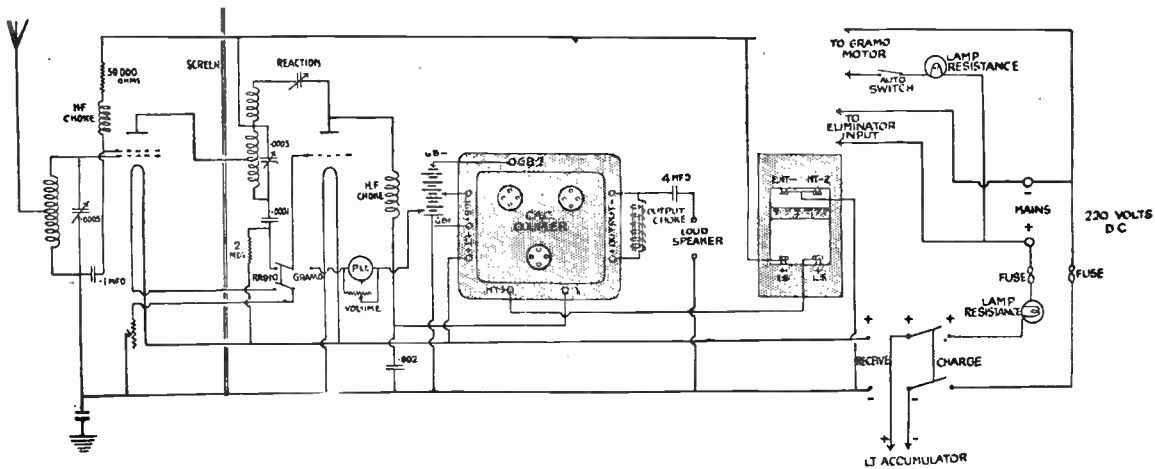
**BATTERY OR D.C. MAINS TYPE**

Two Stage . . . . . 35/-  
Three Stage . . . . . 52/6

**A.C. MAINS TYPE FOR INDIRECTLY HEATED VALVES**

Two Stage . . . . . 45/-  
Three Stage . . . . . 60/-

*Guaranteed for Two Years.*



**WIRING DIAGRAM OF RADIO-GRAMOPHONE WORKING FROM D.C. MAINS. COMPLETE SPECIFICATION ON REQUEST  
CIRCUITS FOR A.C. MAINS OPERATION SUPPLIED ON RECEIPT OF STAMPED ADDRESSED ENVELOPE.**

*We cordially invite all those interested in Perfect Musical Reproduction to hear  
this wonderful Coupler under working conditions at our address below.*

**GRAMO-RADIO AMPLIFIERS, Ltd., 1a, NEW LONDON STREET, E.C.3**

Royal 1300.

(facing Fenchurch Street Station).

# A high tension battery eliminator

suitable for any of the popular receiving sets requiring a maximum of 20 milliamperes is most conveniently built up round a



## METAL RECTIFIER TYPE H.T.3.

**NO FILAMENTS, MOVING PARTS, OR CHEMICALS.**



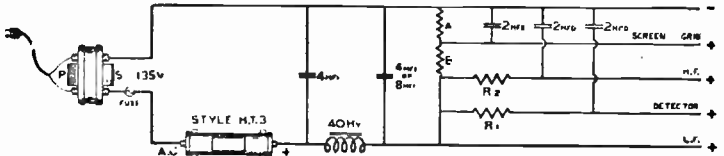
**PRICE ONLY 21/-**

A tested and recommended circuit.

Full details of this and other circuits are given in our new book "The All-Metal Way, 1930"—32 pages of valuable information about mains units of all types.

Did you get your copy at the Radio Exhibition?  
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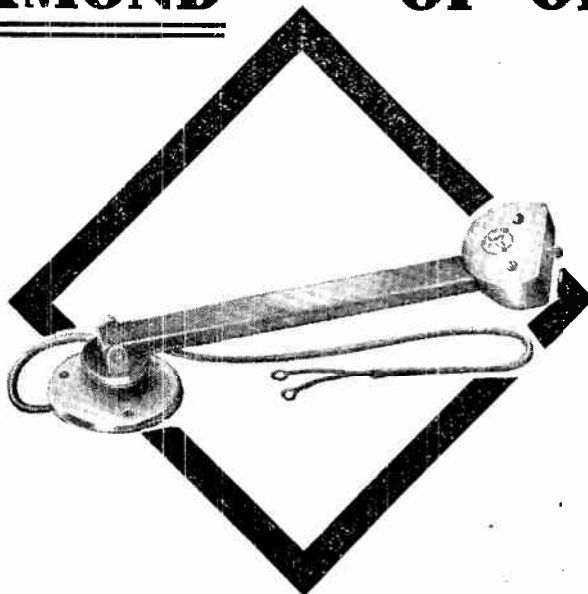
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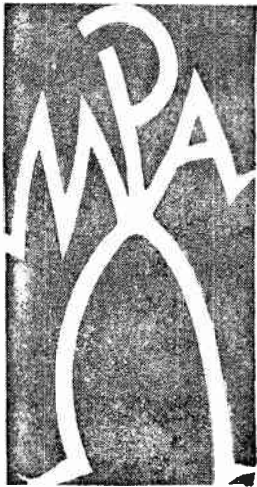
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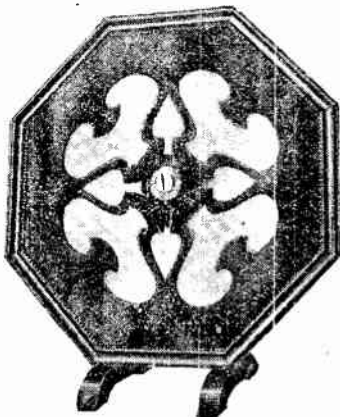
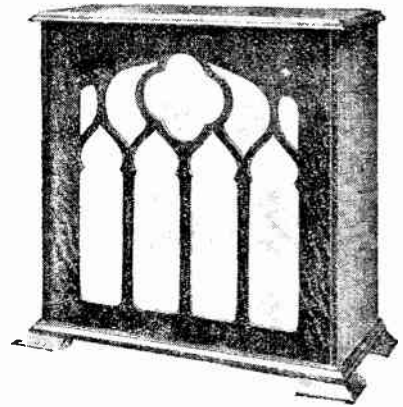
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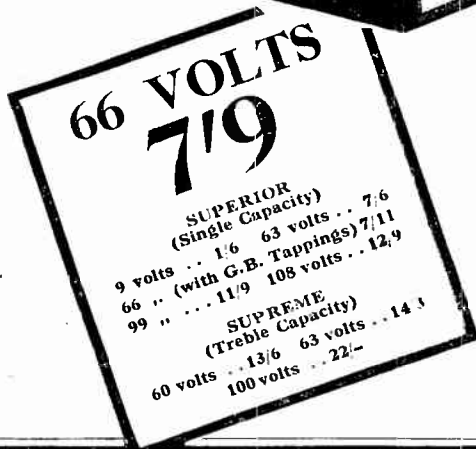
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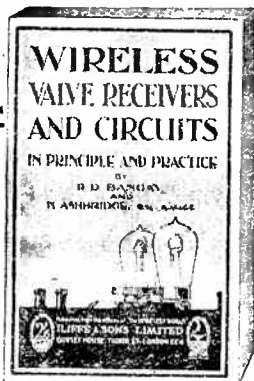
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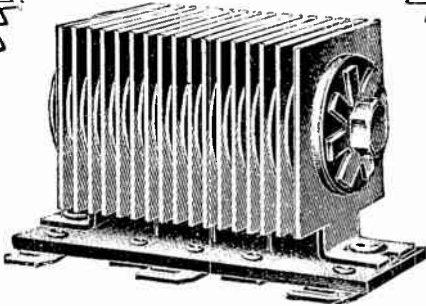
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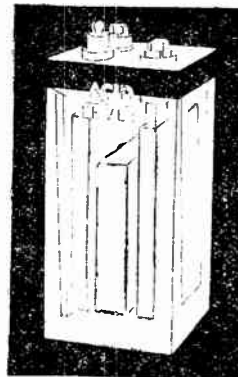


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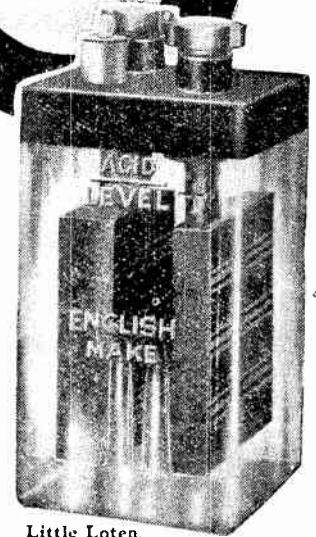
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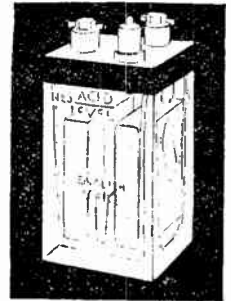
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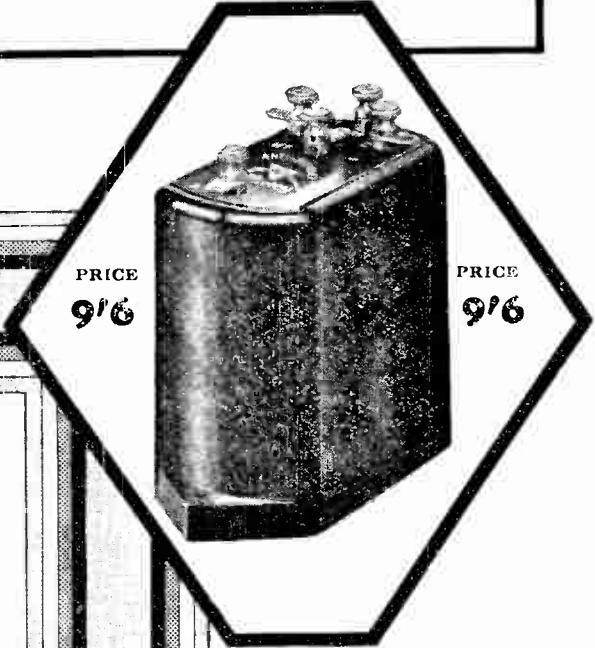
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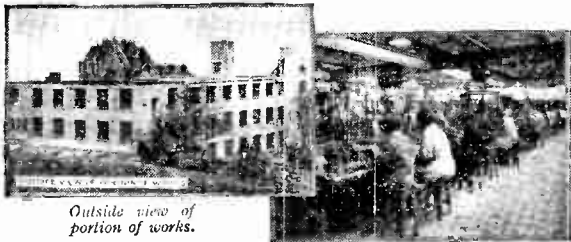
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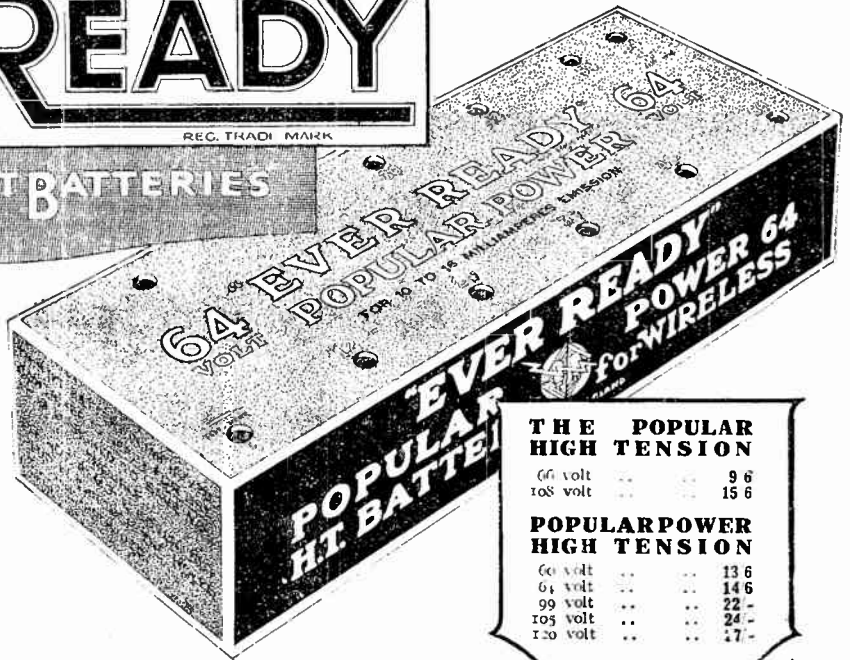
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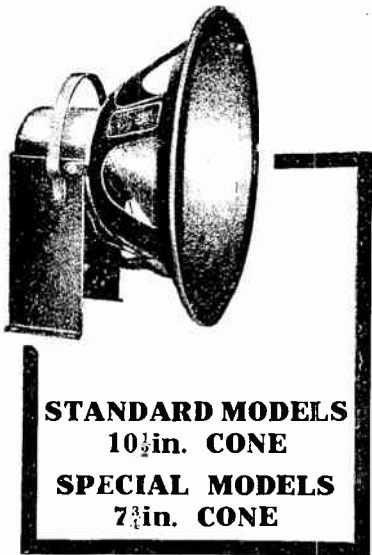
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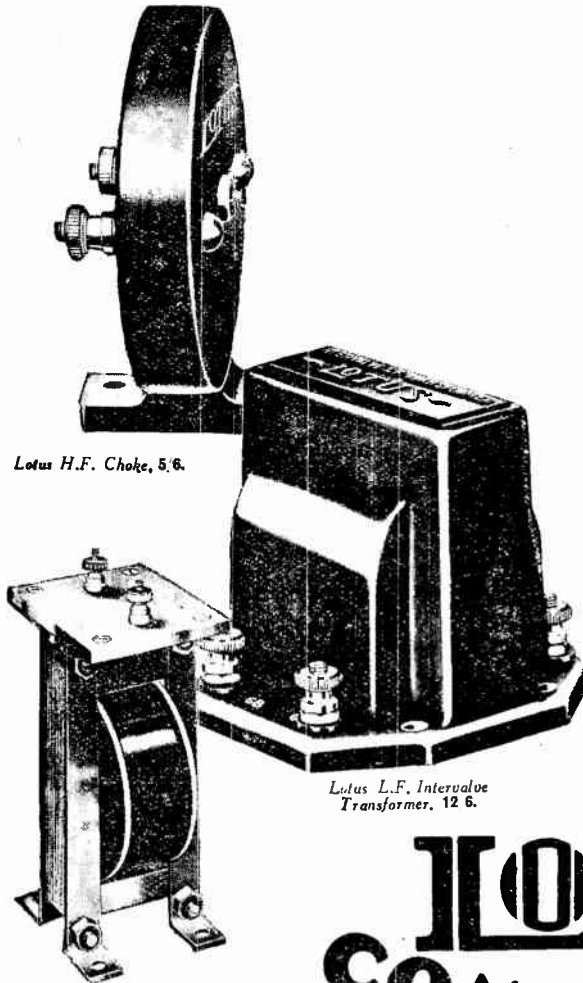
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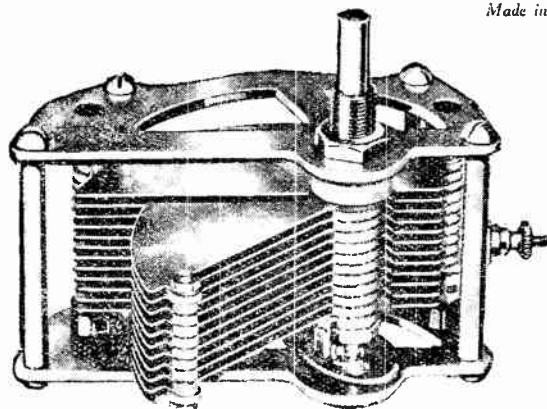
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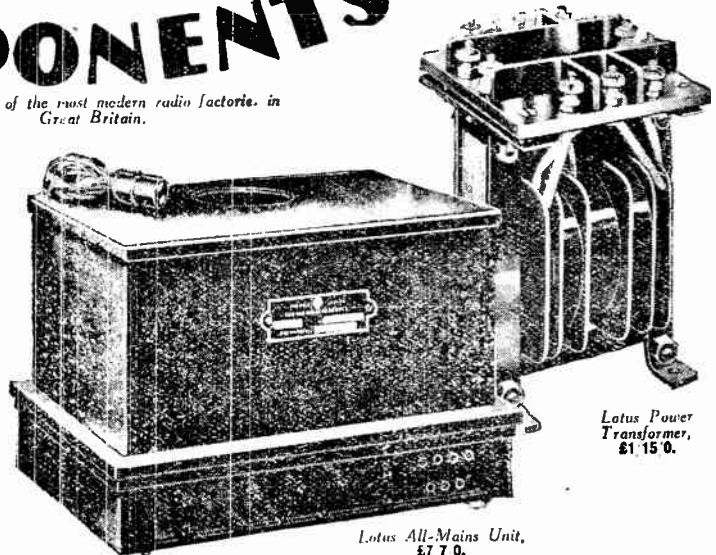
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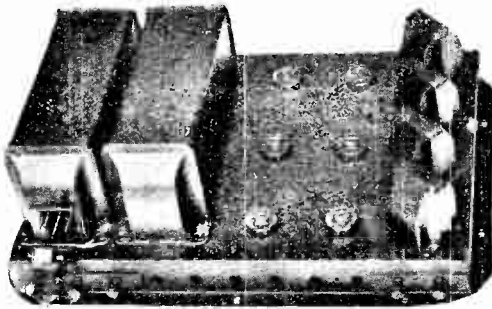
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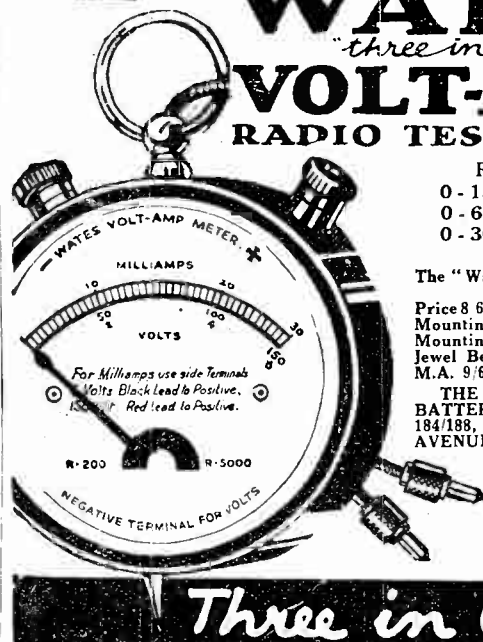
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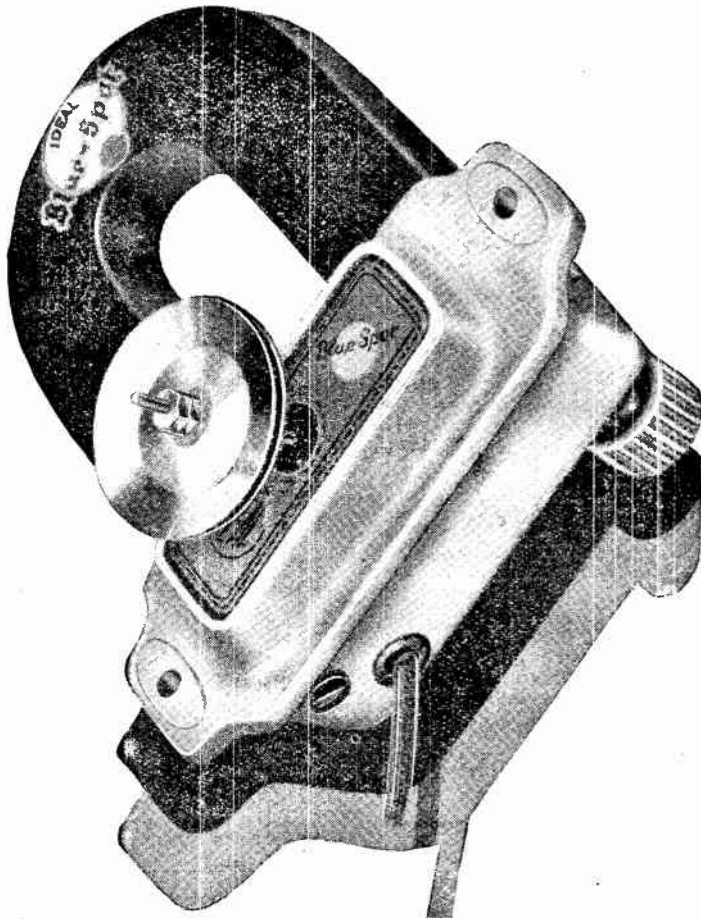
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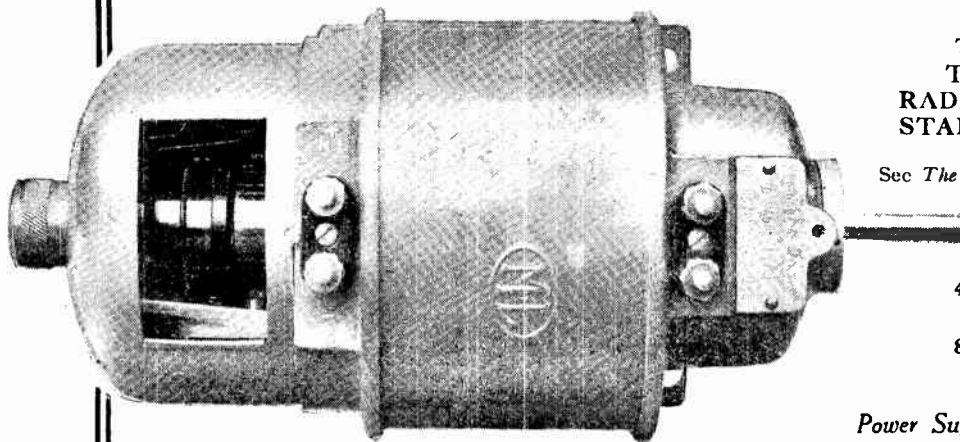
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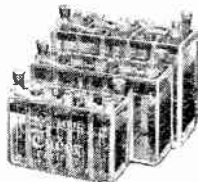
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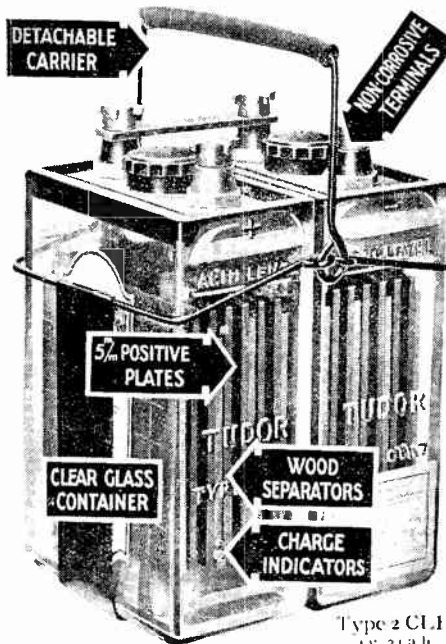
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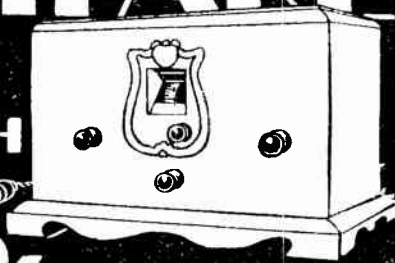
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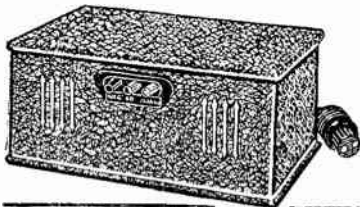
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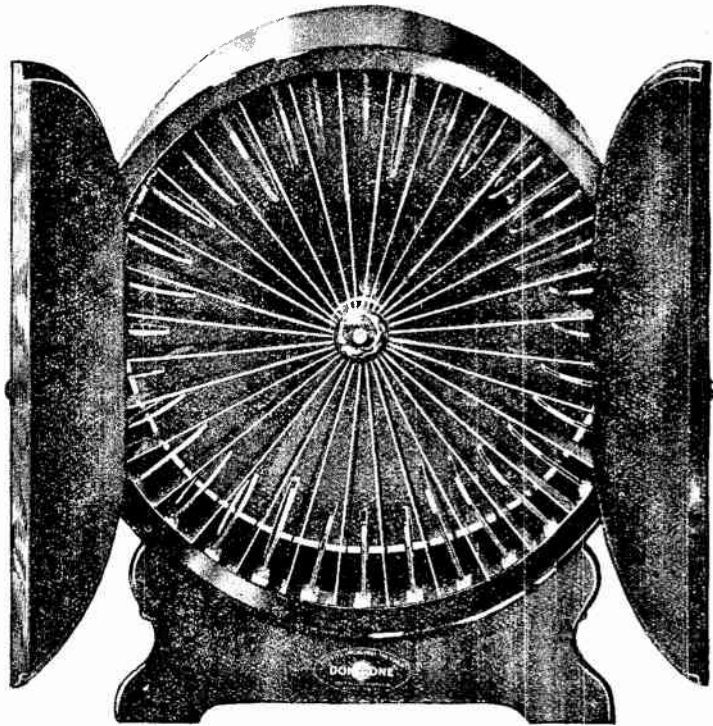
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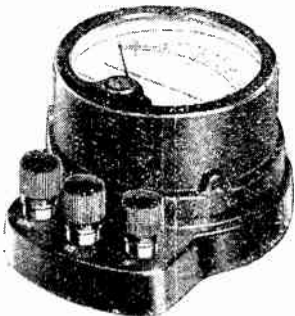
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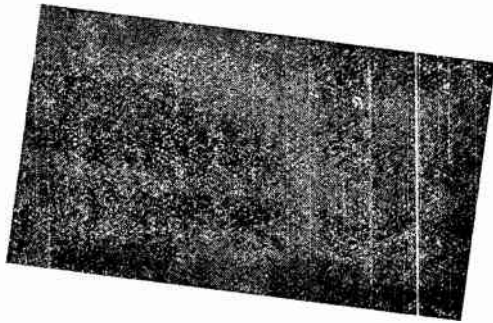
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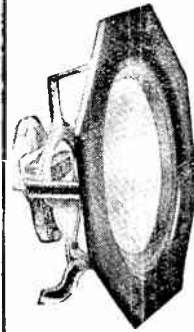
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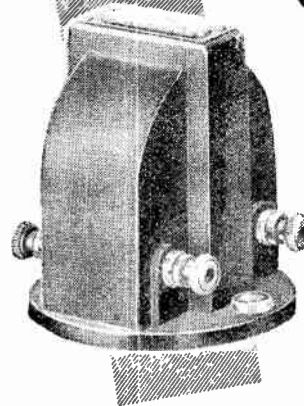
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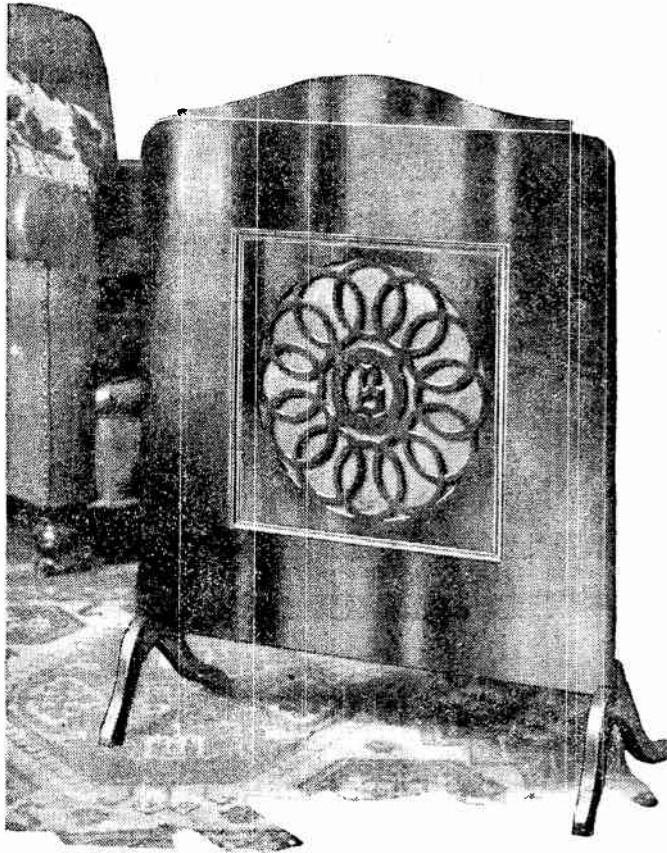
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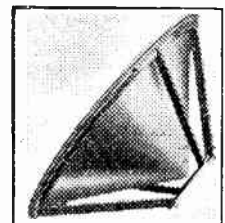
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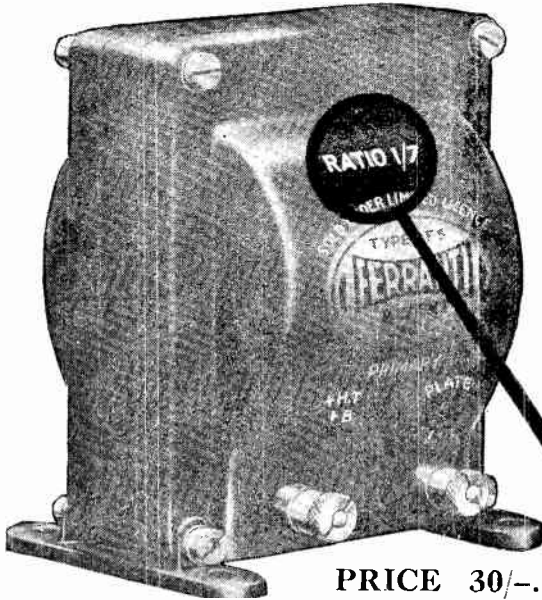


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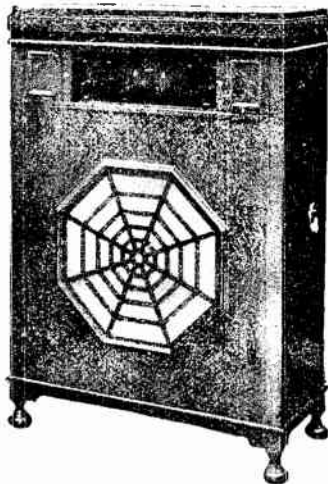
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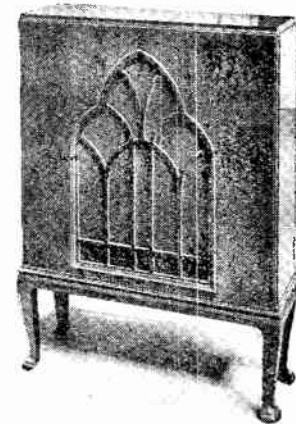
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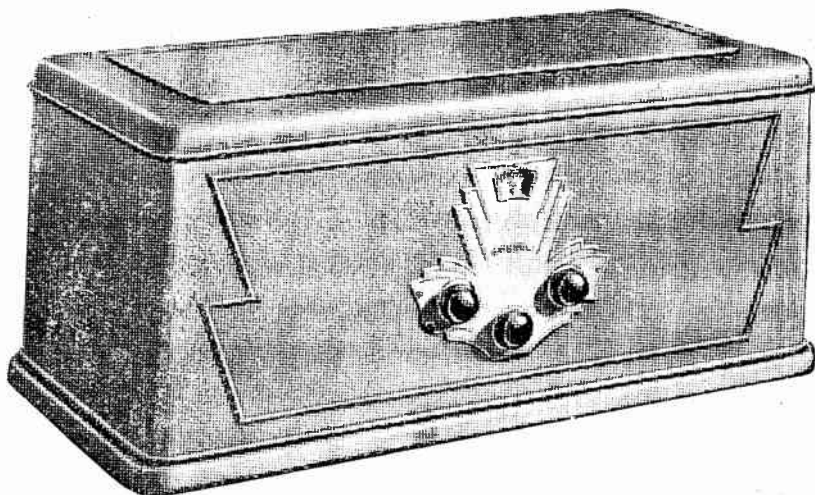
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# The Wireless World

AND  
RADIO REVIEW  
(17<sup>th</sup> Year of Publication)

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 As many of the circuits and apparatus described in these pages are covered by  
 patents, readers are advised, before making use of them, to satisfy themselves  
 that they would not be infringing patents.

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## MUST THE REGIONAL SCHEME BE SCRAPPED?

IT was expected that Monday, October 14th, would have seen the eclipse of the old Oxford Street transmitter of 2LO in favour of Brookman's Park, which it was announced officially by the B.B.C. would take over the whole of the London programme transmission from that date; but for some reason which, at the moment, has not been disclosed, the complete transfer of the programme transmissions to the new station has been postponed.

It is natural that after so much expectancy the public should be interested to learn just what is the real reason for the postponement. One can only venture a guess, and since on the engineering side there has already been ample evidence that the quality and the performance of the station is satisfactory, one must look elsewhere for the cause than to any technical trouble. Is it that, judging from reports of listeners, which must already have been pouring into the B.B.C. as a result of the

preliminary trials from Brookman's Park, the B.B.C. are not yet prepared to face the deluge of criticism which we feel sure must fall upon them when Brookman's Park takes over? The daily Press, we observe, has awakened to the troubles of listeners who find that the transmission from Brookman's Park deprives them of programmes from farther afield, and if this is the state of affairs to-day, what is going to be the position if a second programme starts up from the same centre?

### Our Views Unchanged.

Our criticism of the power of the Regional stations is not an attitude of recent growth, and we think that the present is a suitable occasion to quote the views which we expressed in our issue of March 2nd, 1927, when, under the title of "The Next War," we wrote:—

"On the face of it the scheme seems to have much to recommend it, provided that one is confident that distribution of programmes over the whole country can be obtained with the four stations (*four or more stations were originally proposed*), but where we find fault with the proposal is in the suggested power of the stations. With many listeners the complaint at present is that it is difficult to cut out the local station if you are anywhere near it, on account of its power. What, then, will be the position when we have two transmissions on 50 kW. in our neighbourhood? Has the B.B.C. quite forgotten its former concern for the interests of the crystal user, for with unselective sets it seems difficult to believe that, close up to a 50 kW. station broadcasting independent programmes on two wavelengths, it will be possible to have a choice of programmes; rather it would seem that two programmes will always be available, but not necessarily as alternatives!

"But there will be a later opportunity for discussing the details of any scheme contemplated. For the moment our desire is to express our disagreement with any proposal which calls for the employment of unnecessarily high power. We believe that in arranging stations and their power to provide for national broadcasting the endeavour should be made to keep down the power so that transmissions do not carry far beyond the frontiers of the country concerned, except, perhaps, in the case of one high-power station for international communication when required.

"As things stand at present the power of stations in Europe is constantly being increased in order to overcome interference from neighbouring stations.

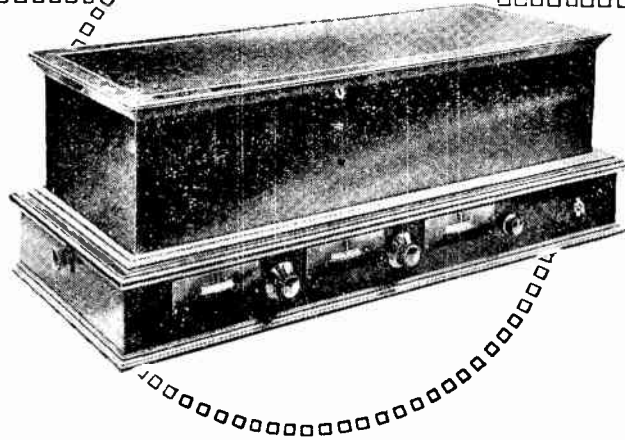
"The first wars of history were almost invariably fought as a result of incursions being made into neighbouring territories; at a later date wars more frequently started because one nation trespassed upon the trade interests of another; to-day we have another possible source of friction between nations to take into account in so far as an invasion of the ether by some foreign nation which may interfere with the broadcasting service of neighbours may at any time excite the indignation of the listening public. We have at the moment the one consolation that, judging from popular views on the programmes, the British nation is not likely to be roused to a high pitch of resentment even if some of our home programmes are overpowered by the programmes from the Continent!"

# THE 1930 EVERYMAN FOUR

Screen=Grid  
H.F.  
Amplification.

Selective Coupled  
Aerial Circuit.

By F. L. DEVEREUX,  
B.Sc.



THERE is much diversity of opinion as to the ideal type of receiver for quality reception of the B.B.C. programmes, with occasional explorations into foreign fields. This is hardly the place to go into the pros and cons of the various circuit arrangements at present in vogue; it is sufficient to state that each possesses definite advantages and enthusiastic supporters. One school of thought favours a four-valve combination comprising H.F., detector, and two L.F. amplifiers, and has recruited a formidable army of adherents as a direct result of the introduction of the "Everyman Four" receiver in 1926.

Since that date many changes have taken place, not only in reception conditions in the ether, but also in the characteristics of valves and components. Many

enquiries have been received asking if it is possible to introduce these improvements into the original "Everyman Four" design without sacrificing the essential qualities which so largely contributed to the success of the original design. The design of the receiver about to be described has been governed by these considerations, and most, if not all, the suggestions put forward have been incorporated.

Naturally, the original sequence of valves has been retained, viz., H.F. amplifier, detector, and two low-frequency amplifiers. Other features of the original design which remain substantially the same are the design of the low-wave grid circuit coils, the anode bend detector with resistance coupling to the first L.F. stage,

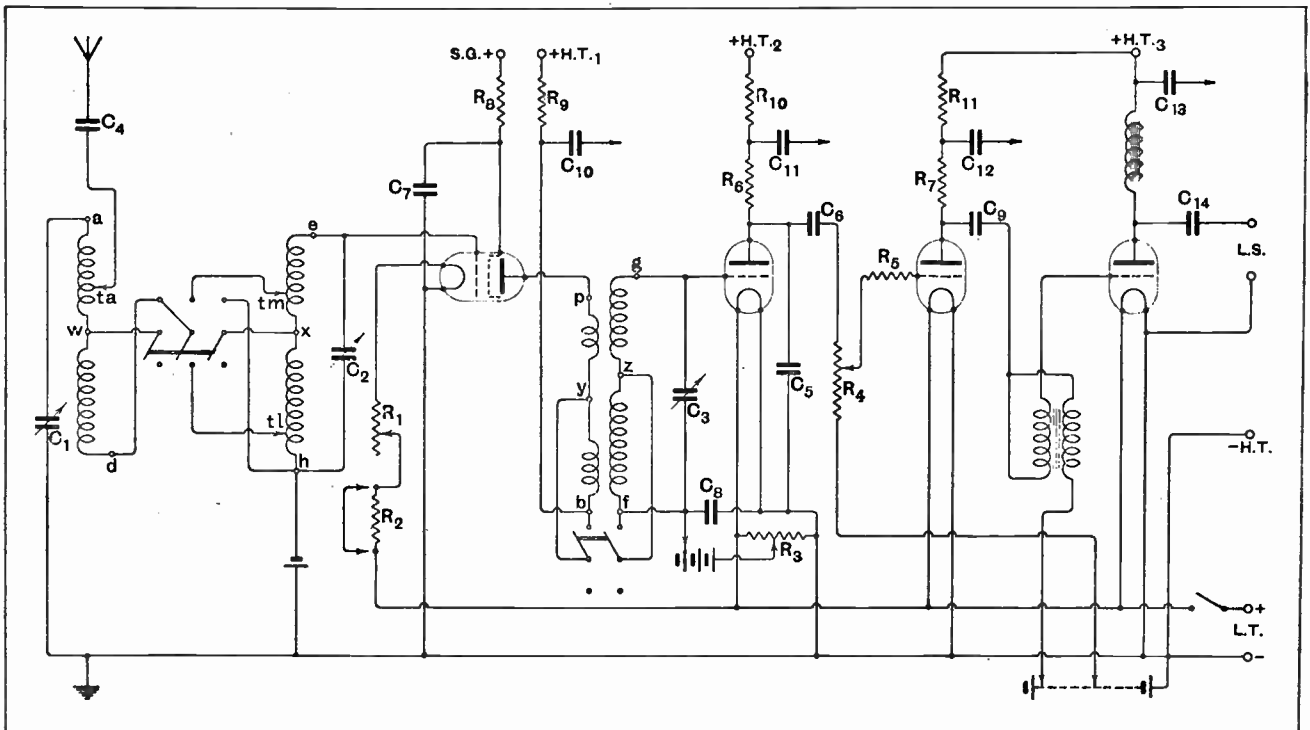


Fig. 1.—The circuit diagram. C<sub>1</sub>, 0.0005 mfd.; C<sub>2</sub>, C<sub>3</sub>, 0.0003 mfd.; C<sub>4</sub>, 0.0002 mfd.; C<sub>5</sub>, 0.0003 mfd.; C<sub>6</sub>, 0.02 mfd.; C<sub>7</sub>, 1 mfd (low H.F. resistance type); C<sub>8</sub>, C<sub>9</sub>, C<sub>10</sub>, C<sub>11</sub>, 1 mfd.; C<sub>12</sub>, C<sub>13</sub>, C<sub>14</sub>, 2 mfd.; R<sub>1</sub>, 50 ohms; R<sub>2</sub>, 0, 12.5 or 25 ohms, depending on filament voltage of valves in last three stages; R<sub>3</sub>, 400 ohm potentiometer; R<sub>4</sub>, 1 megohm (variable); R<sub>5</sub>, 0.1 megohm; R<sub>6</sub>, 250,000 ohms; R<sub>7</sub>, 30,000 ohms; R<sub>8</sub>, R<sub>9</sub>, 100 ohms; R<sub>10</sub>, R<sub>11</sub>, 20,000 ohms. The coil connections are lettered to correspond with Figs. 2 and 4.

**The 1930 Everyman Four.**— and transformer coupling between the first L.F. and the output valve.

Perhaps the most important modification is the introduction of H.F. amplification on long waves. To accomplish this successfully with simple switching arrangements it is necessary, of course, to drop the neutralised triode in favour of the screen-grid valve. This enables us to obtain an amplification in the H.F. stage in excess of the old "Everyman Four" without neutralising; and the change over from long to short waves becomes merely a question of short-circuiting the long-wave windings.

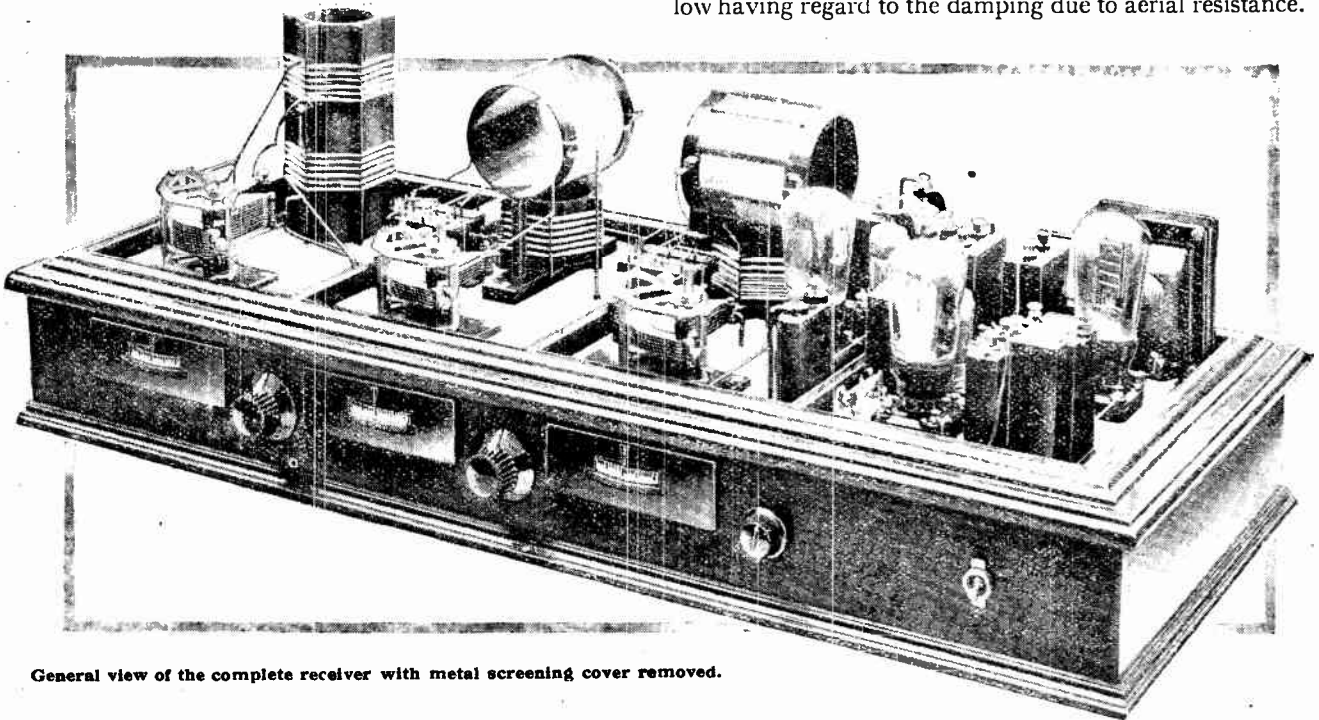
The demand for improved selectivity has been met by the inclusion of a coupled aerial circuit. Unfortunately

densers which effectively prevent any possibility of "motor-boating."

Finally, the receiver has been assembled in a standard four-compartment metal cabinet of the "Kilo-Mag. Four" type, which not only simplifies the work of construction but provides all the necessary screening for the H.F. and coupled aerial circuits. A further advantage of this cabinet is the provision of a screen between the detector and L.F. compartments, which assists in preventing H.F. straying into the L.F. amplifier.

The foregoing covers the outstanding deviations from and additions to the original design. We may now consider the technical aspects of the new circuit in detail.

The tuned aerial circuit is housed in the compartment at the extreme left of the metal cabinet. The coils are section-wound, and their H.F. resistance is sufficiently low having regard to the damping due to aerial resistance.



General view of the complete receiver with metal screening cover removed.

this introduces a third tuning control, and this is the only feature of the design which compares unfavourably with the original. There can be no doubt that a two-control set possesses many advantages in the matter of easy tuning over the present design with three controls, but conditions in the ether in the near future leave no choice. The coupled aerial circuit, with its extra tuning control, is a necessity if adequate selectivity is to be attained with only a single stage of H.F. amplification.

Two important improvements have been made in the low-frequency part of the receiver, namely, the introduction of a post-detector volume control and a filter-feed circuit in the output stage. The volume control enables the detector to function with an increased H.F. input and greater efficiency without overloading the last stage, while the filter output circuit protects the loud speaker windings and prevents the circulation of strong L.F. currents in the H.T. circuit. A further improvement has been the incorporation of anode feed resistances and con-

In order to reduce aerial damping a series condenser is included in the aerial lead, which is connected to a point near the low-potential end of the medium-wave coil. To tap down the long-wave coil also would involve the use of an additional set of contacts on the change-over switch. This is obviated by the arrangement shown, for the tapping reduces the damping to the required figure on low waves while the small series aerial condenser looks after the long waves.

The aerial circuit is coupled to the secondary or tuned grid circuit by including a few turns of the secondary coils in the aerial circuit. A three-pole change-over switch short-circuits the long-wave coils of both aerial and secondary circuits, and also transfers the grid circuit tapping to the appropriate coil.

The secondary circuit is given a compartment to itself (the second from the left). The medium-wave coil follows standard "Everyman Four" practice in that it is wound with 68 turns of 27/42 Litz on a 3in. diameter

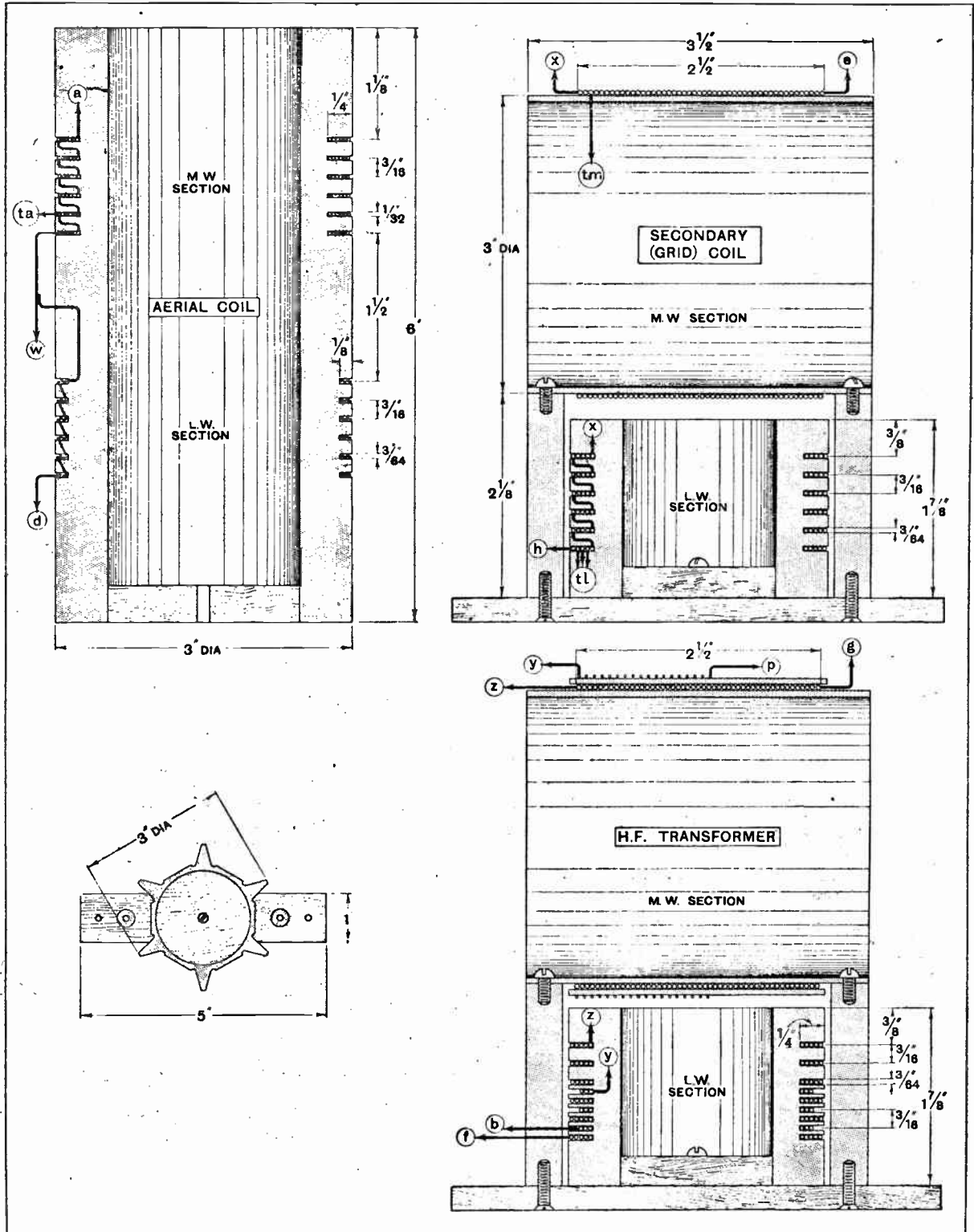


Fig. 2.—CONSTRUCTIONAL DETAILS OF COIL UNITS. The windings require the following turns and tappings. AERIAL COIL, Medium wave : 6 slots, 8 turns per slot No. 26 D.C.C., tapped at 40th turn from start (a), Long wave : 6 slots, 25 turns per slot No. 32 D.S.C. SECONDARY (GRID) COIL. Medium wave : 68 turns 27/42 Litz tapped at 2nd turn from low potential end (X). Long wave : 6 slots, 35 turns per slot No. 32 D.S.C., tapped at 3rd, 5th and 6th turns from low-potential end (h). H.F. TRANSFORMER. Medium-wave primary (for Mazda S.G.215 valve) : 30 turns No. 38 D.S.C., spaced 30 turns per inch on 9 ebonite spacing strips. Medium-wave secondary : 68 turns 27/42 Litz. Long-wave primary : 3 slots, 30 turns per slot No. 40 D.S.C. Long-wave secondary : 6 slots, 30 turns per slot, No. 35 D.S.C. All windings are wound in same direction on each former and the lettering corresponds with Figs. 1 and 4.

## LIST OF PARTS.

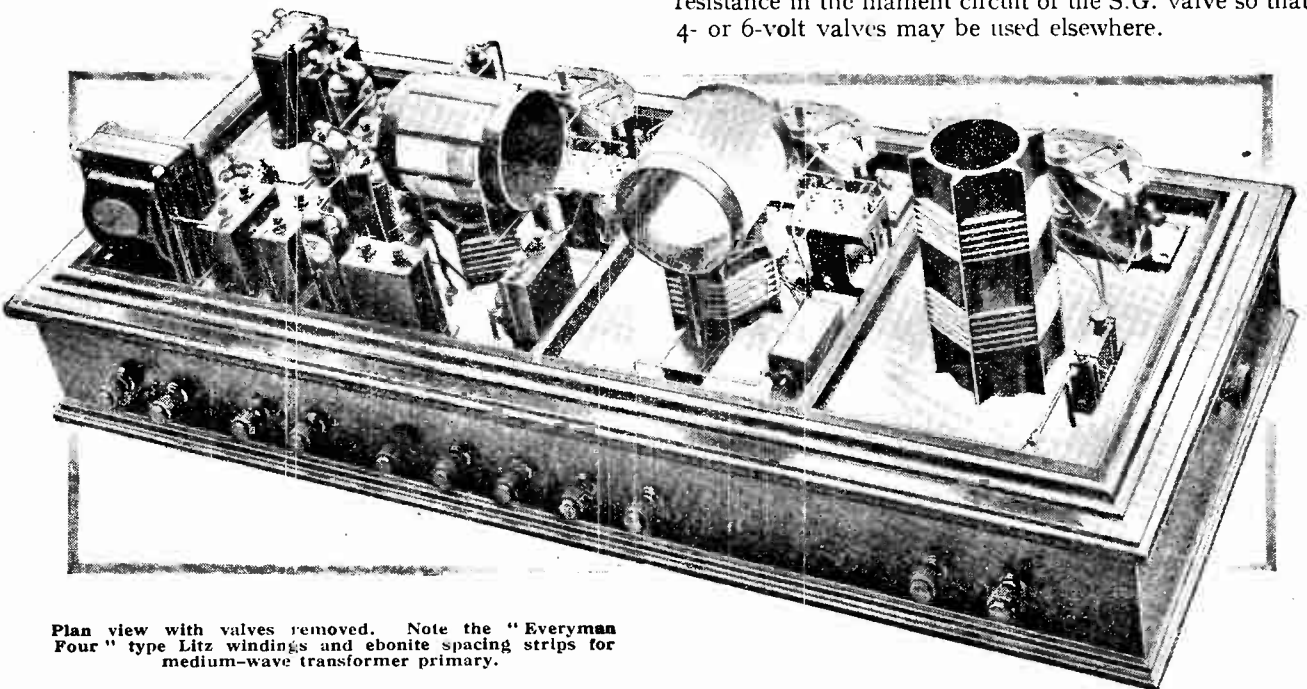
- |  |  |
|--|--|
| <ul style="list-style-type: none"> <li>1 Special metal container (Rigby &amp; Woolfenden, Rochdale).</li> <li>2 Variable condensers, 0.0003 mfd. (J. B. "Universal Lij.").</li> <li>1 Variable condenser, 0.0005 mfd. (J. B. "Universal Lij.").</li> <li>3 Special dials and eureka plates.</li> <li>1 Fixed condenser, 0.0002 mfd. (Dubilier, No. 620).</li> <li>1 Fixed condenser, 0.0003 mfd. (Dubilier, No. 620).</li> <li>1 Fixed condenser, 0.02 mfd. mica (Dubilier, No. B. 775).</li> <li>3 Fixed condensers, 1 mfd. (Dubilier, B.T. type).</li> <li>4 Fixed condensers, 2 mfd. (Dubilier, B.T. type).</li> <li>1 Fixed condenser, 1 mfd. (Dubilier, L.A.A. type).</li> <li>3 Valve holders (Boyer-Lowe "White Line").</li> <li>1 Valve holder (Acromatic "A" type).</li> <li>1 Switch, 3 pole D.T. (Utility Lever pattern).</li> <li>1 Switch, 2 pole D.T. (Utility Lever pattern).</li> <li>1 L.F. transformer (R.I. "Hypermu").</li> <li>1 L.F. choke (Ferranti B.V.).</li> <li>1 Special aerial coil.</li> <li>1 Special secondary (grid) coil.</li> <li>1 Special H.F. transformer.</li> <li>1 Resistor holder and shorting plug (Burndepl).</li> </ul> | <ul style="list-style-type: none"> <li>2 Wire-wound resistances, 20,000 (Varley).</li> <li>1 Wire-wound resistance, 30,000 (Varley).</li> <li>1 Wire-wound resistance, 250,000 (Varley).</li> <li>1 Grid leak, 0.1 megohm (Lyon).</li> <li>1 Porcelain holder for above (Bulgin).</li> <li>2 Decoupling resistances, 630 ohms (Wearite).</li> <li>1 Variable high resistance, 1 megohm (Igranite "Megostat").</li> <li>1 Rheostat, 50 ohms (Ormond).</li> <li>1 Potentiometer, 400 ohms (Ormond).</li> <li>1 G.B. battery, 16½ v. (Siemens).</li> <li>1 G.B. battery, 9 v. (Siemens).</li> <li>1 pr. G.B. clips (Bulgin).</li> <li>1 Cell, 0.9 v. (Siemens).</li> <li>5 Wander plugs (Clie).</li> <li>1 On-and-off switch (Claw's Lyons, "QMB" type).</li> <li>11 Terminals, ebonite shrouded (Bellamy-Lee).</li> <li>11 prs. insulated bushes, 2 B.A. (Igranite).</li> <li>Brass strip, Sistofer, wire, screws, etc.</li> </ul> |
|--|--|

Approximate cost, including metal cabinet, £15.

In the "List of Parts" included in the descriptions of *THE WIRELESS WORLD* receivers are detailed the components actually used by the designer, and illustrated in the photographs of the instrument. Where the designer considers it necessary that particular components should be used in preference to others, these components are mentioned in the article itself. In all other cases the constructor can use his discretion as to the choice of components, provided they are of equal quality to those listed and that he takes into consideration in the dimensions and layout of the set any variations in the size of alternative components he may use.

paxolin former. The long-wave coil is designed in accordance with established practice, and is section-wound in a slotted 6-rib ebonite former. The damping on these coils is much less than in the original "Everyman Four," and they therefore contribute considerably more to the overall selectivity of the set.

The screen-grid H.F. valve is mounted underneath the base, out of the field of the tuning inductances, and in this position acts as a link between the two middle screening compartments of the metal container.



Plan view with valves removed. Note the "Everyman Four" type Litz windings and ebonite spacing strips for medium-wave transformer primary.

After careful consideration it was decided to specify a Mazda S.G.215 valve for this stage. By making this decision it is possible to specify a definite number of turns for the low-wave primary of the H.F. transformer, giving a well-balanced compromise between amplification and selectivity. It was found that the number of primary turns is somewhat critical when using a Litz-

wound secondary of high efficiency, and it would be necessary to specify a different number of primary turns for every make of screen-grid valve on the market. This would involve many difficulties in the production of the coils, so that in the interest of all concerned the obvious step has been taken of recommending a single combination of valve and primary winding which has been found to give very satisfactory results. Considerable latitude is possible in the choice of valves for the remaining three stages, and provision is made for the insertion of a fixed resistance in the filament circuit of the S.G. valve so that 4- or 6-volt valves may be used elsewhere.

We come now to the detector stage, which occupies the third compartment from the left. The assignment

**The 1930 Everyman Four.—**

of suitable values for the components involved in this stage is perhaps the most difficult task which confronts the designer of a receiving set. It is necessary to effect a compromise between the following conflicting factors:—

- (1) Detector efficiency, i.e., L.F./H.F. ratio for both large and small inputs.
- (2) Grid circuit loading.

(3) High-note loss.

(4) H.F. leakage to the L.F. amplifier.

(5) Post-detector volume control, the operation of which does not affect any of the foregoing conditions.

In order to attain a high detector efficiency, the anode resistance should be large compared with the A.C. resistance of the valve under working conditions, while the by-pass condenser should have a high value to prevent reduction of the H.F. input due to grid circuit

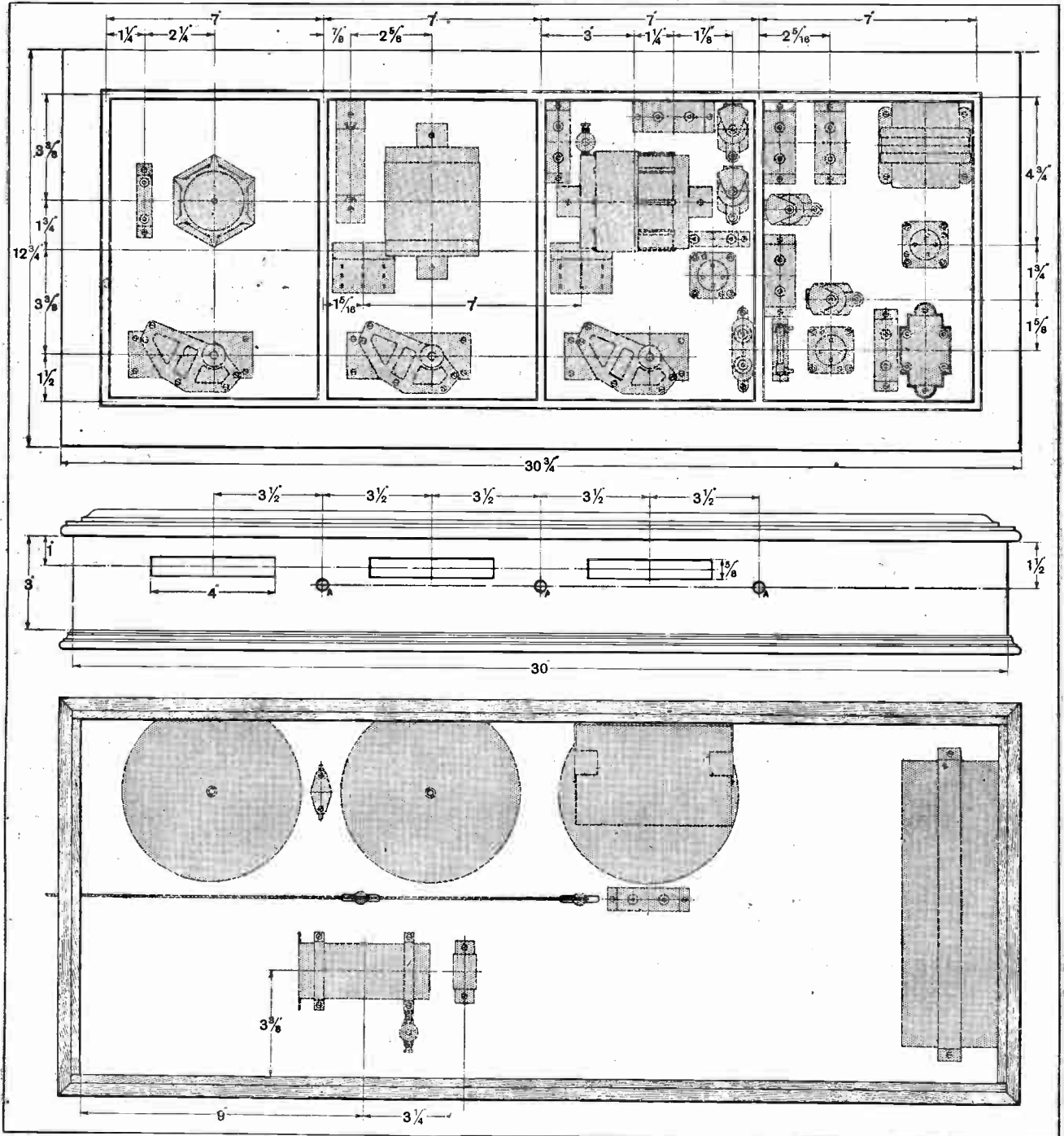


Fig. 3.—Layout of components above and below baseboard. The holes A are  $\frac{1}{16}$  in. in diameter.



**The 1933 Everyman Four.—**

loading. Unfortunately, high note loss sets a limit to the capacity of the by-pass condenser, and it is necessary to steer a middle course between these two conflicting factors. There is little point in using a valve of lower A.C. resistance with a reduction in the anode circuit resistance as a much larger by-pass condenser has to be used to bring the grid current loading to the same figure, and by the time this has been done the high note loss is equivalent to the case of the high resistance valve. In general the high resistance combination is more sensitive to weak signals and has therefore been specified in the design.

**Detector Grid Bias.**

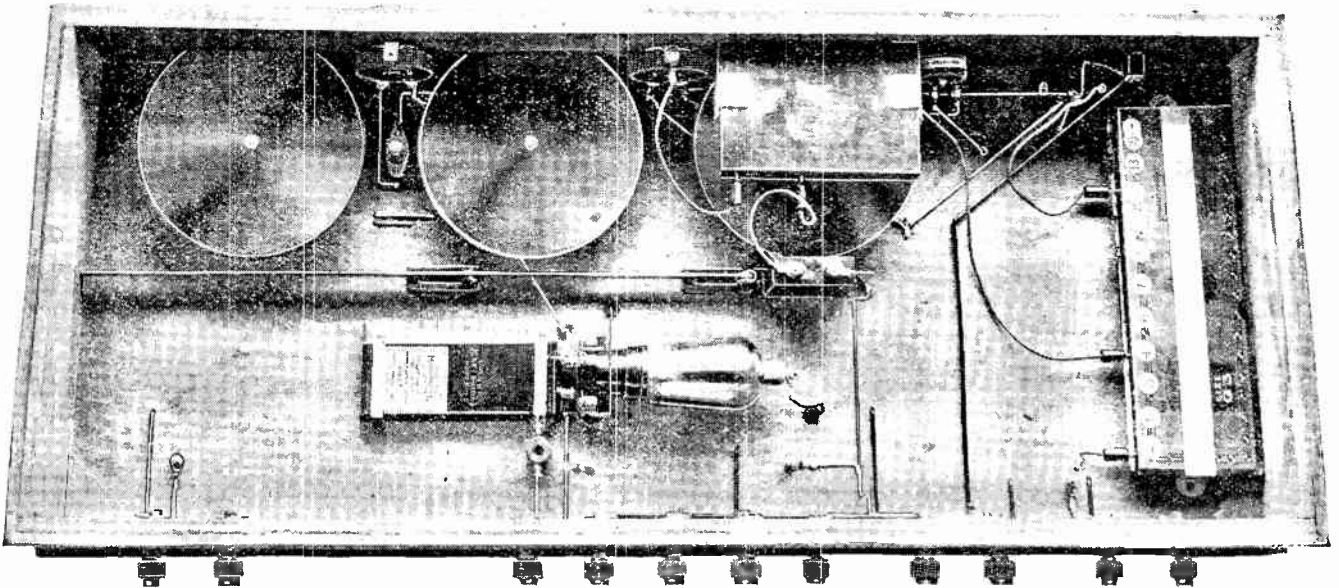
The value of the grid bias and the magnitude of the H.F. input also has some bearing on the grid circuit loading, which is reduced when the negative bias is increased. The introduction of a post-detector volume

the L.F. output circuit. The results show that no drastic modification of the original design is necessary at this stage. A slight loss of high notes was permitted in the interest of conditions (1), (2) and (4) above, in view of the fact that the upper frequencies are reinforced in the succeeding stage.

An R.I. "Hypermu" transformer was chosen to couple the first L.F. amplifier to the output valve, since this component, when connected as an auto-transformer and freed from direct anode current by means of a resistance-capacity filter, shows a marked rising characteristic (*vide* N.P.L. curves).

The remainder of the circuit is self-explanatory and does not call for special comment.

The work of assembly and wiring is so greatly simplified by the special form of metal cabinet that detailed description is superfluous; all the necessary information is crystallised in the working drawings and wiring diagram.



View underneath base showing disposition of detector and L.F. grid bias batteries.

control permits this adjustment, for the H.F. input can be increased in accordance with an increased negative bias without necessarily overloading the output valve. A potentiometer has been included for critical adjustment of the grid bias.

The values specified in the diagrams are the result of actual measurements on the factors (1) to (4) set out above. An experimental detector stage with a special low-loss tuned input circuit, sensitive to grid damping, was energised by means of a modulated H.F. oscillator. The H.F. input and L.F. (and any H.F.) output could be measured simultaneously. Variations were made in the type of valve, values of anode resistance, by-pass condenser, etc., and for each new set of conditions readings were taken for the detector efficiency with 600 and 6,000 cycle modulation, and the depression of the input circuit volts due to switching on the valve. Tests were also made for H.F. in

It is important that the low-frequency transformer connections should be made exactly as indicated in the wiring diagram, while if the volume control grid leak is of the logarithmic type care should be taken that the end connections are not reversed, otherwise the change in volume will be crowded to one end instead of being distributed evenly over the range of movement of the dial. In the case of the Igranic "Megostat" the red terminal should be joined to grid bias and the blue to the coupling condenser.

**Valves and H.T. Voltages.**

Suitable H.T. and grid bias values will depend on the valves, and should be fixed in accordance with the maker's recommendations. It has already been stated that a Mazda S.G.215 valve should be used in the first stage. A general purpose (H.L.) valve having an A.C. resistance of about 25,000 ohms and amplification factor

The 1930 Everyman Four.—

20 to 25 is suitable for the detector, while the first L.F. amplifier should be a type "L" valve of about 10,000 ohms resistance (amplification factor 10). The output valve may be of the "power" or "super-

be suitable, minor alterations being made by experiment until best results are obtained: H.T.<sub>1</sub>, 120 volts; H.T.<sub>2</sub>, 100 volts; H.T.<sub>3</sub>, 150 volts; Screen, 60 volts.

In conclusion, it can be definitely stated that the H.F. amplification is at least double that of the original

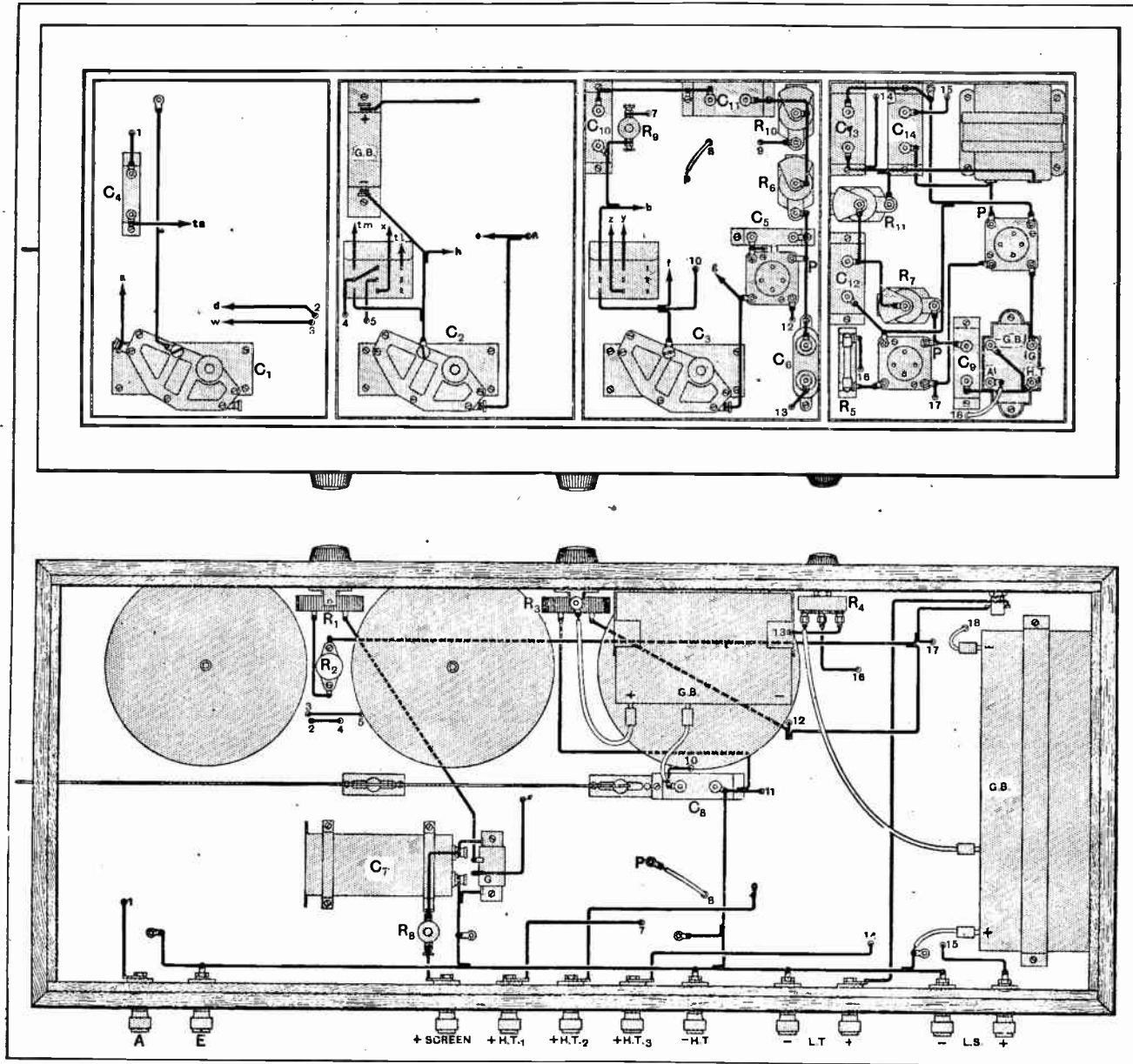


Fig. 4.—Complete wiring diagram. Connections to the coil units are lettered to correspond with Figs. 1 and 2. The red terminal of R<sub>4</sub> goes to grid bias and the blue to C<sub>11</sub>.

"power" type according to the requirements of the individual.

If 2-volt valves are used throughout a shorting plug must be inserted in the fixed resistor holder R<sub>2</sub>. With 4-volt valves in the last three stages a 12.5 ohm resistance will be required, and with 6-volt valves 25 ohms.

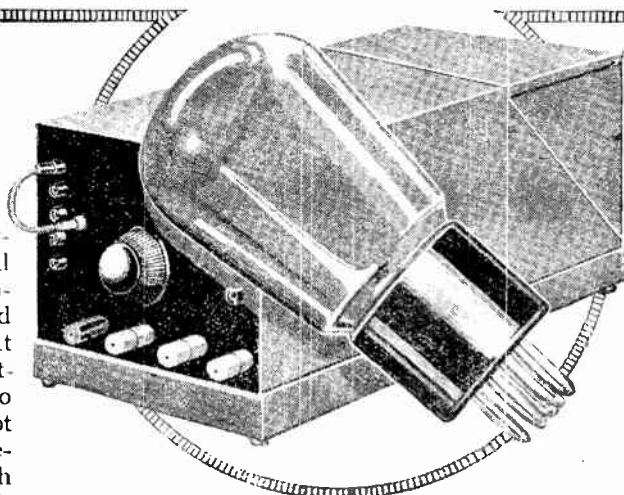
For the initial tests the following H.T. voltage will

"Everyman Four" employing a neutralised three-electrode valve, while tests have proved that the selectivity is more than adequate for long-distance reception under the new Regional conditions.

*This receiver, together with other sets recently described in these pages, will be available for inspection on THE WIRELESS WORLD Stand (No. 34) at the Manchester Radio Exhibition.*

# A NEW HIGH-VOLTAGE PENTODE

Public Address  
Volume  
with 250 Volts.



Characteristics  
of the New  
PM.24A Valve.

ONE of the chief drawbacks to the original pentode valve, introduced by Messrs. Mullard just over a year ago, is that it is rated for an anode voltage not greater than 150 volts. A pentode is not usually incorporated in a receiver for the sake of its high amplification, though this is always very acceptable, but rather because it will give, without overloading, a greater output of signals than can be attained from a triode operated at the same anode voltage. In view of this fact it has always been rather annoying to find that the makers have hitherto restricted us to a maximum of 150 volts on the anode, especially as 200 volts or over is directly available from most D.C. mains, and from many eliminators used on A.C. supply. As there are several triodes on the market capable of standing up to these slightly higher voltages, the restriction has, in the past, seriously curtailed the usefulness of the pentode, for one of these triodes, operated at full voltage, would provide nearly as great an output as the pentode at its maximum rating.

The new Mullard PM.24A is a much more tempting proposition from the point of view of the designer of a set for mains operation. It is rated to withstand up to 300 volts on the plate, with a maximum of 200 volts

on the screening-grid. It may, therefore, be put straight into an all-mains receiver and be allowed to operate on the full voltage available from the mains.

In appearance, there is no difference between the new valve and the familiar PM.24, its low-voltage prototype. It is available, however, with the five-pin base

recently adopted for indirectly heated mains valves, the screening-grid being, in this case, brought out to the centre pin which is used, in an indirectly heated triode, for the cathode connection.

The makers give the following data for the valve:—

Filament Voltage	...	...	4.0
Filament Current	...	...	0.275 amp.
A.C. resistance	...	...	53,000 ohms.
Amplification Factor	...	...	83
Mutual Conductance	...	...	1.56 milliamps. per volt.

The conditions in which the figures for A.C. resistance and amplification factor are obtained are not stated; the standard conditions for a triode are anode volts 100, grid volts zero.

### Operating Data.

Since there would be no point in choosing this valve, rather than its less robust brother, the PM.24, unless the use of a voltage higher than 150 were contemplated, the curves for this valve were all taken with the permitted maximum of 200 volts on the screening-grid. With this voltage applied to both screening-grid and anode, the anode currents corresponding to various grid voltages were measured, and are plotted in Fig. 1. The slope of the curve in the neighbourhood of 20 to 25 milliamps., which represents normal operating conditions, is 1.85 milliamps. per volt. It will be seen that this is a little higher than the figure of 1.56 quoted by the makers, and indicates that the valve is conservatively rated. Another curve was also taken, with the same voltage on the screening-grid, but with 300 volts on the plate. At all points this second curve shows about 3 per cent. greater anode current than that of Fig. 1; it is not reproduced on the diagram because the closeness of the two curves would make both difficult to read, while if we allow for permissible variations from valve to valve, that shown may be taken as valid for any anode voltage between 200 and 300. Thus, as might be expected, the screening grid voltage exerts more influence on the anode current than the anode voltage.

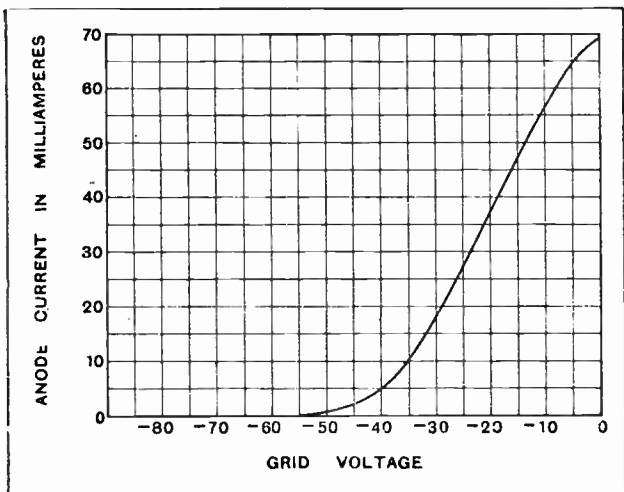


Fig. 1.—Characteristic of the PM.24A with anode and screen voltages of 200. The curve is little changed by substituting anode voltages from 150 to 300.

**A New High-voltage Pentode.—**

The operating instructions given with the valve include the following table:—

Anode Volts .....	100	150	200	250	300
Grid Bias Volts .....	9	15	21	27	33
Anode Current .....	8	11	15	19	23 milliamps.

There is also a statement that the screening-grid voltage must not exceed 200 volts, otherwise the emission will be excessive and the valve may be damaged.

**Enormous Power Output.**

Thus, we did not venture to increase the auxiliary grid voltage above 200, but kept it at this value while measuring the anode current at a series of anode voltages. The three curves obtained are given in Fig. 2, the grid voltages adopted being those suggested in the last three columns of the table reproduced above from the makers' instructions. The middle curve of the three, corresponding to a grid bias of 27 volts, would appear to represent the normal working conditions, for the standing anode current at 200 to 300 volts is some 23 milliamps., the highest mentioned in the table. The slope of this curve shows that the valve, under working conditions, has an A.C. resistance of about 60,000 ohms, from which, knowing the mutual conductance, we deduce an amplification factor of 110. Both these figures are rather on the high side, but that is a matter of very little importance with a pentode. If a lower impedance together

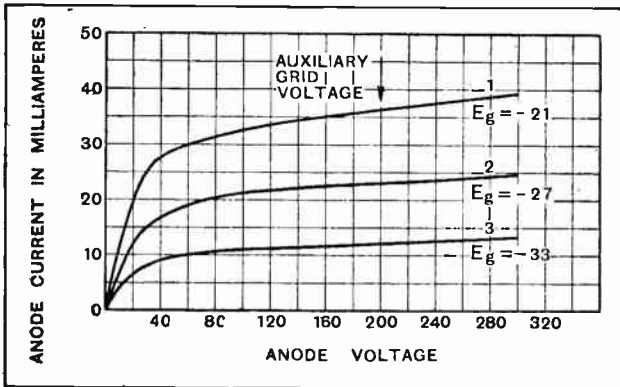


Fig. 2.—Anode voltage-anode current curves when the screen-grid voltage is 200 and the control grid is biased as shown. In curve 1,  $R_o$  is 27,000 ohms and  $\mu = 54$ ; in curve 2,  $R_o = 60,000$  ohms and  $\mu = 110$ ; in curve 3,  $R_o = 80,000$  ohms and  $\mu = 130$ .

with a lower amplification factor is desired, it can be had by choosing the lower value of grid bias that corresponds to the uppermost of the three curves, and which is the actual grid bias suggested in the maker's table of data. The anode current rises then to nearly 40 milliamps., while A.C. resistance and amplification factor become about 27,000 ohms and 50 respectively. Neither the available output nor the amplification yielded by the valve are greatly varied by this change; to the ear, the most significant difference is an increase of bass notes with the lower grid-bias voltage.

The maximum power that can be taken from the pentode is not easy to specify exactly, since it depends to a very great extent on the impedance connected in the anode circuit. If we assume this to be a non-inductive

resistance of 10,000 ohms, the audio-frequency power that the PM.24A will deliver to it before overloading commences is in the neighbourhood of 2 to 3 watts. Using a moving-coil of 2,600 turns, fifty to sixty ampere-turns are available to move the coil and the cone attached to it. These figures compare well with the output to be had from a valve of the LS5A variety on its maximum rated voltage of 400.

As a final test, the valve was given a practical trial in a receiver. Using a moving-coil speaker fitted with a special "pentode coil" of 2,500 turns, the volume available before overloading began was found to be greater than could be tolerated in any but a very large room. With the lower plate-current (23 milliamps.) corresponding to a high valve impedance it was noticed that the treble was unduly pronounced; this was easily rectified by connecting the loud speaker to a tapping on the choke, as in Fig. 3. No volume appeared to be lost by so doing.

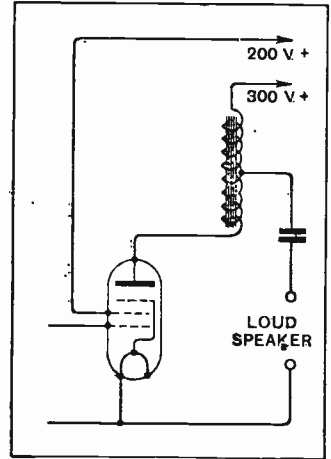


Fig. 3.—The use of a tapped output choke was found to improve quality.

Used with a moving armature speaker, overloading occurred at a much smaller signal strength than with the moving coil, as might be expected from the higher impedance and lower sensitivity of this loud speaker. Nevertheless, quite satisfactory volume was to be had, though the introduction of a 2:1 step-down transformer with a resistance of 20,000 ohms connected across its primary resulted in better quality, with less accentuation of the higher frequencies. These practical tests suggest that the pentode, even more than the triode, is best served with a moving-coil speaker.

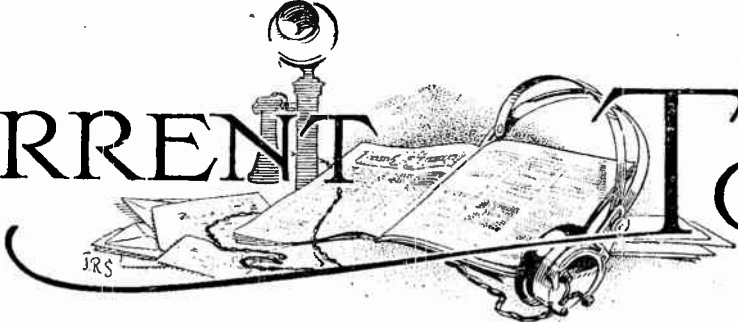
We understand that the PM.24A is being fitted to all-mains receivers, in which the filament is heated by alternating current. We ourselves have tried this, and find that no noticeable hum is introduced provided that the usual precautions are taken. Pending the arrival of a pentode specially designed for A.C. mains, the present model may be used with complete satisfaction in A.C. sets, while its extreme suitability for use on D.C. mains, where the high voltages normally associated with an output stage of "public address" dimensions cannot be attained, is very evident indeed.

**NEXT WEEK'S ISSUE**

will contain a fully illustrated report of

**THE MANCHESTER SHOW.**

# CURRENT TOPICS



## Events of the Week in Brief Review.

### WHY NOT IN BRITISH TRAINS ?

The news that express trains between Paris and Havre are to be equipped with wireless receivers serves to emphasise the lethargy of the British railway companies in regard to the possibilities of broadcast reception on long-distance runs.

### ANXIETY IN GLASGOW.

Known as "The Terror," the Post Office detector van is now touring the Glasgow district in search of oscillators and "pirates." The equipment in the van includes a screen-grid four-valve set with a frame aerial. The receiver covers a wave range from 15 to 2,000 metres.

### THE POPE'S WIRELESS STATION.

It is announced in the Vatican City that the Italian Government has decided to contribute half a million lira towards the expense of erecting the Papal wireless station now under construction. The apparatus is being built by the Marconi Company. The two masts, each nearly 250ft. high, are being made in Italy.

### WHEN IS A WAVE SHORT ?

Many arguments will be settled (or started!) by the news that the International Consultative Committee of the Radio-Electrical Conference now in session at the Hague has decided to classify wavelengths as follows:—

- Long, 3,000 and upwards.
- Medium, 200 to 3,000.
- Intermediate, 50 to 200.
- Short, 10 to 50.
- Ultra-short, below 10.

### PHYSICAL AND OPTICAL SOCIETIES' EXHIBITION.

The Twentieth Annual Exhibition of Electrical, Optical and other Physical Apparatus is to be held by the Physical Society and the Optical Society on January 7th, 8th and 9th, 1930, at the Imperial College of Science and Technology, South Kensington.

### WIRELESS ON TAP AT SING SING.

The many attractions of Sing Sing prison have been added to by the inclusion of a wireless phone "point" in each of the 800 cells in the new block, says a New York message. It is stated that a prison official chooses what programme shall be relayed to the cells, this precaution being necessary to obviate the possibility of prisoners' friends talking to them *via* a night club microphone?

### ALL ROADS LEAD TO MANCHESTER.

To-day (Wednesday) sees the opening of the Manchester Wireless Exhibition at the City Hall. A guide to the show appears on page 437.

### "TALKIES" FOR THE DEAF.

The Paramount "Talkie" Theatre at Brooklyn, New York, has fitted up a portion of the auditorium with amplifiers and an extensive net of headphones for the use of deaf members of the audience. In order to cope with degrees of deafness, the headphones are equipped with a potentiometer to control the volume of sound according to individual requirements.

### IS YOUR MAST SAFE ?

A correspondent in *The Times* has drawn attention to the possibility that

many wireless poles erected four or five years ago may now have reached a dangerous condition due to rot at the "wind and water" line, viz., 6in. above and 6in. below ground. *Verb. sap.*

### POLICING THE U.S. ETHER.

The largest radio frequency measuring station in the world is to be opened next December at Grand Island (Nebraska), U.S.A. It is to be used for checking the wavelengths of all United States transmitters. Roughly, six hundred broadcasters, two thousand ship installations, sixteen thousand amateurs, as well as aerodrome, naval and military stations are expected to avail themselves of this service.

### WIRELESS FOR EVERY BLIND PERSON.

The National Institute for the Blind which has just published its sixtieth annual report, has a special Technical Research Committee devoting attention to the upkeep of sets owned by blind listeners. It is hoped that schemes will eventually be evolved which will bring wireless to every blind person in the country.

### NOISY LOUD SPEAKERS.

The Health Committee of the Hul Corporation has requested the Town Clerk to draft a bylaw to stop noise arising from loud speakers which are operated in a manner to cause annoyance.

Simultaneously we learn that an organisation of apartment house owners in Brooklyn, N.Y., have decided to incorporate in leases to new tenants a clause prohibiting the operation of loud speakers after 10.30 p.m.

### PAPER CONDENSER PATENT.

The paper condenser is to be the subject of litigation in America, according to a New York correspondent, who states that the Dubilier Condenser Corporation has brought an action for infringement of patent rights against the Aerovox Manufacturing Corporation in respect of U.S. Patent 1,688,478, which relates to the manufacture of paper condensers.

Large sums of money may be involved, as it is estimated that the cost of such condensers used in radio sets and amplifiers amounts to more than twenty million dollars annually. Many important companies in America and Europe have taken licences on a royalty basis.



GERMAN FIELD WIRELESS. A photograph taken during the recent Autumn Manœuvres of the German Army. The portable mast is about 20ft. in height.

# Selectivity in Plain Terms

A New Unit and its Applications to Practical Circuits.

By R. T. BEATTY, M.A., B.E., D.Sc.

THE opening of the Brookmans Park Station with a power consumption of 30 kilowatts, ten times as great as that of the old 2LO, is bringing to the fore among listeners in the London area the subject of selectivity in receiving sets and the growth of the regional scheme will ultimately compel interest in this topic to extend over the whole country. For, with the realisation of the regional scheme, the local station will

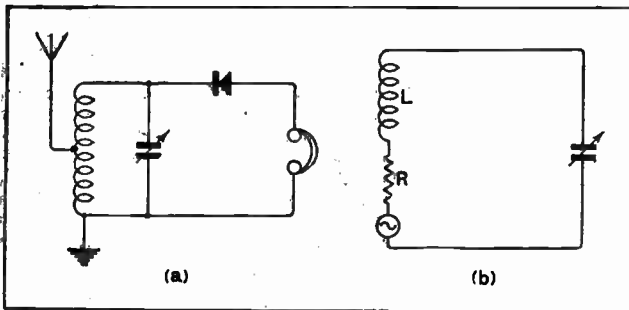


Fig. 1—Simple crystal set and equivalent H.F. circuit.

become dominant over a wide sector of the tuning dial, and its elimination in favour of distant stations can only be effected by an increase in selectivity.

The discussion of selectivity has been hampered in the past by the lack of an exact definition of the term—a definition, in fact, which will allow us to express the selectivity of a set as a numerical quantity from which we can infer its performance both as regards quality of reproduction and power of separating stations of contiguous wavelengths.

This performance can, it is true, be inferred from the resonance curve of the high-frequency stage or stages of the set, assuming that the low-frequency stage is of sufficiently good quality to cause no serious distortion. But we must admit that the formula which gives the resonance curve is a formidable one, and that even when this formula is mastered the numerical work involved in plotting the curve is laborious.

In this article a proposal will be made to express the selectivity of any set as a numerical quantity, and it will be shown that when this number is known it is but a moment's work to draw the H.F. resonance curve.

## Resonance Curves.

A set consisting essentially of a single tuned circuit such as the crystal set shown in Fig. 1 (a) is equivalent from the H.F. point of view to the circuit of Fig. 1 (b) in which the resistive loads due to the aerial, the crystal and the phones are incorporated as an equivalent series resistance  $R$ .

Fig. 2 shows the resonance curve of this circuit: its shape depends solely on the ratio of the reactance of the coil to the series resistance (Fig. 1 (b)). This ratio is called the coil magnification. If it is large the curve is steep: if small, the curve is flat.

All these differently shaped curves can, however, be reduced to a single curve by the simple device of plotting them on logarithmic paper. In Fig. 3 the curve corresponding to a single tuned circuit is the same as that of Fig. 2; if now the value of the coil magnification  $m$  be changed, the shape of this curve is unaltered; it is merely shifted bodily in a horizontal direction (to the right if  $m$  be decreased, to the left if  $m$  be increased).

Accordingly, if we copy the curve on a piece of tracing paper and slide the paper horizontally by the requisite amount in any particular case we can obtain immediately the resonance curve for *any* single tuned circuit.

## The Selectivity Number.

In order to decide where to put the tracing paper we must fix on some reference point on the resonance

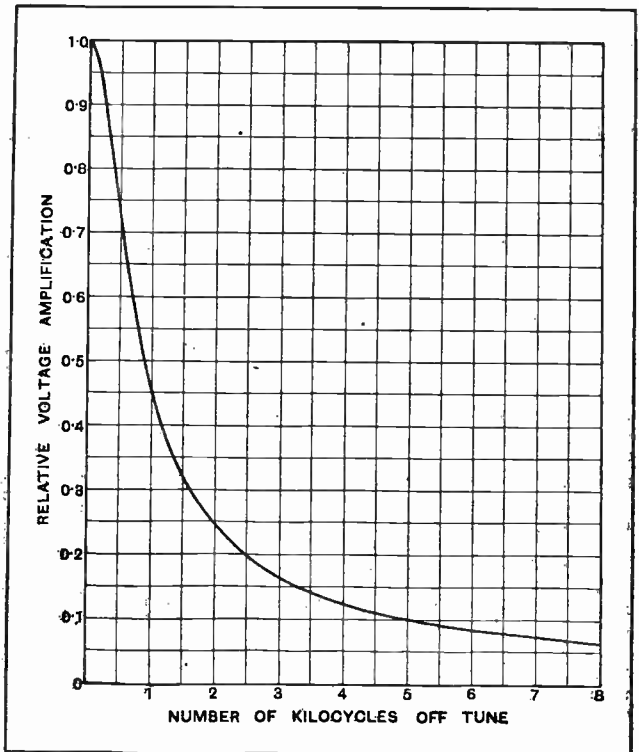


Fig. 2—Typical resonance curve for the single tuned circuit of Fig. 1.

**Selectivity in Plain Terms.**— curve; this point we will take to be the intersection of the curve with the cross-hatched horizontal line in Fig. 3, that is, the number of kilocycles by which the circuit must be detuned in order that the ordinate of the curve may fall to 0.1 of its value at resonance. In Fig. 3 this value is 5 kilocycles for all the curves.

The position of this reference point can be found by giving to the single tuned circuit in question a number, called the selectivity number (and this proposal is the kernel of the present article), so chosen that the following statement is true.

*The number of kilocycles by which a single tuned circuit must be detuned to cause the ordinate of the resonance curve to fall to 0.1 of its value at resonance is obtained by dividing the frequency of the carrier wave in kilocycles by the selectivity number.*

Thus, if the frequency of the incoming signal is 1,000 kc., and the selectivity number is 200, the resonance curve will cut the cross-hatched line in Fig. 3 at  $1,000/200 = 5$  kc.; this is the position actually shown.

It has already been stated that the position of this intersection depends only on the coil magnification  $m$ , so that the selectivity number must depend on  $m$ .

Actually the relation is very simple: it is shown in the Appendix that for a single tuned circuit the selectivity number is  $0.2 \times m$ : the example quoted above would consequently refer to a coil with  $m = 1,000$ , which is, of course, much larger than would obtain in a crystal set, where we may expect  $m$  to be about 10, and the selectivity number consequently to be  $0.2 \times 10 = 2$ , so that with a carrier wave of 1,000 kc., the intersection<sup>1</sup> lies at  $1,000/2 = 500$  kc.

<sup>1</sup>It should be noted that the resonance curves of Fig. 3 are reliable only up to an amount of detuning not exceeding 10% of the carrier frequency, and so in the example above, although the intersection can be displaced to 500 kc., the useful part of the displaced curve only extends to 100 kc.

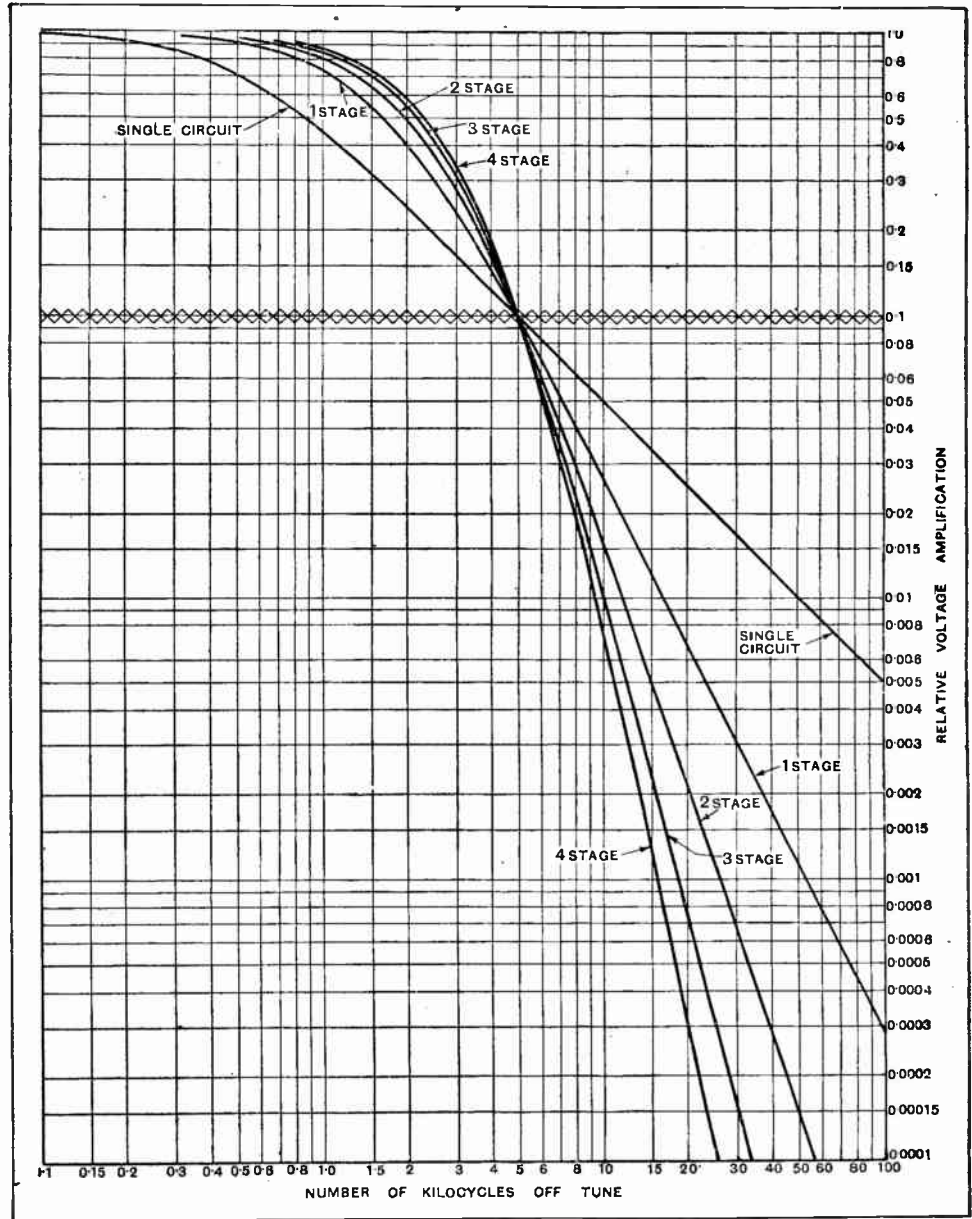


Fig. 3—Resonance curves plotted on a logarithmic scale. The shape of each curve is unaffected by changes in the value of the coil magnification, which only varies its position on a horizontal axis.

**Single-stage H.F. Amplifier.**

The single-valve H.F. amplifier shown in Fig. 4 (a) with tuned grid and plate circuits is equivalent to the scheme in Fig. 4 (b) where the equivalent grid circuit contains a series resistance  $R_1$ , including the aerial load, and the equivalent plate circuit contains a resistance  $R_2$ , including the load due to the valve resistance.

The resonance curve depends only on the coil magnifications of these two equivalent circuits, i.e.,  $m_1 = 2\pi L_1 f / R_1$ , and  $m_2 = 2\pi L_2 f / R_2$ , and, to a high degree of approximation, it depends only on the product  $m_1 m_2$ , provided that  $m_1$  does not exceed twice  $m_2$ , or vice versa.

**Selectivity in Plain Terms.—**

Thus if we draw the resonance curve for an amplifier whose equivalent grid and plate circuits have  $m_1 = m_2 = 100$ , then a different amplifier with  $m_1 = 71$ ,  $m_2 = 140$ , will give practically the same resonance curve, since in both cases  $m_1 m_2 = 10,000$ .

The resonance curve for one stage is given in Fig. 3 and, as in the case of a single circuit, its shape is invariable: it slides right or left as the product  $m_1 m_2$  changes.

The selectivity number is  $0.2 \times 3.33 \times \sqrt{m_1 m_2}$  as proved in the appendix: thus if the coil magnifications are 225 and 400, the selectivity number is 200, and with a carrier wave of 1,000 kc. the resonance curve cuts the cross-hatched line at  $1,000/200 = 5$  kc., as it actually does in Fig. 3.

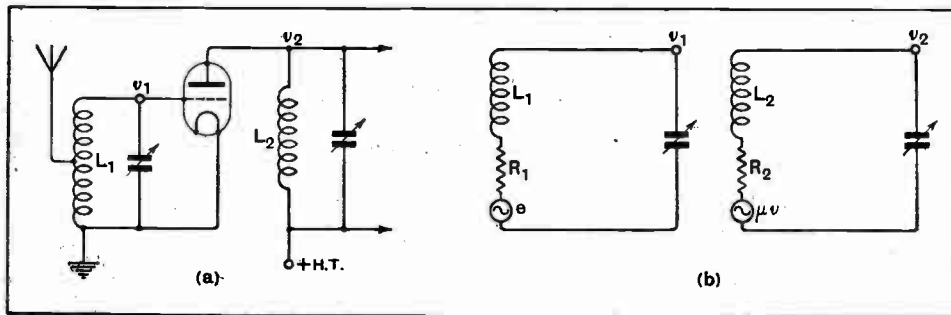


Fig. 4—Single-stage H.F. amplifier and equivalent H.F. circuits.

**Multi-stage H.F. Amplifier.**

Similar reasoning can be applied to H.F. amplifiers with more than one stage, and the results are given in the following table.

	Selectivity Number.
Crystal Circuit .. ..	$0.2 \times 1 \times m$
1 stage H.F. .. ..	$0.2 \times 3.33 \times [m_1 m_2]^{\frac{1}{2}}$
2 stages H.F. .. ..	$0.2 \times 5.24 \times [m_1 m_2 m_3]^{\frac{1}{2}}$
3 stages H.F. .. ..	$0.2 \times 6.80 \times [m_1 m_2 m_3 m_4]^{\frac{1}{2}}$
4 stages H.F. .. ..	$0.2 \times 8.13 \times [m_1 m_2 m_3 m_4 m_5]^{\frac{1}{2}}$

In this table a column of figures occurs which can be replaced by the consecutive odd numbers, 1, 3, 5, 7, 9, with an error not exceeding 11 percent., and this circumstance allows us to formulate a simple rule for calculating the selectivity number.

*Add the number of H.F. valves to the number of H.F. tuned circuits and multiply this sum by 0.2 times the geometric mean product of the coil magnifications. The result is the selectivity number.*

This statement, in conjunction with the preceding italicised statement, may be taken as a summary of this article.

**Uses of the Selectivity Number.**

Let us take as an example a set with two H.F. screen valves, followed by an anode bend detector, an outside aerial being used. If the tuning coils are wound with solid wire on  $2\frac{1}{2}$  in. formers and squeezed rather tightly into the screening boxes, the coil magnifications of the equivalent tuned circuits will be about 50 for the aerial

circuit, and 100 for each of the tuned anode circuits.

The geometric mean product of these figures is  $[50 \times 100 \times 100]^{\frac{1}{3}} = 100[0.5 \times 1 \times 1]^{\frac{1}{3}} = 80$  (approx.).

Hence the selectivity number is  $5 \times 0.2 \times 80 = 80$ .

When the set is tuned to a 1,600 kc. station the two-stage resonance curve in Fig. 3 must be displaced sideways till it intersects the cross-hatched line at 1,600/80 = 20 kc.

What about the quality of reproduction of this set? Inspection of the displaced curve shows that the relative voltage amplification at 10 kc. is 0.37, and 0.72 at 5 kc. Evidently the sidebands come through quite well, and the quality should be excellent.

Again if two stations 20 kc. apart are of equal strength at the receiver, one of them can be reduced to 0.1 of the strength of the other at the grid of the detector valve. This reduction is just sufficient to swamp the unwanted station.

If the stations are 47 kc. apart, one of them can be cut down to 0.01; hence even if it were originally ten times as strong as the other it can be swamped.

The same set made up with stranded wire coils in roomy screening boxes and provided with a frame aerial

might have the coil magnifications somewhere about the values  $m_1 = 250$ ,  $m_2 = 200$ ,  $m_3 = 200$ . The geometric mean of these is  $200[1.25 \times 1 \times 1]^{\frac{1}{3}} = 216$ .

Hence the selectivity number is  $5 \times 0.2 \times 216 = 216$ , and when the set is tuned to a 1,080 kc. station the intersection occurs at  $1,080/216 = 5$  kc. This is the position of the two-stage curve in Fig. 3.

The sidebands in this case are cut down drastically, and the reproduction is barely tolerable: the separation of stations, however, is good. If two stations are 56 kc. apart, one of them can be cut down to 0.0001 relative to the other, so that even if it were 1,000 times as strong as the other at the receiver it could be cut out.

Since the curves in Fig. 3 have a common point of intersection they refer to sets which have the same selectivity number, namely, (station kc.)/5, which may be taken as the limit of tolerable reproduction.

Tolerable reproduction is given by (station kc.)/10, and good reproduction by (station kc.)/20.

It should be possible for manufacturers to guarantee the selectivity numbers of their sets, and it is quite possible for amateurs to calculate the selectivity number before a set is constructed. All that is required is the coil magnification, i.e., the ratio of coil reactance to coil resistance, of each coil which forms part of a tuned circuit, taking into account the loading due to the aerial in the case of the first coil and that due to the preceding valve in the case of each subsequent coil.

These data are well known, and only require setting out in tabular form to be immediately useful to readers.



**Selectivity in Plain Terms.—**

One striking result follows from Fig. 3. Among a number of sets having equal selectivity numbers, and therefore intersecting the cross-hatched line at the same point, the set having the greatest number of tuned circuits gives the best reproduction and gives the sharpest separation of adjacent stations.

*Several poor coils give better results than a few good ones.* It may be that the realisation of high selectivity combined with good quality is to be found in the employment of a large number of H.F. stages with interstage H.F. transformers with a high step-up ratio to ensure stability.

**Appendix.**

The height of the resonance curve (Fig. 2) corresponding to a single tuned circuit (Fig. 1) is given by the expression

$$1/[1+4m^2 \cdot \delta f^2/f^2]^{\frac{1}{2}}$$

where  $m$  = coil magnification,

$\delta f$  = number of kilocycles off tune,

$f$  = frequency of carrier wave in kilocycles.

This expression is equal to 0.1 when  $m \cdot \delta f/f = 5$ .

Hence at this point on the curve  $f/\delta f = 0.2 \times m$ , and this is defined as the selectivity number.

For two tuned circuits (single-stage H.F. amplifier) the expression is

$$1/[1+4m_1^2 \cdot \delta f^2/f^2]^{\frac{1}{2}} [1+4m_2^2 \cdot \delta f^2/f^2]^{\frac{1}{2}}$$

where  $m_1, m_2$  are the coil magnifications.

This expression is equal to 0.1 when  $[m_1 m_2]^{\frac{1}{2}} \cdot \delta f/f = 1.5$  to within a few per cent., provided that neither  $m$  is more than double the other.

Hence the selectivity number  $= f/\delta f = 0.2 \times 3.33 \times [m_1 m_2]^{\frac{1}{2}}$ .

Similar results can be worked out for multi-stage H.F. amplifiers, and the results are given in the preceding table.

# MANCHESTER RADIO SHOW

## Guide to the Stands.

THE Home Secretary, the Rt. Hon. J. H. Clynes, will to-day open the sixth Manchester Wireless Exhibition, to be held in the City Hall under the auspices of the *Manchester Evening Chronicle*. Unlike its immediate forerunner at Olympia, the Manchester Show is not limited to manufacturers of any particular trade organisation, with the result that the City Hall contains many exhibits which were not shown in London, including apparatus of foreign manufacture. There will be altogether about 170 exhibitors, an increase of forty over last year, and this has necessitated some important structural additions which provide an additional 2,000 square feet of floor space.

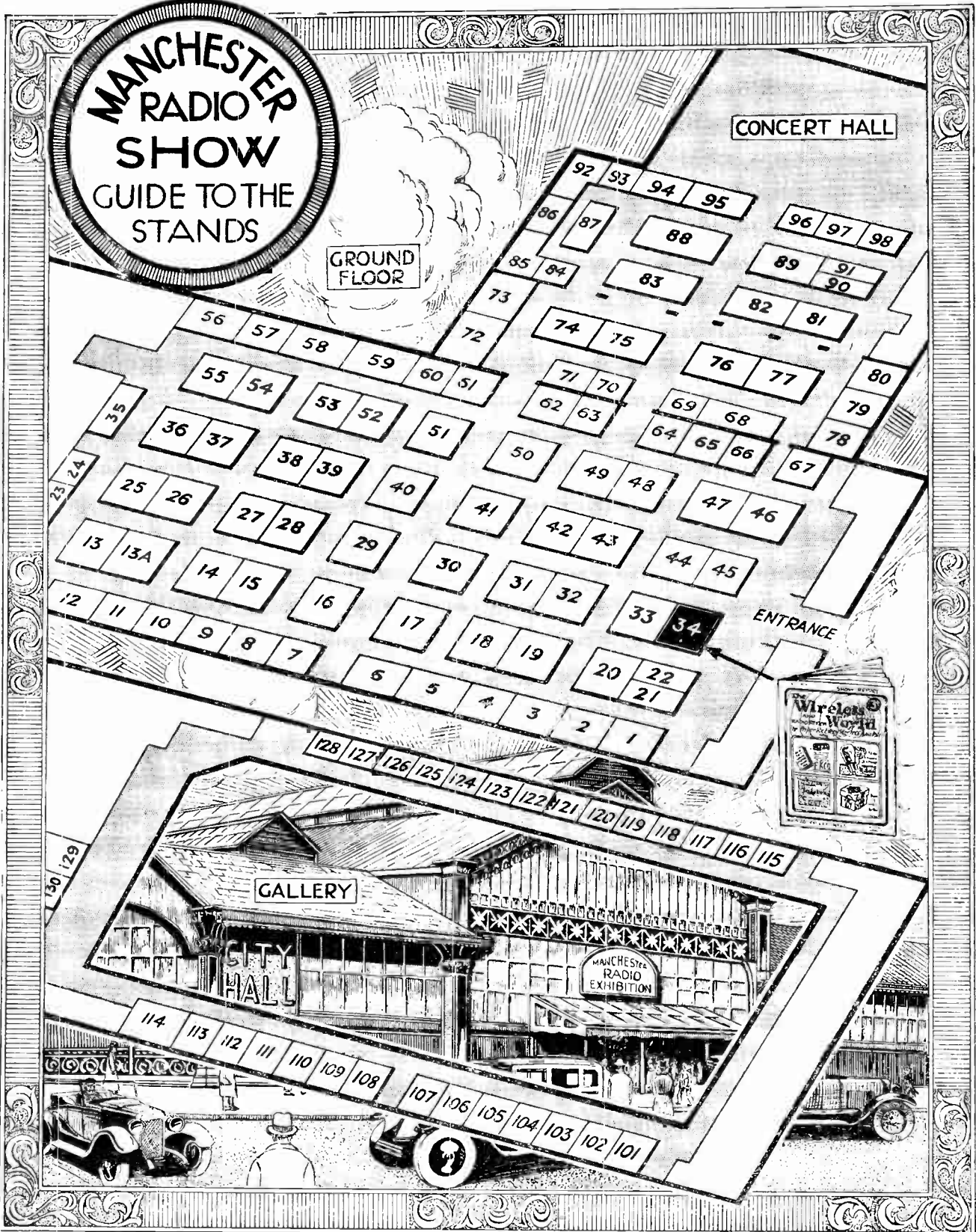
As in previous years, visitors will be able to hear various types of loud speakers working from a common amplifier constructed by Messrs. Ferranti, Ltd. An innovation this year is the provision of a number of soundproof cubicles to enable manufacturers to demonstrate their products without interruption.

Of special interest to amateur constructors will be the public tests of home-made apparatus entered for set building competitions.

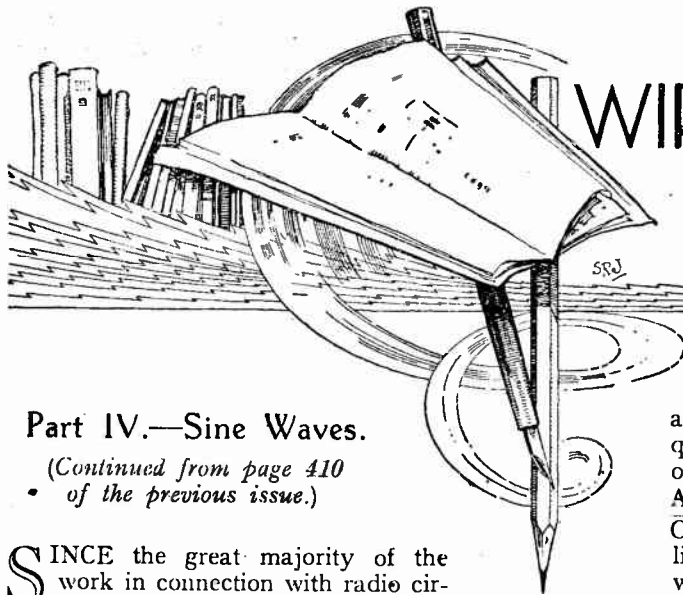
The Exhibition will remain open until Saturday, October 26th.

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HIND.



# WIRELESS THEORY SIMPLIFIED

By S. O. PEARSON, B.Sc., A.M.I.E.E.

## Part IV.—Sine Waves.

(Continued from page 410 of the previous issue.)

SINCE the great majority of the work in connection with radio circuits relates to alternating current phenomena we shall have a good deal to do with sine waves. It would be a very tedious process if we had actually to draw one or more sine waves every time we had a calculation to make, and fortunately this is not necessary. A sine wave of current or voltage can be represented by a simple straight line, and the method of doing this is explained below.

So far we have referred to a sine wave without giving any explanation as to its nature or how it can be drawn. The term "sine" is simply the name given to the ratio of two sides of a right-angled triangle. For instance, in Fig. 1 we have a right-angled triangle OAB in which the angle at O is denoted by  $\theta$  (Greek letter "theta"); the ratio of AB to OA is the sine of  $\theta$  or  $\sin\theta$ . The sine of  $\theta$  is the side opposite to the angle  $\theta$  divided by the side

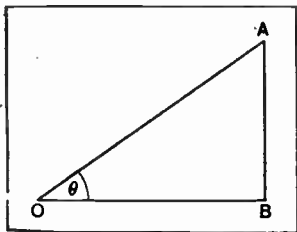


Fig. 1.—In the right-angled triangle OAB the sine of the angle  $\theta$  is  $\frac{AB}{OA}$

opposite to the right angle. In any right-angled triangle the side opposite to the right angle is the longest, so that the sine of an angle can never be greater than 1. When  $\theta$  is made nearly equal to  $90^\circ$ , OB becomes very short, and AB becomes very nearly equal to OA, and the sine becomes nearly equal to unity. The sine of  $90^\circ$  is actually equal to 1.

Now suppose that the side OA is of constant length and is slowly rotated about the end O in the opposite direction to that of the hands of a clock, i.e., anti-clockwise, so that the end A moves in a circle as shown in Fig. 2, the other two sides OB and AB remaining horizontal and vertical respectively. It will be seen that the angle  $\theta$  gets larger as the line OA pivots round and at the same time the length of the line AB is changing, increasing at first until OA becomes vertical,

and then decreasing again as OA moves over the second quadrant or quarter of the circle. Thus for each value of the angle  $\theta$  there is a definite value for the sine

$\frac{AB}{OA}$ . If we follow the line OA round step by step we get various values for AB, as shown by  $A_1B_1, A_2B_2, A_3B_3$ , etc., in the diagram. If the rotating line OA is made one inch long, the lengths in inches of  $A_1B_1, A_2B_2$ , etc., give the values of the sines of the corresponding angles.

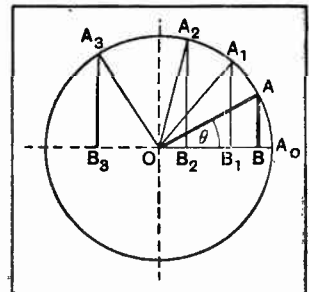


Fig. 2.—If the side OA of the right-angled triangle of Fig. 1 is rotated about O whilst the other two sides keep their original directions, the relationship between  $\theta$  and  $\sin\theta$  can be found for all values of  $\theta$

The sine reaches its maximum value when OA becomes vertical, being equal to 1, and begins to diminish again as OA passes through the second quarter of the circle. In the third and fourth quadrants AB falls below the horizontal line, and the sine has a negative value.

The connection between a rotating straight line or rotating vector, such as OA of Fig. 2 and a sine wave, is shown in the construction of Fig. 3. A circle is drawn and its circumference divided into, say, sixteen

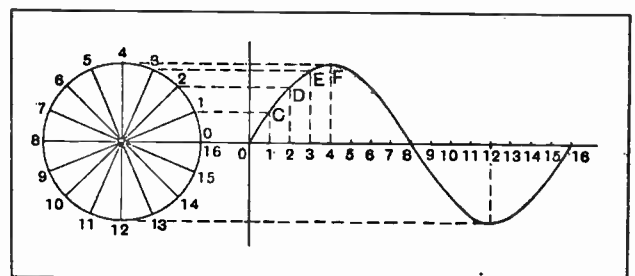


Fig. 3.—Showing how a sine wave can be projected from a circle. Both the circumference of the circle and the base line are divided into 16 equal parts.

equal parts, the sixteen radial lines representing the successive positions of the rotating line or vector. A horizontal line is then drawn through the centre of the circle and extended to the right. Starting from O,

**Wireless Theory Simplified.—**

sixteen equal divisions are measured off along this line and numbered as shown. If now a horizontal line through 1 on the circle is drawn to cut the vertical line through division 1 on the base line, the point of intersection, shown at C, gives a point on the sine wave being constructed. By proceeding in this way with the remainder of the corresponding pairs of numbers we obtain the points D, E, F, etc., which enable the sine wave to be traced.

**Explaining the R.M.S. Value.**

There are two things to be noticed regarding the relationship between the rotating vector and the sine curve constructed from it: (a) the maximum height of the sine curve is equal to the radius of the circle or the length of the vector; (b) one complete revolution of the vector corresponds to one complete sine wave—one positive and one negative half wave.

We have seen how a sine wave can be obtained from a straight line rotating about one end, and therefore if we have a sine wave to consider showing the relationship between any quantity and time, we can represent it by a straight line rotating continuously about one end with constant speed. For instance, if we have an alternating current whose maximum value is 10 amps. and whose frequency is 50 cycles per second, we can represent it by a straight line 10 cms. long rotating about

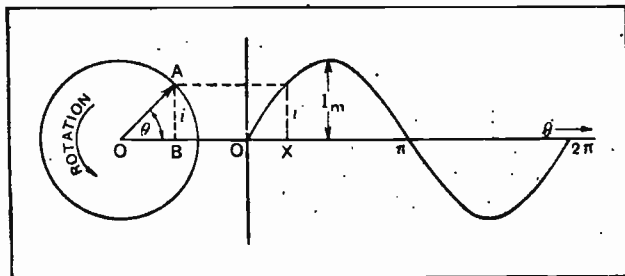


Fig. 4.—Showing how a sine wave of current can be represented by a rotating straight line OA.

one end at a speed of fifty revolutions per second. Actually on paper we draw it in one only of the positions which it is bound to pass through, and have to imagine the rotation—not a very difficult feat.

On the right-hand side of Fig. 4 is a sine wave of current whose maximum value or amplitude is  $I_m$  amperes. The rotating vector OA representing it is made equal in length to  $I_m$  to the same scale as that to which the wave is drawn. If the frequency of the current is  $f$  cycles per second, the vector is assumed to be rotating at a speed of  $f$  revolutions per second about one end. At the instant indicated by X, the current has a value of  $i = AB$  amperes. But  $\frac{AB}{OA} = \frac{i}{I_m} = \sin\theta$ . Therefore,  $i = I_m \sin\theta$ , or, in other words, the current is varying according to a sine law with respect to the angle  $\theta$ , which is increasing continuously with time.

It will be noticed how very frequently the number  $2\pi$  is met with in alternating current work. It is a very important number, and our simple rotating vector

enables us to see exactly how it originates. The circumference of a circle is 3.1416 times as long as the diameter, and this number is denoted by  $\pi$  (Greek letter "Pi"). Thus the circumference is  $2\pi$  times the radius. Now if we mark off on the circumference of a circle a length PQ equal to the radius as in Fig. 5, the angle POQ subtended at the centre is called *one radian*, and there are obviously  $2\pi$  radians in a complete circle of 360 degrees. Referring again to Fig. 4, the constantly increasing angle  $\theta$  which the vector OA makes with the horizontal line is measured in radians, and in order that the base of

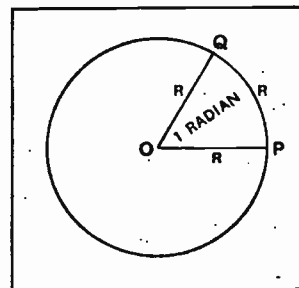


Fig. 5.—When PQ is equal to the radius of the circle the angle QOP is one radian.

the sine wave shall correspond this is scaled to represent the angle passed through by the vector instead of the time in seconds. Since the angle is exactly proportional to time it simply involves a different scale; in other words, the wave is plotted to an angle base instead of a time base as previously. Since one complete wave is represented by one complete revolution of the vector it follows that the base line of one complete wave corresponds to  $2\pi$  radians.

It was stated that when the frequency is  $f$  cycles per second the rotating vector makes  $f$  revolutions per second, and the vector therefore passes through  $2\pi f$  radians every second. Thus in  $t$  seconds after passing through the starting position the angle  $\theta$  will be  $2\pi ft$  radians, and therefore at any time  $t$  the value of the current is given  $i = I_m \sin 2\pi ft$  amps., where  $I_m$  is the maximum value, the effective or R.M.S. value being  $0.707 I_m$ .

**Two Alternating Currents in Phase.**

Two sine waves of equal frequency are said to be *in phase* if they are exactly in step, i.e., if they both pass

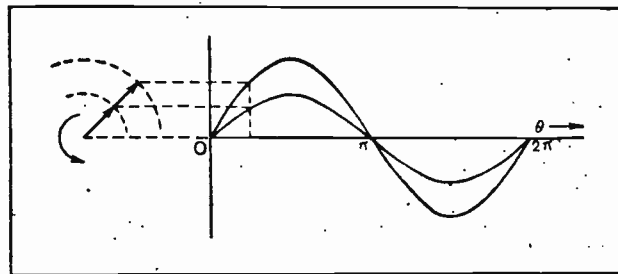


Fig. 6.—Two sine waves in phase with each other. The diagram shows that the vectors representing the two waves coincide with one another.

through their maximum positive values at the same instant. Two waves in phase are shown by the sine curves of Fig. 6, the waves having different amplitudes. Since each reaches its maximum value at the same instant it follows that the respective vectors representing them must pass through the vertical position simul-

**Wireless Theory Simplified.—**

aneously, and therefore must coincide with each other as shown on the left-hand side of the diagram. Their lengths may be simply added together to give the maximum value of the sum of the two currents.

**Sine Waves Out of Phase.**

It is only under special circumstances that we find sine waves exactly in phase in A.C. circuits. In the great majority of cases the two or more waves under consideration are out of step or *out of phase*. There is said to be a phase difference between them. In Fig. 7 are shown two sine waves which are out of step by exactly one quarter of a cycle—one of them passes through its zero value just as the other reaches its maximum value. It will be clear that the vector representing the one must be horizontal at the same instant as the vector representing the other is vertical, and so for two waves out of step by a quarter of a cycle, the respective vectors representing them are mutually at right angles. For this reason the two waves are said to be out of phase by an angle of 90°. Note that curve (1) reaches its maximum value before curve (2), and so curve-(2)

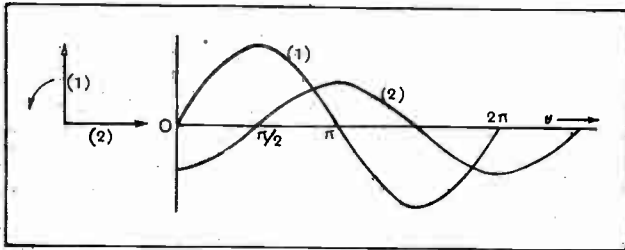


Fig. 7.—Showing two sine waves 90° out of phase. The vectors representing them are mutually at right angles.

is said to *lag behind* curve (1) by an angle of 90°. Also since the vectors are assumed to be rotating anti-clockwise, vector (2) is shown lagging behind vector (1) by 90°.

**Adding Currents which are Out of Phase.**

Suppose that we have two alternating currents  $I_1$  and  $I_2$  out of phase by 90°, and that we require to add them together to find the resultant. They cannot be

added numerically because they are out of step. Draw the two vectors  $OI_1$  and  $OI_2$  representing them, mutually

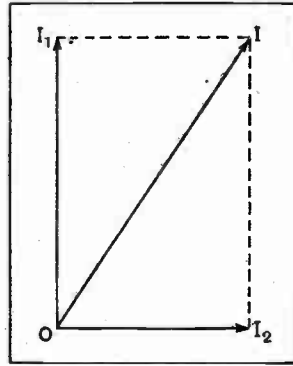


Fig. 8.—Showing how to add together two alternating currents which are out of step by a quarter of a cycle.

at right angles as shown in Fig. 8. Complete the rectangle  $OI_1 I_2$ . The diagonal  $OI$  gives the resultant both in magnitude and phase relationship to the others. This may be done to scale and  $OI$  measured, or by calculation, in which case the resultant current is given by  $I = \sqrt{I_1^2 + I_2^2}$  amps.

If the currents (or E.M.F.s) are out of phase by any other angle than 90° the same procedure is adopted, namely—draw the individual vectors to

scale at the correct angle to each other, complete the parallelogram and measure the diagonal.

As an example, suppose that two alternating E.M.F.s of 100 volts and 50 volts respectively are out of phase by an angle of 60° and are connected in series. Draw two lines mutually at 60° as in Fig. 9, making one 10 cms.

long and the other 5 cms., that is, to a scale of 1 cm. = 10 volts. Complete the parallelogram and measure the length of the diagonal which passes through the intersection of the original vectors at O. The length will be found to be about 13.2 cms., giving a resultant voltage of 132.

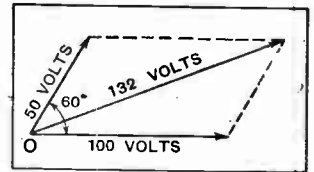


Fig. 9.—Addition of two voltages by the parallelogram method.

The value could be calculated, but the process is more complicated.

It is very important to remember that when adding up alternating currents or voltages the phase difference must always be taken into account by using the parallelogram method explained. Ordinary arithmetical addition does not give a true answer when the quantities to be added are out of step. (To be continued.)

**Club Season Begins.**

The return to G.M.T. has signalled the resumption of club activities all over the country. In the majority of cases programmes for the ensuing months have already been prepared, and it seems likely that the 1929-30 session will equal any of its predecessors in enthusiasm and useful work.

**A Seven-Year Record.**

An apology is due to the Hackney and District Radio Society in respect of the paragraph in our issue of September 18th, in which it was stated that the Society had "resumed its meetings." To the Hackney and District Radio Society belongs the distinction of having maintained its activities throughout the summer months, and meetings have, in fact, been held every week for seven years. An attractive programme has been prepared for the winter months, and full particulars can be obtained on application to Mr. G. W. Heath, Assistant Hon. Secretary, 61, Lauriston Road, Hackney, E.9.

**Edinburgh Society's New Headquarters.**

The Edinburgh and District Radio Society now has new headquarters at 46, Royal Terrace, and

**CLUB NEWS.**

meetings will be held every Wednesday during the winter months at 8 p.m. Full particulars can be obtained from the Hon. Secretary, Mr. E. I. Robertson, 10, Richmond Terrace, Edinburgh.

**Institute of Wireless Technology.**

The Annual General Meeting of the Institute of Wireless Technology was held on Wednesday last, October 9th, at the Engineers' Club, Coventry Street, London, W. All interested in the activities of the Institute are invited to communicate with the Hon. Secretary, at 71, Kingsway, London, W.C.2.

**Bringing Olympia to Birmingham.**

Members of Slade Radio (Birmingham) who were unable to visit the Olympia Wireless Exhibition were specially catered for in an interesting summing-up of the Exhibition given by Mr. A. Freeman at a recent meeting. Demonstrations

were given of various kinds of apparatus which were on view at Olympia.

The Society will hold its fourth Whist Drive and Dance on October 23rd. On October 24th a lecture on battery eliminators and mains receivers will be given by Mr. Ingham, of Messrs. Clarke and Co. (Manchester), Ltd. Details of these and other activities of the Society may be obtained from the Hon. Secretary, "Enville," Warren Road, Erdington.

**Newcastle-upon-Tyne Radio Society.**

The Annual General Meeting of the Newcastle-upon-Tyne Radio Society was held in the English Lecture Room, Armstrong College, on October 7th, when the forthcoming lectures of the society were discussed.

Hon. Secretary, Mr. W. W. Pope, 7, Kimberley Gardens, Jesmond, Newcastle-upon-Tyne.

**Lectures for Beginners.**

Weekly lectures specially for beginners are a feature of the syllabus at the Woolman Radio Society. Meetings are held every Friday at the John Woolman Settlement, 28, Ducaan Terrace, London, N.1. Hon. Secretary, Mr. E. Dart, 86, Hampden Road, Hornsey, N.8.



By Our Special Correspondent.

### Transatlantic Relay Rivalry.—Prague Plan Fears.—5GB's Wavelength.

#### A Postponement.

For certain domestic reasons, the B.B.C. has decided that the high-power station at Brookman's Park shall not "take over" entirely from the Oxford Street transmitter until Monday next, October 21st, a week later than was originally announced.

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#### Free Transmitters for All.

From the Savoy Hill letter-bag:—  
"I have a small crystal set and should like a Brookman transmitter, which on my wireless this evening you say is given free of charge."

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#### Satanic Interruptions.

Interference with the morning religious service from Daventry has been traced to the Devil's Point station (GYO), Plymouth.

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#### A Spaced-Aerial Triumph.

Although the solder on the receiving set had scarcely hardened, the new Tatsfield station of the B.B.C. played a distinguished part in the reception and relaying of the running commentary on the Prime Minister's arrival in New York. Two American short-wavers were picked up, viz., 2XAD (19.56 metres) and 2XK (17.34), which are both at Schenectady.

The Tatsfield station is not yet fully equipped (two of the short-wave receivers have still to be completed), and for this reason the relay was also undertaken by the spaced-aerial receiving plant at Tarling, near Chelmsford, so that both receivers sent signals to the Savoy Hill control room. I am told that the spaced-aerial method has recently been giving a good account of itself.

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#### Tarling versus Tatsfield.

It will be remembered that the idea of spacing aeriols at intervals over several miles arose out of conversations between Captain Eckersley and Dr. Goldsmith, of the National Broadcasting Company of America, when Transatlantic relays were discussed two years ago. Then, to a greater extent than now, fading was the great obstacle to Transatlantic programmes, and it was with the object of obtaining constancy of aerial input that the experiment was tried of feeding one receiver from a number of widely separ-

ated aeriols, which would not all be subjected to fading at the same moment.

The success of the latest relay shows that the experiment may justify the large expenditure necessary to erect such an elaborate system. But I have no doubt that Tatsfield, when once it is in full working order, will have something to say about this.

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#### Is the Prague Plan Good Enough?

Even if it failed as a Transatlantic relay station—and there is nothing to suggest such a possibility—the Tatsfield station would still be fully employed as the B.B.C.'s ether sleuth. More and more the B.B.C. engineers are coming to rely upon the periodical reports from the official receiving station regarding European transmitters which stray from their allotted frequencies under the Prague Plan. During the past fortnight heterodyne troubles have been growing all over Europe, and a significant feature is that in not every case is this due to departure from the allotted frequency.

Savoy Hill is beginning to fear that the separation of 9 kilocycles between transmitters is insufficient during the winter months.

#### FUTURE FEATURES.

##### London and Daventry.

OCTOBER 21ST.—"Point of View (4), by Mr. H. G. Wells.

OCTOBER 25TH.—Orchestral Concert from the Queen's Hall.

OCTOBER 26TH.—Old-time Vaudeville Programme.

##### Daventry Experimental (5GB).

OCTOBER 22ND.—"The Monkey's Paw," a story by W. W. Jacobs, dramatised by Louis N. Parker.

OCTOBER 24TH.—An Edward German Programme.

##### Cardiff.

OCTOBER 22ND.—"Sixty Years of Song," a programme in memory of Fred E. Weatherly.

##### Manchester.

OCTOBER 24TH.—A Musical Comedy Programme.

##### Glasgow.

OCTOBER 22ND.—A Jacobite Concert.

OCTOBER 26TH.—Running Commentary on Wales v. Scotland International Association Football Match.

##### Belfast.

OCTOBER 24TH.—"The Faithful Sentinel," an opera, music by Franz Schubert.

#### Another B.B.C. Pamphlet.

So many complaints have been received at headquarters regarding interference from Continental stations that the Technical Correspondence Department is seriously considering the preparation of yet another pamphlet, which will tell the listener all he wants to know about heterodyning, and probably a good deal more.

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#### New Wavelength for 5GB?

Owing to continued interference by Langenberg, it is rumoured that Daventry 5GB may shortly change its wavelength from 479.2 to 398.5 metres. Such a step would increase the troubles of southern listeners, who already experience difficulty in cutting out Brookman's Park when receiving the alternative programme, and it is to be hoped that 5GB's wavelength change will be deferred until the regional station is sending out twin transmissions.

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#### On Armistice Day.

The Cenotaph service will be relayed to listeners on Armistice Day, the transmission being almost exactly the same as last year. All B.B.C. stations will participate, including 5GB and 5SW.

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#### A Happy Ending.

An idea is prevalent that the majority of Russian plays are of an unhappy character; in contrast to that view, a play entitled "Michael," which 5GB listeners will hear on October 29, ends on a note of triumph.

"Michael" is a play in three scenes by Miles Malleson; it is an adaptation of Leo Tolstoy's tale, "What Men Live By." The incidental music is by Norman O'Neill.

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#### Running Commentary: New Style.

A change from the ordinary running commentary will be broadcast from 2LO, 5XX, throughout the Northern Region and from other stations on Saturday next, October 19. It will be a humorous description by L. T. Whipp, the Lancashire dialect entertainer, of the military band contest which is taking place on that day at Belle Vue, Manchester.

Following Mr. Whipp's efforts, a performance by the winning band will be broadcast.

# LABORATORY TESTS.

A Review of Manufacturers' Recent Products.

## KESTER SOLDER.

Soldering and its indispensable partner, soldering paste, play an important part in the construction of a wireless set. This, however, is one only of the multitudinous uses to which it is put to-day. Many schemes to render soldering easy have



Kester rosin-core solder for wireless use. The illustration shows a 4-oz. tin.

been devised, and one of the latest is the Kester method. Kester radio solder consists of a hollow tube of genuine tin and lead filled with a non-corrosive rosin flux, and can be used to solder the most delicate wires with safety.

This is sold in 4oz. tins at 1s. 6d. for set constructors' use, and in 1lb. spools, at 3s. 4d. per spool, for those requiring larger quantities.

An acid core solder for general domestic use, but not recommended for wireless purposes, is available in 1lb. spools at 3s. 4d. each.

Supplies can be obtained from the Rothermel Corporation, Ltd., 24 and 26, Maddox Street, Regent Street, London, W.1.

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## VEE-CEE DRY BATTERY.

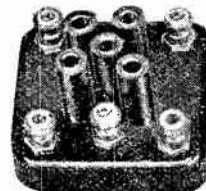
These batteries are made by the Vee-Cee Dry Cell Company (1927), Ltd., 5, Queensway, Ponders End, Middlesex. The sample submitted for test was a standard capacity size, rated at 66 volts, and sells at 7s. 6d. It was decided that about 8 mA would be the normal discharge rate of a battery of this size, so the discharge was commenced at just over 10 mA, which would assure a current of this order after the initial voltage drop.

The terminal voltage at the commencement of the test was 76 volts, but this

fell rapidly during the first few hours and soon reached a more steady state at 60 volts. However, this was maintained for about 40 hours only, after which the voltage dropped steadily until the battery was exhausted. There was a slight recovery after 280 hours' discharge, and for the next 200 hours the voltage was maintained at a fair level. It would appear from an examination of the discharge curve that the initial current was on the high side for a battery of this size, and a better performance would have resulted if this had been reduced to between 6 and 8 mA.

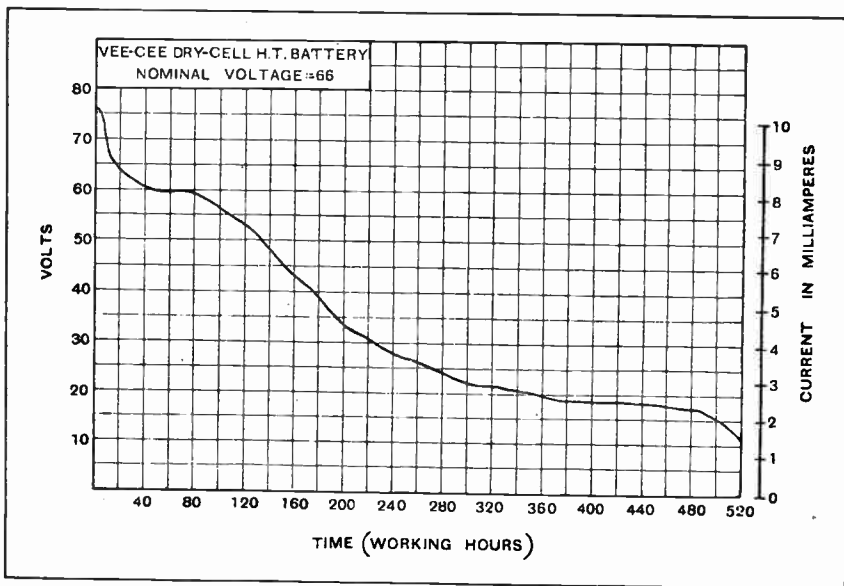
The useful life of this particular battery at a discharge of the order of 8 mA would appear to be about 200 working hours, but this figure would be doubled, probably, by limiting the current taken to about 6 mA. Many other sizes of these batteries are available, all having the same capacity, however. A 108-volt size

from the others; these are encased in black material. Five small terminals are fitted, four being marked, but the fifth, which connects with the centre socket, is



"Trix" A.C. valve holder for the new 5-pin A.C. valves.

not distinguished by any particular marking. The makers are Messrs. Eric J. Lever (Trix), Ltd., 8-9, Clerkenwell Green, London, E.C.1, and the price is 1s. 3d.



Discharge curve of the "Vee-Cee" 66-volt H.T. dry cell battery.

costs 12s. 6d., and the 120-volt model 14s. 6d. Grid batteries, 9 volt size, are marketed at 1s. 3d.

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## "TRIX" A.C. VALVE HOLDER.

This valve holder has been designed for the new 5-pin A.C. valves which have recently appeared on the market. It is of the rigid type and consists of a moulded base carrying five insulated pillars with brass insets. Four of these are spaced as in the familiar 4-pin type, the extra socket being placed in the centre. The valve holder is, therefore, of universal application, since it can be used with either the new or the old type of valve fitted with base pins.

The insulating sleeve on the anode socket is coloured red to distinguish it

## Catalogues Received.

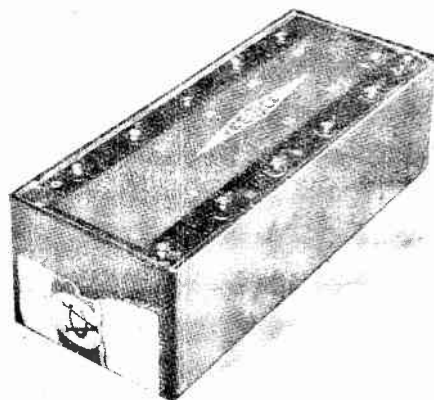
Messrs. Lissen, Ltd., Lissenium Works, Friars Lane, Richmond, Surrey.—Illustrated folders dealing with radio-gramophone sets, portable receivers, the Lissenola three-valve cabinet receiver and new season Lissen components.

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The Peto-Scott Co., Ltd., 77, City Road, London, E.C.1.—Illustrated catalogue of proprietary receivers available under the convenient purchase system arranged by this company.

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Messrs. Wright and Weave, Ltd., 740, High Road, Tottenham, London, N.17.—Illustrated folder describing some new Wearite components.



"Vee-Cee" dry cell battery; 66 volts nominal.



READERS' PROBLEMS.

"The Wireless World" Supplies a Free Service of Technical Information.

The Service is subject to the rules of the Department, which are printed below; these must be strictly enforced, in the interest of readers themselves. A selection of queries of general interest is dealt with below, in some cases at greater length than would be possible in a letter.

**Saving the Batteries.**

In order to reduce the risk of leaving my set switched on all night I should like to fit a warning lamp; will you please tell me how it should be connected? The set is a commercial product, and I do not know its precise circuit arrangement, but imagine that it should be an easy matter to add the lamp.

M. K. W.

The fitting of a lamp to indicate when the filaments are switched on is the simplest possible operation. Having obtained a lamp—a type having a low current consumption should be chosen—and a suitable holder, all you have to do is to wire it directly across the filament terminals of any convenient valveholder in the receiver.

If your set has provision for gramophone reproduction arranged in such a way that the H.F. valve is automatically switched off, you must take the precaution of seeing that the lamp is operative when the gramophone pick-up is in use.

**An Indoor Aerial Set.**

Can you refer me to any published description of a receiver designed specifically for use with an indoor aerial?

J. S. P.

It is correct to say that there is no basic difference between a receiver designed for working with a very short aerial and one intended for operation with a collector of the full 100ft. length allowed by the Post Office regulations.

Generally speaking, any of the sets described in this journal are suitable for short aerials; naturally, the more sensitive receivers give better results.

It may be added that where aperiodic aerial coupling or a separately tuned aerial is employed it is generally advised that the aerial connection should be made directly to the grid of the first H.F. valve.

**Screening Unnecessary.**

I am building a set on the lines of the "Kilo-Mag Four," but with two L.F. stages. Provided all the apparatus associated with the H.F. amplifier and the detector valve is adequately screened, will it be necessary to mount the L.F. portion in a metal box?

C. N. A.

This precaution will be quite unnecessary if the H.F. component in the de-

torator anode circuit is adequately disposed of, and if matters are so arranged that it cannot cause instability through interaction with the input end of the set.

**An Extra Tuned Circuit for the "Everyman Four."**

My set is an "Everyman Four" constructed in accordance with the instructions given in the revised booklet. With a view to increasing its selectivity still further, I should like to add a loose-coupled and separately tuned aerial circuit, which, it is noted, is included in a number of modern sets.

Will you please tell me if this scheme is practicable, and if so, give me a hint as to how I should proceed?

A. C. P.

This set lends itself very readily to your proposed alteration; additions to the present wiring will be made clear, if you consider the circuit diagram given in Fig. 1.

The existing aerial connections on the primary of the aerial-grid transformer should be ignored, and an extra tapping will be made at approximately the second

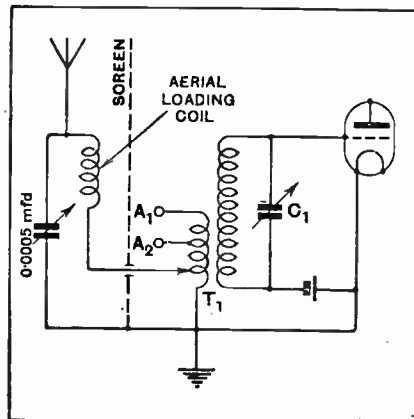


Fig. 1.—Aerial-grid circuit of the "Everyman Four" receiver modified by the addition of a separately tuned aerial.

turn from the earthed end of the primary. If the selectivity afforded by this connection is insufficient, it will be necessary to join the loaded aerial to a point still nearer the earthed end.

Needless to say, this extra circuit will not be operative on the long-wave band.

**RULES.**

(1.) Only one question (which must deal with a single specific point) can be answered. Letters must be concisely worded and headed "Information Department."

(2.) Queries must be written on one side of the paper, and diagrams drawn on a separate sheet. A self-addressed stamped envelope must be enclosed for postal reply.

(3.) Designs or circuit diagrams for complete receivers cannot be given; under present-day conditions justice cannot be done to questions of this kind in the course of a letter.

(4.) Practical wiring plans cannot be supplied or considered.

(5.) Designs for components such as L.F. chokes, power transformers, etc., cannot be supplied.

(6.) Queries arising from the construction or operation of receivers must be confined to constructional sets described in "The Wireless World" or to standard manufacturers' receivers.

Readers desiring information on matters beyond the scope of the Information Department are invited to submit suggestions regarding subjects to be treated in future articles or paragraphs.

**Changing Conditions.**

Although the selectivity of my "Megavox" receiver is quite adequate for present requirements, I anticipate that it will be necessary to improve it in this respect in the near future. Have you published any information dealing with this problem?

T. M. S.

We think that we cannot do better than refer you to the "Readers' Problems" section of our issue for May 8th, where a modified arrangement of the aerial circuit of this receiver was suggested.

If you do not wish to make any internal alterations, we would suggest that you should study carefully the article on wave traps and absorption circuits which appeared in the issue of October 2nd.

**Ample H.T. Voltage.**

I have an H.T. eliminator with a rated maximum output of 120 volts. Would this be suitable for use with the "Record III" receiver? D. R. S.

Good results would be attainable with an H.T. pressure of about 120 volts, but the performance of the set would be considerably improved by increasing this up to, say, 150 volts. The published figures with regard to measured H.F. amplification were obtained with the full rated voltage applied to the H.F. valve anode.

### Pick-up Connections for the "Foreign Listeners' Four."

*Will you please tell me if it is possible to fit a pick-up to "Foreign Listeners' Four"? If it can be arranged, I should like to retain the feature of "free" grid bias, although if this is inconvenient, I should not object to a bias battery when the set is being used for gramophone reproduction.*

E. N. B.

There is little difficulty in retaining the free grid bias feature when operating this set with a pick-up. We suggest that the detector grid circuit should be connected in the manner shown in Fig. 2, from which you will see that a small resistance is inserted in the detector cathode lead, as in the case of the remaining valves of

receiver with transformer-coupled H.F. amplifier and anode bend detector, resistance-coupled to a pentode. A choke-filter device is included. Now, a circuit of this kind is inherently immune from low-frequency interaction troubles, even without the decoupling devices included in the detector anode circuit, and we feel certain that the trouble really lies in the H.F. end of the receiver. It would appear that high-frequency oscillation is produced as the circuits are brought into tune; this may be due either to insufficient screening, or merely to the fact that attempts are being made to attain a greater stage magnification than the valve is capable of yielding.

We think it would be advisable to test the leak resistance associated with the

of batteries, and with this form of supply you could ascertain fairly conclusively whether there is a fault in the set by noting whether the interference persists when aerial and earth are removed.

It may be added that in cases of this sort we are always inclined to suspect grid biasing batteries, inductive windings, such as chokes, and more particularly L.F. transformer primaries.

o o o o

### An Inevitable Earth.

*I am told that when using D.C. mains for H.T. supply it is possible to earth the receiver through the mains. Will you tell me how this may be done?*

C. S.

It is inevitable that any set deriving its H.T. supply from D.C. mains should be earthed, as without exception public supply mains are connected to earth at the generating station. There is no need for any extra connection, and, although the normal earth terminal of the receiver is left free there will still be an "earth."

It should be pointed out, however, that this form of earthing is not highly effective, and as a general rule another connection is advised.

o o o o

### Free Grid Bias Scheme.

*I am thinking of building the "Flat Dwellers' A.C. Three," but should like to include the scheme of "free" grid bias included in the "Foreign Listeners' Four." Is there any reason why this should not be successful?*

D. R. L.

As far as the H.F. and output valves are concerned, it would be quite easy to arrange for free grid bias by inserting resistances in the cathode leads, but it would be almost impossible to apply this simple method to the detector, which, as you will realise, is arranged to work on the anode bend principle.

If you are particularly anxious to proceed with your scheme, we suggest that bias for the detector could best be taken from a resistance inserted in some part of the circuit where current flow is fairly heavy, and not from one of the circuits associated only with this valve itself.

o o o o

### Where the Frame Aerial Fails.

*Can it always be assumed that a frame aerial set will be more selective than one with an open aerial? I am considering the design of a new receiver, and, in view of the proximity of Brookman's Park, am wondering which form of collector will be the more suitable.*

J. W. J.

A good deal depends on the purpose for which the set is intended. If it is desired to receive only the two projected alternative transmissions from Brookman's Park, then it may be stated definitely that the frame will contribute nothing towards real over-all selectivity; both stations are on the same site, and its directional properties will serve no useful purpose. If, or the other hand, the reception of other and more distant stations is needed, it will be of the greatest advantage.

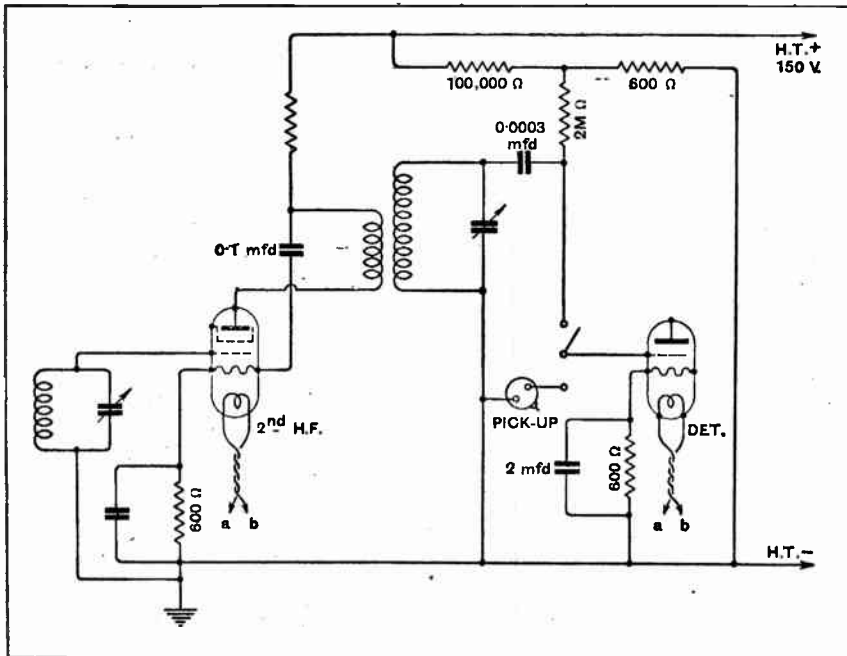


Fig. 2.—Method of inserting a pick-up in the detector grid circuit of the "Foreign Listeners' Four." Reference lettering corresponds with that of the original circuit diagram.

the set. When the switch is in the "detector" position, the grid is not affected by the potential difference existing across the biasing resistance, as the grid condenser acts as an effective insulator, and the operating conditions of the valve are exactly as before.

For the sake of completeness, we show the grid circuit of the second H.F. amplifier, in order that you may compare the method adopted in providing for the biasing of this valve.

o o o o

### On the H.F. Side.

*Will you please examine the enclosed circuit diagram of my receiver and tell me what is wrong with its L.F. amplifier? When the H.T. battery is connected, violent motor-boating is produced when the circuits are brought into tune.*

R. D. G.

The circuit diagram submitted by our correspondent represents a three-valve re-

ceiver with transformer-coupled H.F. amplifier and anode bend detector, resistance-coupled to a pentode. A choke-filter device is included. Now, a circuit of this kind is inherently immune from low-frequency interaction troubles, even without the decoupling devices included in the detector anode circuit, and we feel certain that the trouble really lies in the H.F. end of the receiver. It would appear that high-frequency oscillation is produced as the circuits are brought into tune; this may be due either to insufficient screening, or merely to the fact that attempts are being made to attain a greater stage magnification than the valve is capable of yielding.

o o o o

### External Interference or Internal Fault?

*I am troubled by an intermittent crackling noise from my loud speaker which sometimes lasts for as long as ten minutes, and then suddenly ceases. Can you tell me whether this is due to the receiver, to the eliminator, or to interference from power circuits?*

H. B. B.

From the information given we feel that it is quite impossible to offer a definite opinion, although we are inclined to think that the trouble is due to interference from outside sources.

It would probably be easy enough for you to prove whether the eliminator is at fault by temporarily substituting a set

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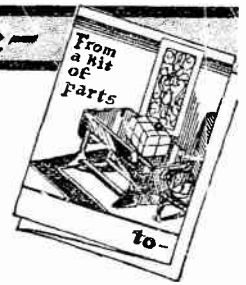
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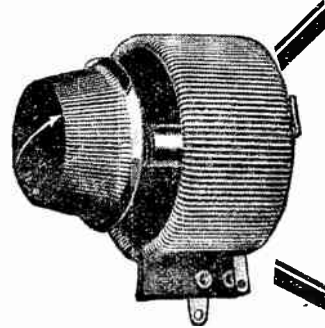
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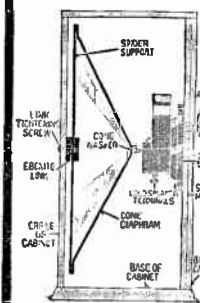
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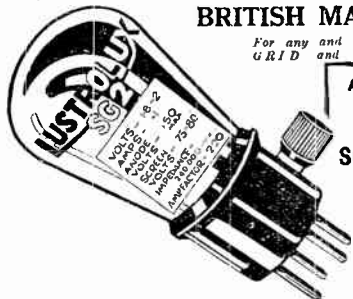
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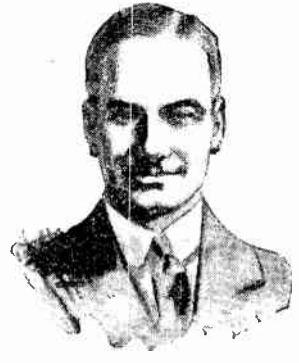
**3-VALVE** American Superhet, by Silver Marshall, in mahogany pedestal cabinet, D.U. eliminator, Magox moving coil speaker, and electric gramophone, amplifier, in mahogany pedestal cabinet; bargain.—Smithers, 19, Hanover Terrace Mews, Regent's Park, W.1. [6685]

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**PENTODE** Users.—Write for details of new size self-charging wet battery; 20,000 millamps, 6d. per volt; illustrated catalogue giving data, post free.—U. Taylor, 57, Studley Rd., Stockwell, London. [0273]

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**TANTALUM** Electrode Strips for H.T. Rectifiers, suitable for A.C. mains eliminators; 2d. each, or set of 8, 1/-.—1-7, Dalton St., West Norwood, S.W.2. [0308]

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**PHILLIPSON'S** Safety Eliminators Give Consistent Results.

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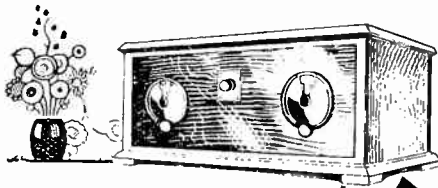
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**PHILLIPSON'S** Safety Eliminators are the Cheapest to Install, and the cheapest to run; prices: Model A.O.5, £4/17/6; A.C.7, £3/17/6; complete with full wave rectifiers; model D.C.A., 3/7/6; D.C.5, 4/5/.

**PHILLIPSON'S** Safety Eliminators are Described and Illustrated in our Booklet "Radio Power." Have you had your copy?—Write to-day to PHILLIPSON'S and Co., Ltd., Radio Engineers, Astley Bridge, Bolton. 'Phone: 2038. 'Grams: Safety, Bolton. Est. over 50 years. [0318]

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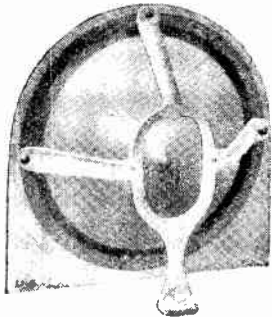
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Just mount the Loudspeaker Unit in this W.B. Chassis. That's all you have to do. Now you have a Speaker which gives full volume and sweet tone. The complete Speaker costs only 23/-.

W.B. Chassis (any Unit will fit)  
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**C.E.C.O. Eliminators Incorporate**

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**20-MILLIAMP Model; 75/-** [6721]

**WESTINGHOUSE Metal Rectifier, A3, as brand** new; 18/6.—King, 117, Thimble-mill Rd., Smethwick. [6707]

**RECTIFIERS.—Two B.T.H. input, 200-250 volts,** 50 periods, complete valves, fuse, crystalline cover, 1 output, 200 volts, 100 milliamps, £3/5; 1 output, 200 volts, 50 milliamps, £2/5, guaranteed perfect.—Bramhall, 53, Braunston St., Birmingham. [6686]

**WESTINGHOUSE Metal Rectifier, H.T.1, new,** £2/18; Ferranti transformer, mains, 220-230 volts, type E.M.1, new, 28/-; for use with H.T.1.—Wright, 13, Ealdham Sq., Eitham, London. [6662]

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## USE

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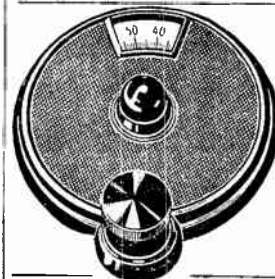
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**BABY JUNIOR**  
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In Black or Brown.

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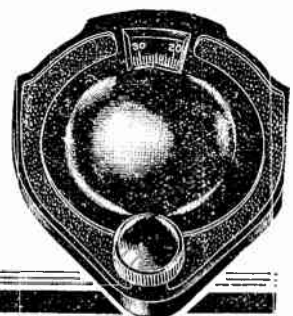
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In Black or Matt'd Mahogany.

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Sole Distributors for "Iso" Products, Condensers, Transformers, Chokes, Couplers, Trickle Chargers, Eliminators, etc.





**Chargers and Eliminators.—Contd.**

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**A.C. Complete Mains Equipment**, separate H.T. and L.T. supply for L.S.S.A.s (400v. 160m.A.), A.C. valves, and low voltage moving coil or accumulator: £12, or offer; after 8.—71, Burbage Rd., Heine Hill, S.E.24. [6949]

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**"WIRELESS WORLD" Metal Cabinets**, finest value offered, new Kilo Mag and Record III, with base, 45/-; cabinet for "Wireless World" kit, as above, 35/-. See advert. under Coils.—Stott. [6540]

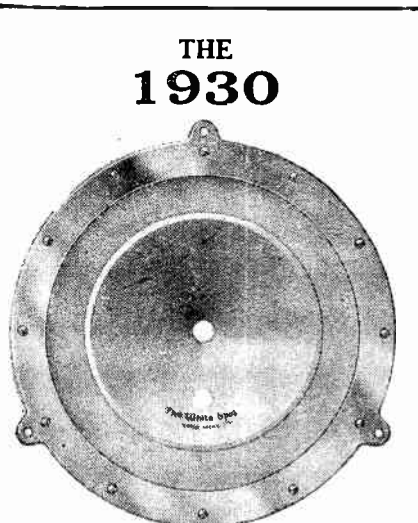
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**WHITE SPOT CHASSIS**

is fitted with a fabric suspended cone which gives a marked improvement in tone.

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**SPARE DIAPHRAGMS.**

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**RECORD III Coils**, 44/-; new Kilo-mag four 40/-; S.G. Regional, 37/6.—Radiograph.  
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**COLVERN Dual Range Coils**, types UV, DSP; bargain, 17/6 pair.—Lewis, 158, Fawcett Rd., Southsea. [6587]

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**EPOCH.**

**EPOCH**.—See the new range of Epoch A.C. mains transformers. [6459]

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**NEW Kilo Mag Coils**, full set, 27/6 only; metal cabinets as specified, 45/-.—Stott.

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**T.**W.L. Wendover, writes: It may interest you to know that I am using a Goodman's chassis, and everyone marvels at the reproduction.

**I**LLUSTRATED Lists Post Free from Goodman's, 27, Farringdon St., London, E.C.4. [0066

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**S**QUIRE Moving Coil Speaker for Sale, worked from 6 volt accumulator in octagonal fireproof cabinet, £5/10; also Master Three set, £3.—Apply B.M.40, Norman Avenue, Wood Green, London. [6600

**B**BROWN Q Loud-speaker, purchased only short time; absolute bargain, £8/5.—60, Sherburn Terrace, Consett. [6612

**W**ESTERN ELECTRIC Kone Loud-speaker, £6/6 model, un-ed; £3.—E. Edwards, 15, Achilles Rd., W. Hampstead, London, N.W.6. [6628

**Y**OUR Old Loud-speaker Taken in Part Payment for the Latest Type; see our advert. under column Receivers for Sale.—Scientific Development Co., 51, Fishergate, Preston. [0227

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**E**POCH.—Any responsible house-holder can obtain any type Epoch moving coil speaker by easy terms; no references, no interest. Particulars from Mr. Laserson, 110, Cannon St., E.C.4. [5518

**A**MPHION Lion Chassis, cost £6, unopened and as brand new; accept £4.—Reynolds, 23, Grange Rd., netwick, Staffs. [6652

**W**HIS is the Webson B.S.7 Moving Coil Loud-speaker used as a standard in the principal laboratories in the wireless trade?

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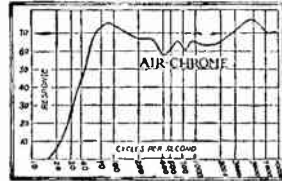
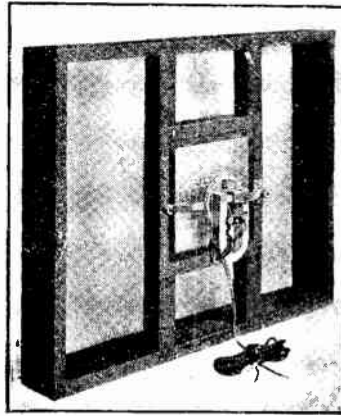
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P & T

**Loud-speakers.—Contd.**

**B**  
**A**  
**K**  
**E**  
**R**

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**S**  
**E**  
**L**  
**H**  
**U**  
**R**  
**S**

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**R**  
**A**  
**D**  
**I**

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**M**  
**O**  
**V**  
**I**  
**N**

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**C**  
**O**  
**I**  
**L**

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**S**  
**P**  
**E**  
**A**  
**K**  
**E**  
**R**

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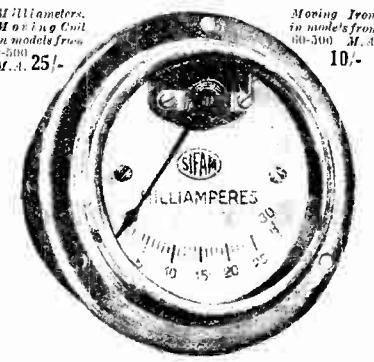
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**TO** Them in the Radio Field Appleby's Appeal; in part exchange exists the most economical method of purchase.  
**BUYERS**, here is Appleby's service—simple, straightforward, fair; a not too dull brochure, more fully descriptive, will be sent to you immediately upon request.  
**WE** Supply Practically All the Leading Lines of Radio Apparatus at Current List Prices, and make no carriage charges except on accumulators and batteries and exceptionally bulky articles.  
**IF** You Wish, we will take in part exchange any branded receiver, component, or loud-speaker, for which you have no further use, providing such is reasonably modern and in workable condition.  
**TO** Make Fair Offers you Must See the Material; on receipt of a parcel, which must contain a list of contents and name of sender, we will send our offer, which is an allowance from an order for new requirements totalling not less than twice the allowance—but it is fair. In the unlikely event of no agreement being reached, we will return your material carriage paid. We cannot execute part exchange orders of less than 10/- nett cash value, that is after part exchange allowance has been deducted.  
**A** CURSORY Analysis into Points of Economical relation and Psychological Effect, of these terms of part exchange, proves interesting.  
**POINT One.**—The terms have existed since the inauguration of radio part exchange several years ago; their suitability may be gauged by the fact that we have served thirty-nine more part exchange customers in the half year ending June 29th, 1929, than in the whole of the year 1928; that 87% customers have repeated their first transaction, and 46% customers have put through five or more transactions.  
**POINT Two.**—We must see the material; making offers for material we have not seen proves inadequate, indefinite, and misleading; it helps no one and progresses nowhere; upon reflection, this is obvious, the value of an article greatly depends on its condition and production age; the likelihood of receiving an inadequate offer for material sent to us can be determined by the fact that our rejected offers are, and always have been, below 1%.  
**POINT Three.**—Twice the allowance; this stipulation causes you a fair offer always; the more we offer you, the more you ultimately spend with us; therefore, in our own interest as much as yours, we offer the maximum market value.  
**WE** Do Not Require You to Purchase to the Value of Twice the Allowance Immediately; if you give a lesser value, half the cost is payable in cash, and the balance of credit due will await use your convenience; virtually, the system is a radio bank; material may be deposited against a credit fee, and no purchase made for several months; for use whose affairs taken them periodically abroad this particularly useful.  
**POINT Four.**—Appleby's part exchange service is conducted in premises separate for the purpose of employing British labour of proved integrity, British and British behaviour; it is the original part exchange service—and a known quantity.  
**APPLEBY'S**, specialists in distribution by mail and the originators of radio part exchange Number 14, in Chapel St., Marblebone, London, N.W.1, in a position opposite, Edwars Rd., Metropolitan Railway, T.4, Paddington, 8828 (3 lines). [6316]  
**FERRANTI** Valve Tester, as new, each range can be used separately; £4.—Box 3462, c/o The Wireless World. [6622]  
**P.5** Transformer, 22/6; 2 Mullard screened grid P.M.14, 10/- each; P.M.4, 5/-; P.M.41, 6/-; 2 Lewcos H.F. transformers (Solodyne type), lat. 5 lat. 20, Davenport and B.B.C., 14/- each pair; 10 H.F. choke, 6/-—Oswald Chippenale, Wedder, Harrogate. [6621]  
**DOWN** Pick-up and Ball Bearing Tone Arm, perfect, 27/6; moving coil loud speaker, 6 volts, 50/-—58, Longlands Rd., Shepp, Kent. [6617]  
**ATELUS** Surplus.—P.M.24, 15/-; P.M.1 H.F., new, 8/-; Telsen Ace transformers, 6/-; Wearite choke, 2/6; Ormond drum dial, 3/-; plug-in Igranic, 150 and 250, 3/6 each; Nentrodine conr (Jackson), 2/6; 5 valve holders, Pye and J.F. each, Robertson, College Gate House, St. Edmunds. [6616]  
 Experimenters Has for Sale a Number of Valves, cabinets, and components, etc., at low price. for list to H. De Laune, Sharnsted Court, Sitting. [6614]

**PERFORMANCE ALONE PROVES IT**  
**LET YOUR EAR - CONVINCIVE YOU**

HEAR it but ONCE. Your ear will convince you there is no other reproducing unit, irrespective of price, to equal the Wates Star—its superlative tonal beauty and the amazing verve and sparkle of its performance. The Wates Star has been deliberately built for those who desire something more than the plot of "built down to a price" units can provide. True its cost is considerably higher—BUT by RESULTS alone and from the sensational interest caused at the Show, there is little doubt that those who do not inspect the Wates Star are missing Radio's "Best Yet."

**WATES STAR**  
**LOUD SPEAKER UNIT**  
 Your set is only as good as its speaker!

Sent against cash on 14 days approx. if your dealer cannot supply.

4 coils, double magnets, upper adjustment for magnets, lower adjustment for armature. Works on newly discovered principle.

THE SHAFTESBURY RADIO CO., (Dept. W.W.) 184/188 Shaftesbury Avenue, London, W.2. Our Stand at Manchester Radio Exhibition is No. 63.

**KILO-MAG & RECORD THREE METAL CABINETS.**

35/- each or with woodwork 46/6 each.  
 Kit-Set 27/6 and 38/6 each respectively.  
 Finished crystalline Brown, Black or Blue.

Trade enquiries invited.—Samuel Eaton & Sons (Manufacturers of Lighting Goods), 66, 72, Barr St., Birmingham

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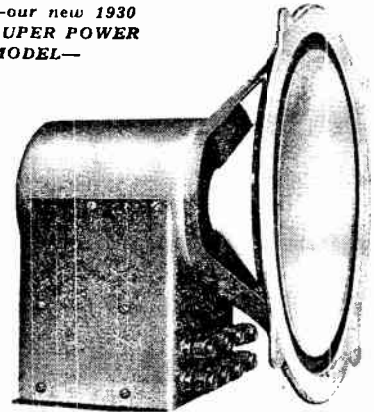
Components, Etc., for Sale.—Contd.

**SALE.**—Lewcos dual range split-primary unit, £1; Ferranti resistances, 40,000, 10,000, 3,000, 50,000 ohms, 3/- each; Utility 0.0003 S.L.P. condenser, 3/-; K. and K. Vernier dial, 5/-; Centralab 500,000 ohm potentiometer, 5/-; set Aero short wave coils and case, 15/-; Eureka S.L.P. 0.0005 condenser, 5/-; Dubilier 0.1 mica condenser, Lissen 0.01 condenser, 4/- for both.—J. White, Gilstead, Caidy, Cheshire. [6611]  
**BAKERS** Solhurst Gr. Lamp. Moving Coil Loud-speaker, unassembled; Ferranti O.P.4C transformer; McMichael Supersonic 5-valve unit, complete Exide batteries, uncharged, W.Z.G.4 D.M.G., D.H.G., C.Z.H.4, C.Z.G.3; 2 Orain 8625 valves; all above articles brand new, must be sold; what offers?—Box 3406, c/o The Wireless World. [6592]  
**MAGNOVOX** M.C. Speaker, 6-volt field, £3/15; Woodruff pick-up, £1/15; genuine sacrifice; demonstration after 7 p.m. evenings.—Williams, 104, Upper Walthamstow Rd., E.17. [6595]  
**EVERYMAN** Four Cabinet, with panel, all panel components fixed, coils, screen, Gauldrell neutrovernia and various small condensers; also Marconi Ideal 6-1, £5, near offer. Seen after 6 p.m., Bingham, 70, Chelverton Rd., S.W.15. [6598]  
**YOUR** Old Components Taken in Part Payment for Latest Type; see our advert. in column Receivers for Sale.—Scientific Development Co., 51, Fishergate, Preston. [6228]  
**EPOCH.**  
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**EPOCH** Moving Coil Speakers.  
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**EPOCH** Chokes.  
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**EPOCH** Scratch Filters, etc.  
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**EPOCH.**—New City Address, 5, Farringdon Av., Ludgate Circus, E.C.4. Phone: Central 1971 (2 lines). Private Branch Exchange. [6027]  
**VALUE.**—Best materials and finest workmanship at lowest prices.—Stoff.  
**NEW** Kilo Mag Metal Cabinets, beautifully finished, with oak or mahogany base, electrically perfect; only 45/-—Stoff.  
**RECORD III.**—The above cabinets also for this super set; metal box alone, 32/6.—Stoff.  
**"WIRELESS WORLD"** Kit Cabinets, as specified; 35/-; note the price.—Stoff.  
**FOREIGN** Listeners Four, screening boxes as specified; 5/- only. Sec advert. under Coils.—Stoff, 63, Syke Rd., Rochdale. [6524]  
**BARGAINS.**—Components for sale, or exchange; send for list.—Whitman, 19, Grange Rd., Peterborough. [6657]  
**COLLYER** Dual Wave Coil, 10.6; original Melody Maker coil, 2/-; Dubilier R.C. unit and triotron valve, 5/-; 2 Ormond 0.0005 condensers, nearly new, 4/6 each.—Meridith, High St., Compton. [6536]  
**A.C. Co.** Special Units.—Titan units, 15/-; Europa portable, £1/1; 2 circuit, 2 medium and long, 17/-; screened grid regional, £1/17/6; Plat Dwellers Three transformer, 16/6; aerial coil, 16/6; Foreign Listeners Four, medium £1/17/6, long £1 17/6; new kilo-mag, £2/7/6; de-coupling resistances 600 to 1,000 ohms, 1/6.—Write for coil and mains component list to Alpha Coil and Component Co., Hawksley Av., Sheffield. [6633]  
**A.C. Co.**—Eliminator, model A.C.1, tappings Sec. G. 60, 90, 120v., at 16 m.a., 10 ft. Hex, switch, brown crystalline metal case, metal rectifier, £3 17/6; transformers and chokes to any specifications, write for all list of standard models; Standard transformers for all metal rectifying valves; Standard transformers for all metal rectifiers; transformers for filament heating; transformers with multiple windings, any outputs quoted for; smoothing chokes, all values; manufacturers of mains sets, send us particulars of your requirements, and quote at your disposal, and let us quote you; Westinghouse metal rectifiers in stock at standard list prices; condenser packs, 4-2-1-1 mfd., tested to 500V. D.C., 7/-—Write for list to Alpha Coil and Component Co., Prospect Works, Hawksley Av., Sheffield. Phone: 43335. [6634]  
**FERRANTI** £3/3 Exponential Spenser, 42/-, unused, in original box; Sterling slow motion 0.00025 unitless, 5/-—White, 9, Thieray Rd., Salford. [6632]  
**R.I.** Components, perfect and practically new, retro-active tuner, 200-2,000 metres, listed 39.6, accept 18/6; H.F. choke, 4/6; multicat transformer, 15/6.—Wood, "Melvale," South Cliff, Bexhill-on-Sea. [6630]

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SUPER POWER  
MODEL—

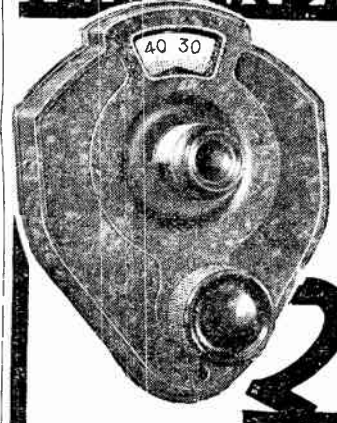


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DOMINION SLOW MOTION DIAL.  
Brownie are now producing 2,000 Dominion Vernier Dials a day. That is why it is possible to offer this high-grade dial at the wonderful price of 2/6.

The mechanism is a special non-back lash design with a reduction ratio which makes fine tuning easy without becoming tedious. Finished in plain black or beautifully grained mahogany Bakelite.

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Components, Etc., for Sale.—Contd.

TWO Variometers, Mullard R.C.C. unit, 6 Igranite 30 ohm rheostats, 4 M.H. plug transformers, 4 resistances, 100,000 Varley dubilier, neutrovernier, 4 coils, Gambrell and Neafson, 1 L.S.S., all half price; 1 Brown 2 speaker, 8 guineas; Blue Spot pick-up wanted.—Harvey, 97, Brouford Lane, West Bromwich. [6629]

P.M.I.s, H.F., L.P., 1a, 5/- each; P.M.12, 2 P.M.22s, 10/6 each; 3 L.S.S.A., 7/- each; Ferranti 1-1, 10/6; Igranite (1 7-1, 12/-); 2 Pye 32H, 6/- each; Ironclad 2 1/2-1, 2/6; Lissen H.P.C., 2/6; Keystone S.G. choke, 2/6; Lissenola and Re-d, 5/6; Phonovox pick-up, 8/6; volume control, 2/9; Buradep pick-up, 8/6; Wates Three Range, 3/9; Lewcos binocular aerial and base, 5/9; Rotorohm 25,000, 3/6; Varley 150,000 and holder, 4/6; 100,000 and holder, 4/-; Lissen wire, 50,000, 10,000, and R.C. unit, 2/6 each; Ferranti 2,000 and holder, 3/-; Blue Spot cone chassis, 5/6; Triotron unit, 8/6; valves after 7 p.m. please.—Shaul, 76, Helix Rd., Brixton Hill, S.W.2. [6626]

MAHOGANY Cabinet, suitable for Megavox, fitted with 2 Silver Marshall drum dials, cost 15/6 each, 0-50 milliammeter, Polar reaction condenser, centralab volume control, Marconi H.T. and L.T. switch and gramophone pick-up, plug and jack, all in first class condition, £3/10; Crossley Merola pick-up, with tone arm and volume control, £2/5.—Freshwater, 77, Seymour Rd., Lea Bridge Rd., Leyton, E.10. [6627]

R.I. Pentode Output Transformer, 15/-; Mullard Pentode P.M.24, 12/6; Marconi D.E.P.410, 6/-; all as new.—Bradbrook, Lower Rd., Chorleywood, Herts. [6680]

LARGE Mahogany Cabinet, 42in. wide, 40in. high, ample room for set, speaker, gramophone, records, batteries, etc., 26; also electric gramophone motor, G.P.C., universal voltage, £3/10; "W.W." Selection Four powerful and selective, £7; Geophone cabinet cone, £3 10; all in first class condition; sell separately; seen evenings.—13, Silver Crescent, Chiswick, W.4. [6674]

GIVING Up Wireless. Useful components at less than half price, including All-Wave Four coils, 2-valve valves, holders, A.P.3. copper screening box, grid leaks, condensers, etc.; enclose stamp stating wants.—25, Leicester St., Rochdale. [6661]

POLISHED Oak Cabinet 7in. x 24in. x 8in., hinged lid, 15/-; Lewcos binoculars, R.T., 250-550, 5/6; 1,000-2,000, 6/6; S625, 10/-; D.E.P.610, 6/6; full emission Colvern S.P.H.F., 250-550, 5/-; Igranite S.W. 4, 6, 9 turns, 3/6 or exchange.—Matthews, Kingsbury, Bishop's Stortford. [6660]

ERICSSON Speaker, 17/6; Medical coil, 5/-; Gossor H.F. coil, 1/9; Radiou 2v. power valve, 3/-; Wanted (cash or exchange) A.C. trickle charger for 230v.—Frank Forshaw, Flixton Rd., Birnston, Manchester. [6659]

A.F.3. new, 15/-; D.E.P.215, unused, 7/6; White Spot chassis, plated, unused, 9/-; also 200 C.T. coil, 6-pin base, pair telephones, 2 microphones, 50,000 ohms resistance, battery plug, 7/6 for lot.—Blair, 36, Hillhead St., Glasgow, W.2. [6656]

MAINS Transformer, A.C., 230v. input, 135v. output, for Westinghouse rectifier; 12/6.—95, Oswald Rd., Manchester. [6651]

FOUR Matched P.M.26, 15/- each, sell separately, guaranteed unused; R.I. Varley pick-up, 4/-; Ferranti 1 to 1 output push-pull, 15/-.—Gilbert, 54, Hazelbourne Rd., S.W.12. [6650]

50 Watt, 4-stage Power Amplifier, A.C. equipment supplying 450 volts to output, 300 to first stages; 3 matched M.C. speakers (1 horn type), fitted field relays; 2 pick-ups; 1 mike; spare valves, etc.; reasonable offer wanted; heard by appointment, daytime only; suit dealer.—How, Wireless Dealer, Chesham. [6605]

PYE 20H Choke, Formo 80H, D.E.P.240, Mazda L.F., Dario power, variable and fixed condensers, other components; half price; stamp for list.—Box 3474, c/o The Wireless World. [6703]

PRACTICALLY New Mullard 4-volt Screened Grid, Detector and Pentode (with valve holder), 31/- the 3, or separately; Dubilier S.W. Toroid coil, with base, 5/-.—Steel, 11, Tassie St., Glasgow, S.1. [6700]

SURPLUS Components, large quantity at scrap prices, transformers, valves, coils, utility switches, rheostats, potentiometers, condensers, resistances, state requirements and enclose stamp for reply; Timgar 6-12 volt 6 amp. battery charger, £2, or exchange 1 amp. trickle; car dynamo, 6 volt 10 amp. new windings, 10/-; Morse key, 4/-; Bowyer Low-superhet (see advert. under Receivers).—Walker, 159, Tempest Rd., Dewsbury Rd., Leeds. [6691]

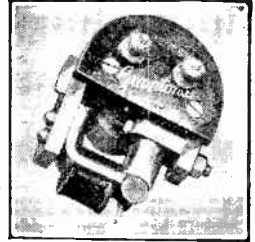
SURPLUS, unused except where stated.—Lion power chassis, £4/10, recent purchase; Lotus dial, 3/6; I.B. 0.0003, 7/- each; Utility 70/1 dials, 5/- each; Utility 0.00015, 8/6 each; 100ff. Negrolae aerial, 11/6; Cambrell Neurovernia, 3/6; Igranite E transformer, 12/6; S.S.210 H.F. and 2 P.M.I. L.F., 7/- each; P.M.2 (week's use), 9/-; Frost 0-500,000, 6/6; Valve test meter, S.W. set, Keech banjulele, etc.; offers considered.—F. Cadick, 15, Stanley Park Rd., Wallington. [6688]

B.T.H. Pick-up and Arm, used once, 38/-; Blue spot adjustable speaker, mahogany cabinet, 30/-; 2 Utility 0.0003, 3/6 each; T.C.C. 0.002 mica, 9d.; Climax potential divider, 2/-; Gossor coil, 2/6; Igranite rheostats, 9d.; 3-way coil holder, 1/-.—B.M. S.E.L.C. London, W.C. [6684]

MARCONIPHONE All Power Supply Unit, H.T., L.T., G.B., 200-240 volts D.C., £3/10, cost £6/10; Colston speaker, mahogany £3/10, cost £6/10, good condition, little used.—Crawford, 268, Rolls Rd., Birmoudey. [6714]



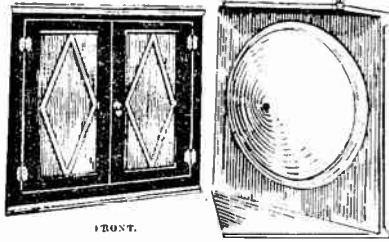
The  
GRANTONA  
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WITH a 2-valve amplifier the volume is sufficient for all ordinary purposes. The Grantona allows the needle to project only to such an extent as to entirely prevent whip. Free vibration of the frame is non-existent. By tightening the set-screw the tone faces are spread allowing greater movement of the armature. Made with bushes to fit all standard tone arms. Fitted terminals or leads.

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Complete with Cone and Unit £3.12.6  
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Manufacturers of Grantona Floating Coils.

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W.W.46

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**Components, Etc., for Sale.—Contd.**

**RADIO HOUSE HUDDERSFIELD (6th Winner).**

**R**ECLIPSE  
**L**AMENTATIONS  
**I**NHABITANTS  
**A**BERDEEN.  
**B**ATTERIES  
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**L**ATELY  
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**Y**ET Offer One per Week Free; likewise unsolicited testimonial was received from Littlehampton reader: Your firm is streets ahead of some of the London houses for business; this unsolicited reputation we endeavour to uphold.

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**S**ECURES H.T. Battery; where there's a will there's a way, so why not submit similarly composed advertisement, using the words "Reliability Wireless Guide," so as to encourage readers to apply for this list? Weekly change of matter desired; a 100-volt H.T. battery for each effort published, and useful consolation prizes given.

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**U**PLANDERS  
**I**NTERESTED,  
**D**ETECTING

**E**LECTRIC H.T. Supply Free, so send for Guide, which will be sent post free from J. H. Taylor and Co., 15, Radio House, Macaulay St., Huddersfield, to whom competition efforts should be submitted, indicating also if name and address publishable if successful; prize winner this week from Batley. (Only 23 alternative words required, Radio House Huddersfield remaining, one word for each initial following.) [6655]

**M**ARCONI M.C. Loud-speaker, 200 volts D.C., Westinghouse metal rectifier, H.T.4 mains transformer, heavy duty, 200-220: £8, or separately; all new.—Thompson, 51, Vesta Rd., S.E.4. [6713]

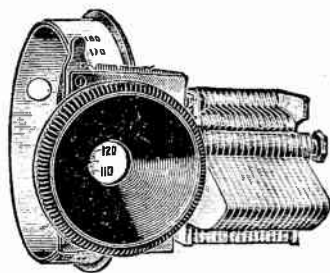
**N**O Superhet Builders.—Massive Shanghai made teak cabinet, mahogany finish, removable glass front, lined back, takes panel 36in. x 11in., depth 7 1/2 in., or with front removed 9 1/2 in., stamp, sketch, bargain, 2/6, carriage forward; four Propaformers, coupler, hue prints, instructions, 47/6; Colvorn broadcast s.a. coupler, with base, 6/-; Cyclon Log 0.00025, 6/-; Sterling square law vernier, 0.0025, 4/6; Igranac F., 12/6; M.I. ditto, 10/6; Brown microphone amplifier, 1500 w., perfect, 40/-; Mullard D.F.A.3, bought error, unused, 15/6; four Royal Frost 8 ohm. ament rheostats, 1/9 each, lot: 6/6; all post free, tick, 58, Bramcote Rd., Beeston, Notts. [6719]

**EC**OND-HAND, as new, two Ormond S.M.D.1 dials, one Midget ditto, 6/-; one M.I.I. neut. cond., Ormond 0.0003 var. cond., 2/6; two Cossor L.F. valves, 10/-; one Lotus Q.A. coil, 7/-; Clin twin coil, special choke, 5/6; Eureka concert and L.F. trans., 6/-; two T.C.C. cond., 4 mid., 800 v., 14/-; two T.C.C., 2 mid., 4/-; one S.P. porcelain thing switch, 6d.; one pair phones, 3/6; two Ben valve holders, 1/6.—Grant, 68, Green Lane, rd., Essex. [6712]

**ARGAINS**—Pye apparatus, bought for new receiver, which circumstances will not permit me make: 4-1 and 2.5-1 transformers, 12/- each; 32h.c., 7/6; portable output transformer, 3.5-1, 14/6; dc charger, 2, 4 and 6 volt tapings, 1/2 amp. out-cost 50/-, 35/-; all brand new.—Box 3476, c/o Wireless World. [6705]

**I**AL Range Coil, fitted wavechange switch, 7/11; Polar R.C.C. unit (7/6), 4/6; short wave coil, base, 1/6; 6-way battery cord, 2/6; 0.0003 sq. condenser, with engraved dial and knob, 1/6. All-wave H.P. Transformer, 3/6; aluminium screening box, 3 1/2 x 4 1/2, with lid, 2/6; 10 B.A. ing, 2d. foot; get there gadget, for inaccessible h, 6d.—Frost, 54, Clerkenwell Rd., E.C.1. [6667]

**EX**PERIMENTER has Following for Sale, new and guaranteed: G.E.C. L.F.s 2-1, 4-1, 7/6 each; c type J, 3-1, 8/7; Dubilier K.C. drum dial, 7/6; Mullard Pentone P.M., 24, 10/-; Polar reaction, 0.0001, 3/-; Dubilier, fixed, 0.0003, Polymet, 0.0001, 6d.; Gambrell Neutrovolver, 1/3; also others; state wants.—Z., 6, Ospringe W.5. [6678]



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**DRUM DIAL**  
that convinced  
**Olympia.**

**T**HERE is no more reliable guide to a Component's value than the opinion of Olympia—where the experts gather. And this new "UTILITY" Drum Dial is yet another "UTILITY" Component to gain the approval of the experts... follow their lead, it is the safest course, and in this instance, proves once again that the best is not the most expensive. The "Mite" Drum Dial Condenser is a combination of an entirely new Dial with our Standard "Mite" Condenser. The Dial will improve the appearance of the panel—is easier to read—and occupies very little space. It is supplied for left or right hand operation. The prices complete with Condenser are as follows:—

PRICES:		
Cat. No.	Qty.	Price.
W.201	0005	11/6
W.202	0003	11/-
W.203	0002	10/6

"UTILITY" Components can usually be obtained from better class dealers or, in case of difficulty, may be had return post from the makers. Write for a fully illustrated list, we will send you one post free. Why not write to-day?

**WILKINS & WRIGHT LTD**  
HOLYHEAD BIRMINGHAM



**Components, Etc., for Sale.—Contd.**

**F**ERRANTI I.T. Trickle Charger, never been used, 46/-; Ferranti transformer, A.F.3, 15/-; Amplion loud-speaker, A.R.19, £1.—H. Freeman, 47, Tenbury Rd., King's Heath, Birmingham. [6708]

**MISCELLANEOUS.**

**S**COTT SESSIONS and Co., Great Britain's radio doctors, officially approved as wireless repairers by Radio Society of Great Britain and Wireless League; old sets of every type repaired, rebuilt, modernised; send set for immediate quotation.

**S**COTT SESSIONS and Co.—New sets constructed with your or our components, guaranteed finest workmanship, we specialise in "The Wireless World" circuits; remember, we have satisfied customers throughout the British Isles! Bristol, Gloucester, Weston, Taunton; send name, address and date and our Bristol representative will call; if winter comes now is the time for overhauls.—Tel.: Tudor 5326, 1, Castle Terrace, Muswell Hill, London, N.10. [0262]

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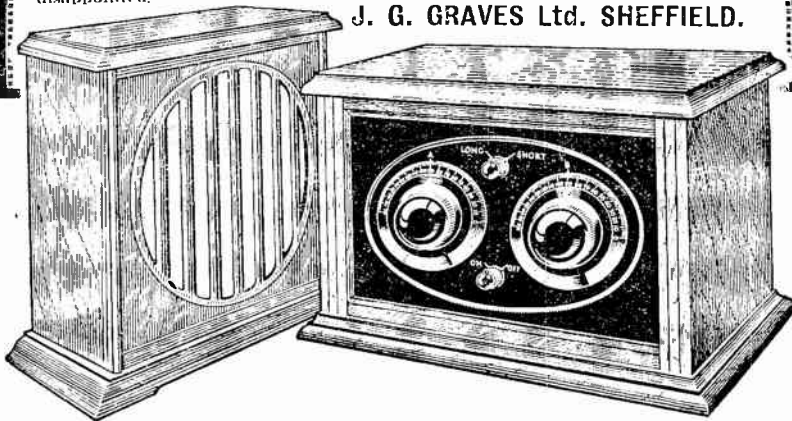
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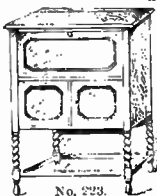
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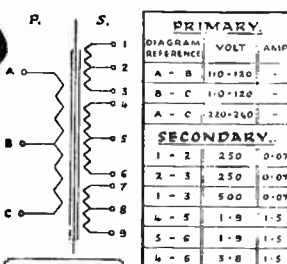


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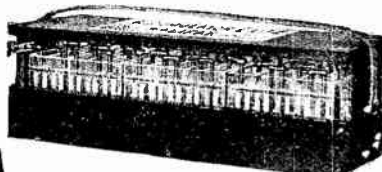
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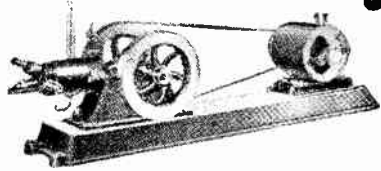
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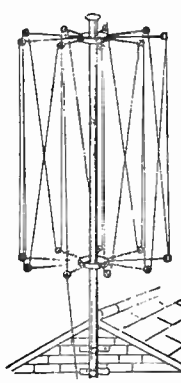
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 How often it happens that just when you require a full supply of current your Accumulators are run down, you are then probably held up for a day or two. With one of our small plants all you would have to do is to start the little engine and connect up your Accumulators, you would have a full supply at once. It is well worth the outlay for that reason alone, and you would be able to see for yourself that they were thoroughly and properly charged. If you have a garage or small outbuilding you would have your own lighting plant.  
 These plants are Petrol driven with a reliable Engine guaranteed to stand up to 10 hours continuous running every day. All our engines are so efficiently silenced that no annoyance is caused from a noisy exhaust; particular attention has been paid to this matter, and we have succeeded in producing an Engine as silent as it is possible to get.  
 Made in three sizes. 40-50 Watts output, £14 0 0, 60-80 Watts, £17 18 6, and 150-180 Watts, £23 18 9. Easy terms arranged if desired.  
 These small plants are not puffie, but a sound engineering job guaranteed to stand up to long continuous runs at full load without attention, and to give good service year in and year out.  
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 15/- New Model 15/- Per Set.

**WONDERFUL RECEPTION**



**Manchester Show.**  
 See Stands 8, 49, 65, 82.



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Ready to assemble: all joints cut.  
 Send P.C. for Free Illustrated Catalogue of 70 "R.T.A." pieces of furniture.  
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**DIX-ONEMETERS are now 50/- only, a remarkably small price for a meter worth £10 in comparison with others.**  
 Latest Model. To 1st Grade Brit. Eng. Standard. Mirror Double Scale. Moulded Base. The finest Precision Multi-measuring instrument is the DIX-ONEMETER, the acknowledged Radio standard beloved by Expert and Amateur.  
 Imitations of its Bakelite case and mirror scale are inferior. They lack the 50 Multiplier Ranges, the Precision, the Duplex Scales, Knife-Edge Needle, Accurate Bearings and High Figure of Merit. Remember that the DIX-ONEMETER is as nearly electro-static in its tiny load and can be used at 2,500 ohms per volt. On 100 volts the high value of 250,000 ohms can be used. Micro-Amps., Milli-Amps., and Amps. to 20A. Milli-Volts and Volts to 2,000V. Resistances from 50 ohms to 50 million ohms. All these are measured with ease on the versatile and finely made DIX-ONEMETER.  
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## VACUUM RESISTANCES.

EDISWAN GLASS-ENCLOSED VACUUM RESISTANCES.

(Grid Leak or Anode)

Ediswan are the only British made resistances of this type on the market. All resistances are thoroughly tested before leaving our works, and are absolutely accurate and noiseless in operation. Obtainable in values from 5,000 ohms to 5 megohms. Overall length, 45 mm.

### CARTRIDGE CONDENSERS.

These condensers are ideal for the man who likes to experiment. In a second, you can pull one out of the clips and put in another of a different value. They are made in values from .0001 mfd. to .001 mfd. Overall length, 45 mm.

*For the best results*

THE EDISON SWAN ELECTRIC COMPANY LIMITED,  
INCORPORATING THE WIRING SUPPLIES LIGHTING ENGINEERING REFRIGERA-  
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123-5, QUEEN VICTORIA STREET, LONDON, E.C.4.  
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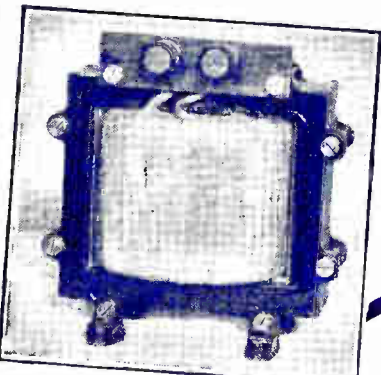


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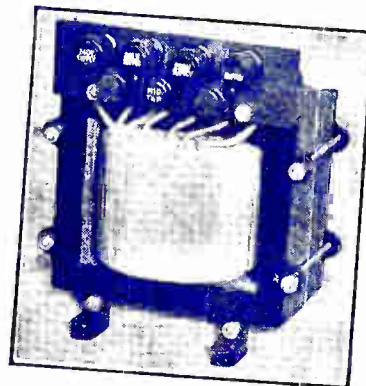
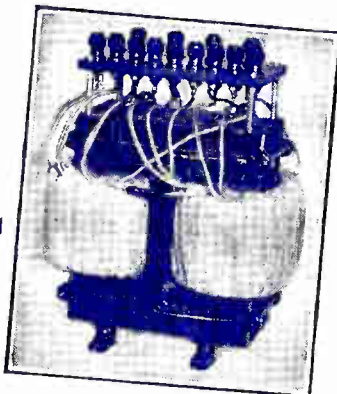
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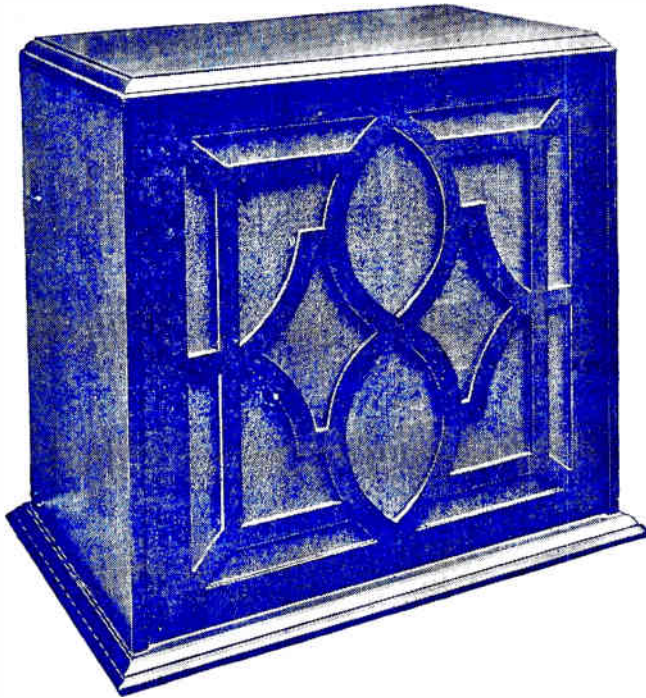


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# Tone so natural that you might actually be in the studio!



*Fit this new Marconiphone Moving Coil Speaker to your set, and you will know for the first time how good wireless can really be.*

**W**HAT a difference this new Marconiphone Moving Coil Speaker makes! Tone—so absolutely pure and natural that you might be in the studio instead of miles away. Volume—strong enough to fill a dance hall, or subdued for a chamber concert in your drawing room.

As soon as you possibly can, hear a Marconiphone Moving Coil Speaker at any dealer's. If you do not know of a dealer near you, write to the Marconiphone Company Limited, 210-212, Tottenham Court Road, London, W.1.



*The first and greatest name in wireless*

**Why so good? Because—**

An entirely new type of diaphragm ensures perfectly balanced reproduction and ample strength to handle considerable output. Strictly accurate centring of the moving coil gives enormous sensitivity. The outstanding success of the Olympia Radio Exhibition. It reproduces the entire musical scale.

Moving Coil Cabinet Speaker, type 110 for 6 volt accumulator, £7. Type 120 for D.C. Mains, £7.10.0. Type 130 for A.C. Mains (new Rectifier Unit, U9 Valve), £12.12.0. Moving Coil Units can also be obtained from £4.10.0.

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*For the best results*

**THE EDISON SWAN ELECTRIC COMPANY LIMITED,**  
INCORPORATING THE WIRING SUPPLIES LIGHTING ENGINEERING REFRIGERA-  
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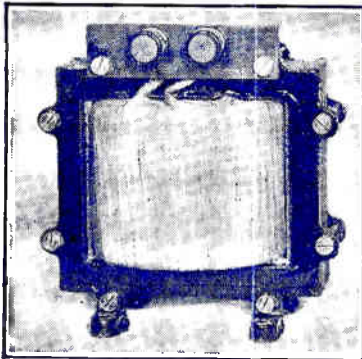


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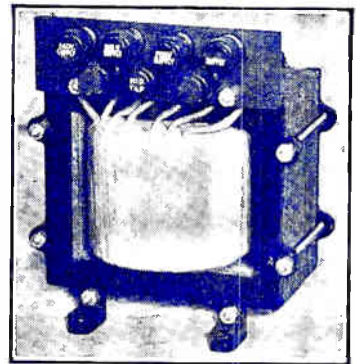
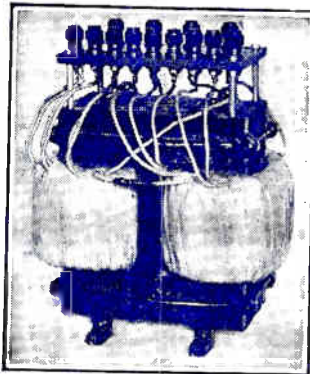
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### and CHOKES for the MAINS from 35/- each

for ALL INPUTS and OUTPUTS.



**SPECIAL  
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 15/- EACH.



*Special Quotations for Gramophone Radio and  
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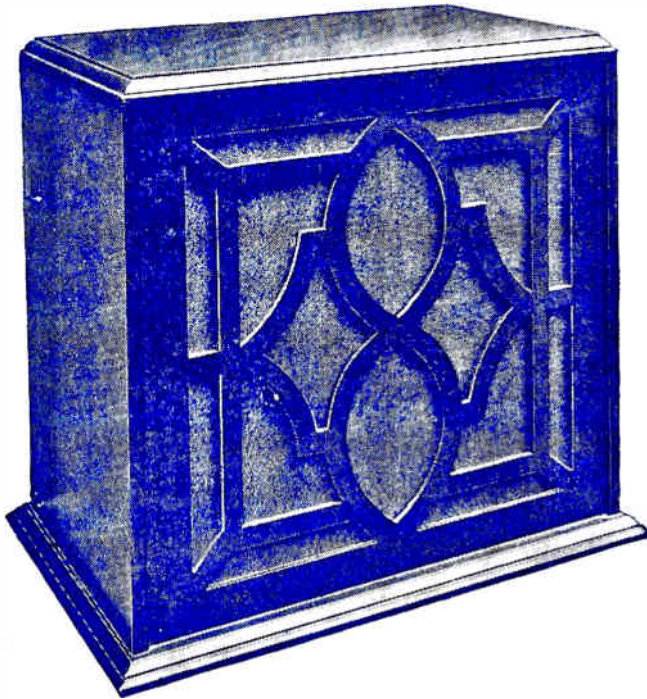
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Telephone: Mid. 1409.

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3<sup>D</sup>

# The Wireless World

## AND RADIO REVIEW

### The Paper for Every Wireless Amateur


Wednesday, October 23rd, 1929.



**EKCO-LECTRIC RADIO RECEIVERS AND POWER SUPPLY UNITS**

**"Plug in—That's all!"**

Write for Free Booklet on "All-Electric" Homes to E. K. COLE, LTD., Dept. W, "EKCO" WORKS, LEIGH-ON-SEA.



**RAJO MULLARD VALVE**  
**P.M.**

**PROFILE**

**PROFILE**

**TONE VOLUME DISTANCE**

**PUT NEW LIFE INTO YOUR RECEIVER**

**Mullard**  
**THE MASTER VALVE**

AWARDED THE CERTIFICATE OF THE INSTITUTE OF HYGIENE FOR QUALITY AND PURITY

Superfine Quality

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GUARANTEED GENUINE EBONITE

This Ebonite is unconditionally guaranteed in quality

120000 VOLTS PER M.M. National Physical Lab. Report

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**BLUE SPOT**  
**66K**

**25/-**

There is nothing better

*A car costs 2/6 per hour to run  
 A wireless set costs less than  
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**EVER READY**  
 BRITAIN'S BEST BATTERIES

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YOU CAN TAKE IT FROM US



—secure  
in the  
know-  
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you get a  
good job for  
your money.

It's compact.

That means simplified assembly and wiring. It's efficient. It does its work properly because of its special core, the silver wire of the primary, and the nickel-wound secondary.

Hear its performance and you'll remember its name—the Mullard PERMACORE L.F. Transformer. It has a step-up ratio of 3:1.

PRICE  
**25/-**

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## MASTER · RADIO

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## FOR EVERYTHING RADIO

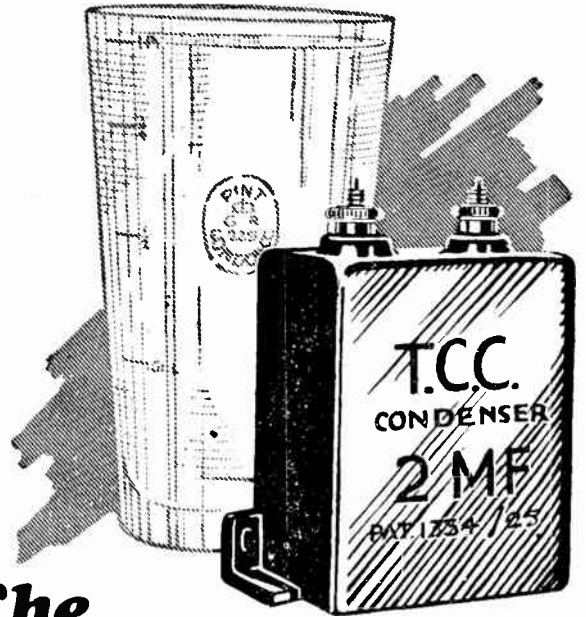
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W.36

# STANDARDS



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THE Imperial Pint is the Standard pint—the pattern for all pints. Many pint pots are etched with the Imperial Pint mark—such a pot, filled, contains true measure. There is also a standard among condensers—and that is T.C.C. Every condenser marked "T.C.C." is an assurance that it is up to standard. T.C.C. Condensers, because of their accuracy, dependability and good service are to-day the recognised standard of all condensers—that's the opinion of experimenter, scientist and amateur alike. Remember this when next you want a condenser.

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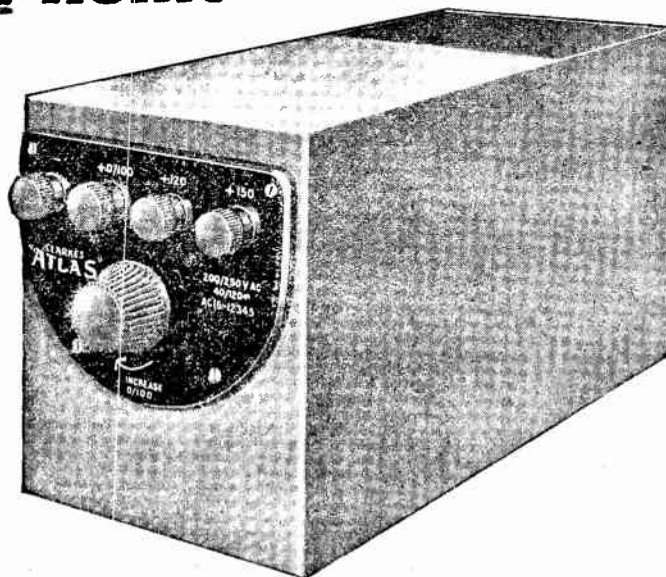
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**10/**  
**DOWN**

brings this **CLARKE'S "ATLAS"**  
super Eliminator into  
your home

*Scrap those  
H.T. Batteries  
& save money,  
time & trouble!*



Why tolerate the expense and trouble associated with H.T. Batteries?—you can never have perfect reception so long as you rely on Battery Supply for H.T. Get this wonderful A.C. 16 model—the difference will amaze you—increased selectivity, absolute clarity, and much greater volume—all the time. Using an A.C. 16 your set will give you as good results as an expensive All-Mains Set. A.C. 16 is the latest Model of the famous Clarke's "ATLAS" Range, made to accommodate any set from 1 to 5 valves, and is adaptable to any portable set when used in the home.

Model A.C. 16 is without doubt the finest Eliminator at the price that has yet been produced. It provides three Tappings, two of which are fixed, one giving 120 Volts and the other 150 Volts. The remaining Tapping is variable from 0/100 Volts. This Model specially caters for sets using Screen-Grid, Detector, and Pentode Valves, where critical adjustment of H.T. is necessary to obtain best results. Max. Out. 25 M.A. Price 10/- down and nine monthly instalments of 10/- or £4 10 0 Cash.

## Our Wonderful Offer to Radio Listeners

For 10/- down—less than the cost of a 100 Volt H.T. Battery—this super Eliminator is yours. The balance you pay in easy instalments, after which the cost for H.T. is finished with, except for the cost of current which is so small as to be negligible. It doesn't matter whether you are on Direct or Alternating current, there is a model in the Clarke's "ATLAS" Range to meet your requirements, any of which can be obtained on this easy payment system.

Full details are given in our new Folder No. 44. **SEND FOR IT NOW!**

Clarke's "ATLAS" Eliminators are made to provide maximum safety in working, and comply with the Institute of Electrical Engineers' Regulations, and the incorporation of the famous Anode Feed System ensures smooth running and entire freedom from "motor-boating."

**SEE STAND No. 41**  
RADIO EXHIBITION  
CITY HALL, MANCHESTER.

**Post this Coupon NOW!**.....

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Atlas Works, Old Trafford, MANCHESTER.

Please send your Folder No. 44, along with details of your easy payment scheme.

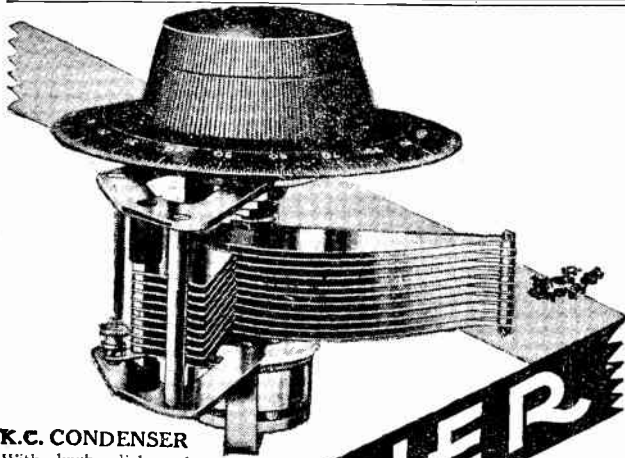
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Please use **BLACK LETTERS.**

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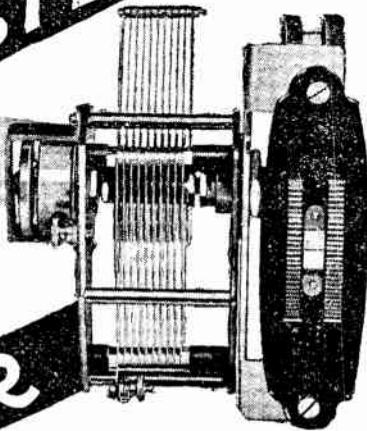


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With knob, dial and slow-motion device, .0003 or .0005 **12/-**  
 Without knob, dial or slow-motion device, .0003 or 8/- .0005 **8/-**

**K.C. DRUM CONTROL CONDENSERS**

With Drum Control and slow-motion device, .0003 or .0005 **15/6**  
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**MIDGET CONDENSER**

A small variable condenser for panel mounting .00005, .0001 or .0003 **5/6**

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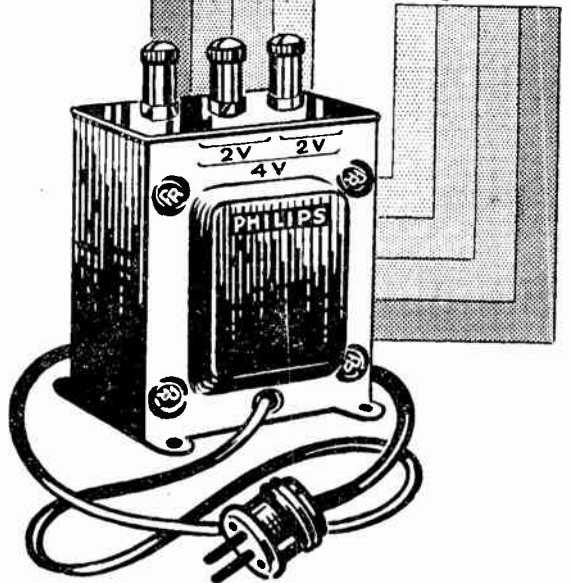
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 VARIABLE CONDENSERS

Ask your dealer for the Dubilier Booklet—"A Bit about a Battery"—it's free.



Dubilier Condenser Co. (1925) Ltd., Ducon Works, Victoria Road N. Acton, London, W.3. B.C. 249IV

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 STRAIGHT OFF  
 THE MAINS FOR  
**29/6**



If you have not an All-Electric Receiver, have the next best thing.

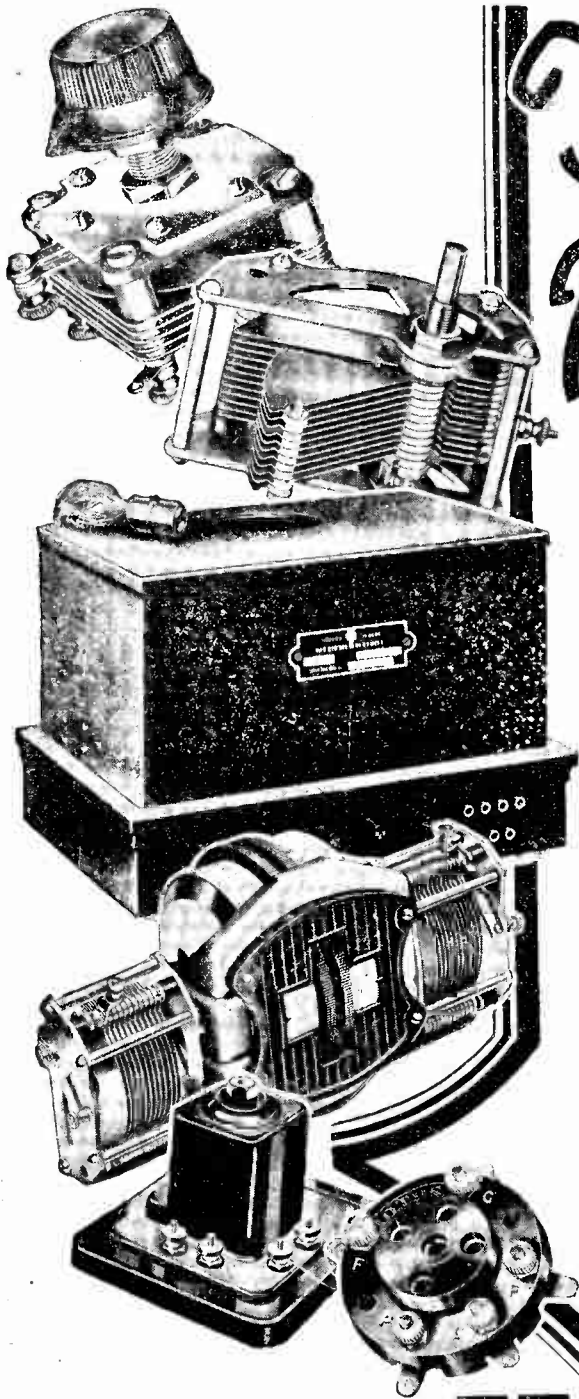
Fit a Philips A.C. Filament Transformer and cut out your L.T. accumulators. Then your set will give better results and you will have none of the trouble or expense of recharging accumulators. Philips A.C. Filament Transformer is low in cost and completely reliable in operation. Bring your set up to date by adding this valuable unit.

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 A.C. FILAMENT TRANSFORMERS

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 Arko T.1

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*Trifles  
make  
Perfection*



**I**n a good set each unit, however small must be perfectly made. It is because components are so important both to the quality of reception and the ease in building, that Lotus components are recommended almost universally by technical men and the Press. Lotus units are made in one of the most modern radio factories in this country. They are made to an exceptionally high standard and each one—large or small—is carefully tested before it leaves the works. You can depend upon Lotus components. Put them into your next set.

**The Lotus range includes:**

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**Send for Two Handsome Catalogues To-day.**

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**GARNETT, WHITELEY & Co., Ltd.,  
Lotus Works, Liverpool.**

*From All Radio Dealers.*

**LOTUS  
COMPONENTS**



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THE NOVOTONE.  
McLachlan Tone Compensator. Patents Pending.

Every user of an electrical pick-up should immediately write for the "Novotone" Booklet.

The Novotone Tone Compensator invented by Dr. N. W. McLachlan not only compensates for the inherent losses in pick-ups but also for the even greater losses in recording.

Read this extract from "The Wireless World," August 21st, 1929, Page 177.

"In ordinary records it is necessary to restrict the amplitude of notes below about 250 cycles in order that the vibrations may be contained within the standard pitch of the groove."

TURN LOSSES INTO GAINS WITH THE NOVOTONE.  
THE NOVOTONE PUTS IN BASS WITHOUT BOOM.  
THE NOVOTONE IMPROVES REPRODUCTION BEYOND BELIEF OVER THE WHOLE MUSICAL SCALE.

REALISM FROM RECORDS CAN ONLY BE ACHIEVED BY USING THE NOVOTONE.

Write now for the 8 Page explanatory Booklet "W.N." See the Diagram illustrating the effect of the Gam-brell Novotone on electrically reproduced records.

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6, Buckingham Street, Strand, London, W.C.2.

Telephone: Temple 1. v. 3213.

# LISENIN

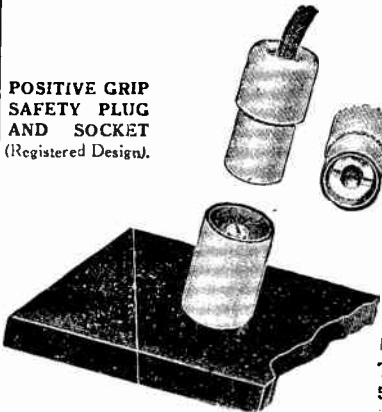
## POSITIVE GRIP TERMINALS

(Patented)

Scientifically constructed, both electrically and mechanically, they hold the wire, but grip the flex covering. All stresses and strains are removed from the conductors, and once a connection is made it stays put, and without any unsightly frayed ends of leads, the bane of all fans.

Write for FREE copy of our latest descriptive leaflet "W.W." Post free. of course.

POSITIVE GRIP SAFETY PLUG AND SOCKET (Registered Design).

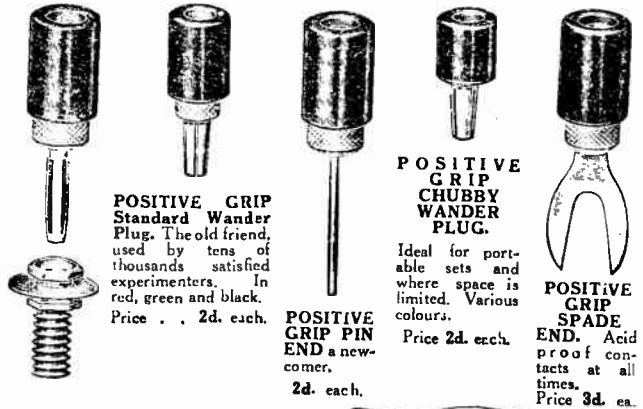


POSITIVE GRIP Banana Type PLUG & SOCKET. A great advance on all other types of plug. A silky, dead smooth contact is NOW obtainable. Price 4d. complete.

LISENIN POSITIVE GRIP ALL MAINS PLUG AND SOCKET (Registered Design). The Lisenin Mains Plug and Socket is totally insulated and is equally as valuable on sets working off batteries as those from the electric supply. The leads may be dropped with impunity and there is no chance of a short circuit. Instantly assembled with the aid of a screwdriver. NOTE THE PRICE, 6d. each, complete as illustrated.

WRITE to-day for our new descriptive folder, mentioning this paper.

We have moved to larger premises. Note new address:—  
**THE LISEININ WIRELESS CO.,**  
5, Central Buildings, HIGH ST., SLOUGH, Bucks.  
Phone: Slough 652. T. Address: POSGRIP SLOUGH.



POSITIVE GRIP Standard Wander Plug. The old friend, used by tens of thousands satisfied experimenters. In red, green and black. Price . . . 2d. each.

POSITIVE GRIP CHUBBY WANDER PLUG.

Ideal for portable sets and where space is limited. Various colours. Price 2d. each.

POSITIVE GRIP PIN END A new-comer. 2d. each.

POSITIVE GRIP SPADE END. Acid proof contacts at all times. Price 3d. ea.



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Recent developments in Radio have created a demand for a new transformer of the same quality and reliability as the AF5, but capable of greater L.F. amplification. In their class of medium ratio, the Ferranti AF3, AF4 and AF5 are still supreme; but changed conditions — notably the advent of the Screened Grid Valve — have rendered this a necessary addition to the standard range.

## THE AF6, RATIO 1/7

Designed to ensure the maximum volume where only ONE L.F. stage is employed with Grid Leak Rectification. It is particularly suitable for sets of the S.G.3 type, where greater amplification is desired than is usually obtained from one L.F. stage. The curve is better than that of the AF3, and the amplification is twice as great. This new transformer is not intended for use in receivers employing more than ONE stage of L.F.

PRICE: 30/-

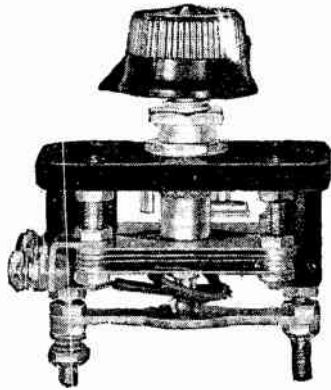
# FERRANTI

FERRANTI LTD.

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# POLAR BEHIND YOUR PANEL



THE POLAR DIFFERENTIAL CONDENSER.

For the Mullard "Orgola."  
 For the "Magic" Three.  
 For the Ferranti S.G. Three.

## FIT THE POLAR DIFFERENTIAL CONDENSER.

**Note:**—For the "Orgola" a .0003 Capacity is specified, but one should realise that this is the **total** capacity. In other words it is equivalent to the "Polar" .00015 capacity **EACH SIDE**.

For the "Magic" Three a .0001 to .00015 **EACH SIDE** is specified. For the "Ferranti" S.G. Three a "Polar" .0001 **EACH SIDE** is specified.

### PRICES FOR THE "POLAR" DIFFERENTIAL CONDENSER :

Obtainable immediately from your local dealer, or direct if any difficulty locally

**.0001 EACH SIDE 6/6    .00015 EACH SIDE 7/-.**

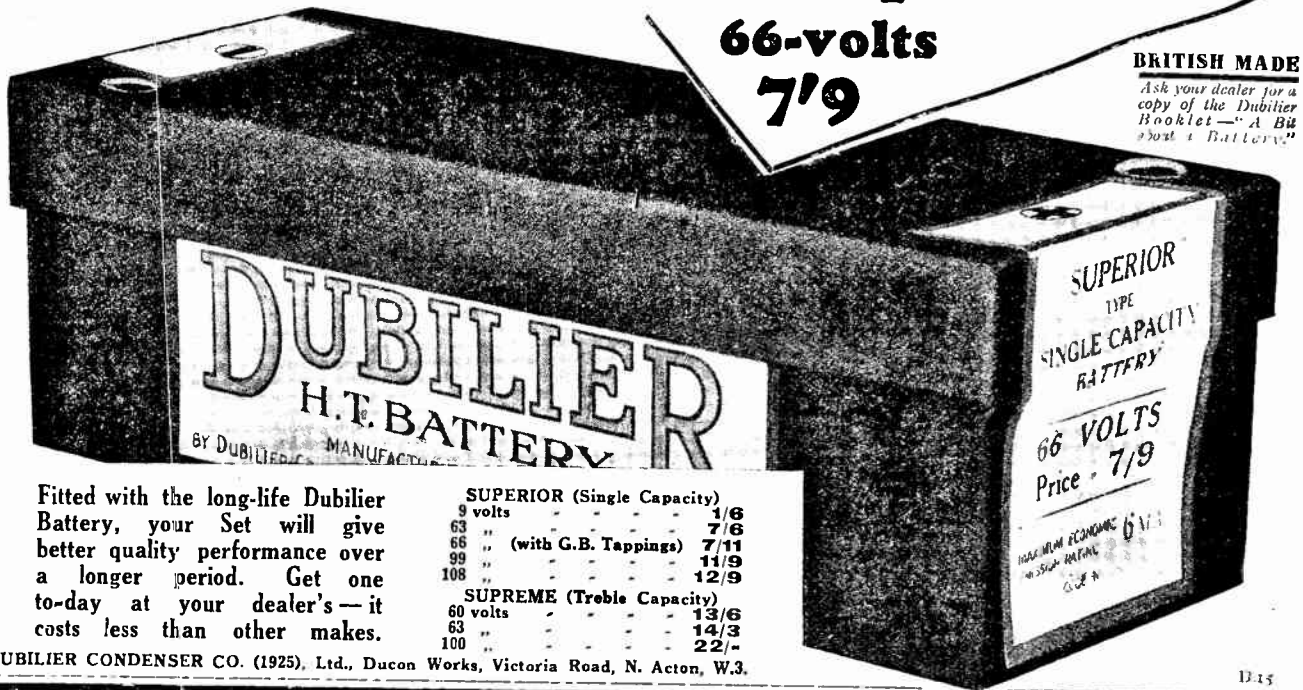
**WINGROVE & ROGERS LTD.,**  
**188-189, STRAND, LONDON, W.C.2.**

Readers of "The Wireless World" who visit the Manchester Radio Exhibition will see definite proof of the benefits obtained by placing "Polar Behind The Panel." A very large proportion of the Portable and Non-portable Sets of well-known manufacturers use "Polar." You can rely upon their choice. To get the best results the best of condensers must be used. Illustrated Catalogue 'K' free on request.

# This long-life Battery will better your reception!

**66-volts  
 7/9**

**BRITISH MADE**  
 Ask your dealer for a copy of the Dubilier Booklet—"A Bit about a Battery."



Fitted with the long-life Dubilier Battery, your Set will give better quality performance over a longer period. Get one to-day at your dealer's—it costs less than other makes.

SUPERIOR (Single Capacity)	
9 volts	1/6
63 "	7/6
66 " (with G.B. Tappings)	7/11
99 "	11/9
108 "	12/9
SUPREME (Triple Capacity)	
60 volts	13/6
63 "	14/3
100 "	22/-

DUBILIER CONDENSER CO. (1925), Ltd., Ducon Works, Victoria Road, N. Acton, W.3.

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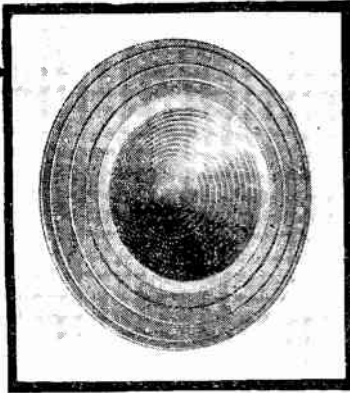
# easy...

for the amateur  
to build his own  
**Super  
Loudspeaker**

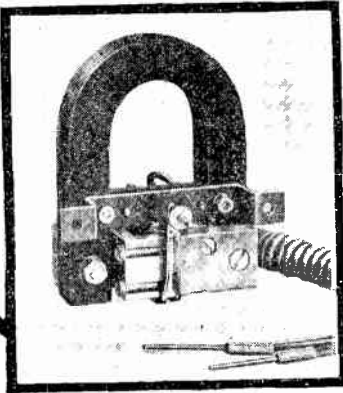
This cone unit and assembly now permits the amateur designer to construct a super-sensitive loudspeaker which is cheaper than a factory built model whilst at the same time allowing him to use his own ideas as to the type of cabinet or baffle to be used.

For the small sum of 15/- for the cone unit and 12/6 for the assembly he can build a loudspeaker unequalled in its class for volume, tone and sensitivity.

Like all Ediswan products this unit and assembly combine typically British quality with life-long dependability.



Assembly—Price 12 6



Cone Unit—Price 15 -

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**EDISWAN**  
**CONE UNIT &**  
**ASSEMBLY**

**THE EDISON SWAN ELECTRIC COMPANY, LIMITED.**

Head Office Ediswan Radio Division and West-End Showrooms:

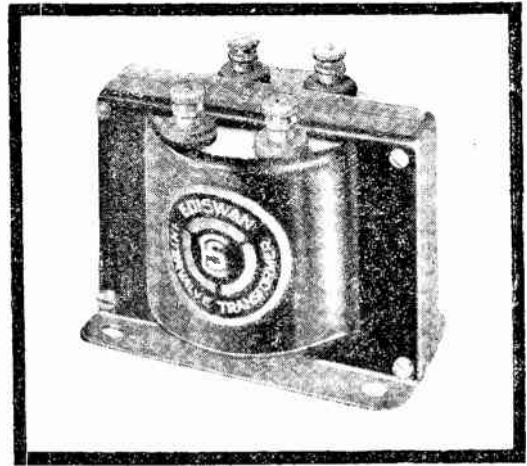
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Phone: Museum 9801.

SHOWROOMS IN ALL THE PRINCIPAL TOWNS.

W.35a.

# The HIGH PERFORMANCE LOW PRICED TRANSFORMER



As good as  
the best  
but costs only  
**20/-**

Ask your radio dealer.

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## INTERVALVE TRANSFORMER

# Get the Best from your Set— only the **GROSVENOR** can do it



The wonderful new *Vitalising Element* ensures continuous and satisfactory service. No other battery can give you the same service. It's the new *Vitalising Element* unique to Grosvenor that does it. Fitted by all the Leading Set Makers after the most exhaustive comparative tests, and **PROVED** to be the best.

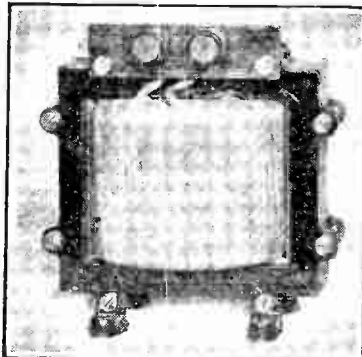
66 v. from 7/6      99 v. from 11/6

**THE GROSVENOR BATTERY Co., Ltd.,**  
2/3, White Street, Moorgate, LONDON, E.C.2.

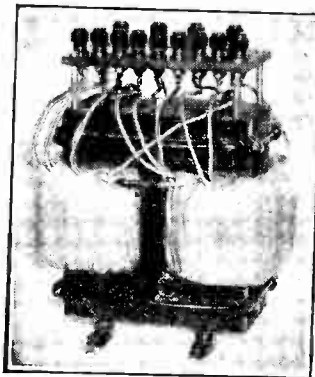
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## GROSVENOR BRITISH MADE BATTERIES

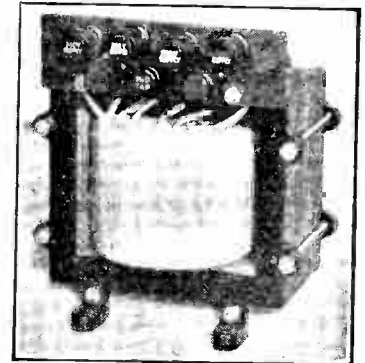
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**SPECIAL  
INTERVALVE  
TRANSFORMERS  
15/- EACH.**



**Special Quotations for Gramophone Radio and  
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**WILLIAM BAYLISS LTD.,** Sheepcote Street, BIRMINGHAM.

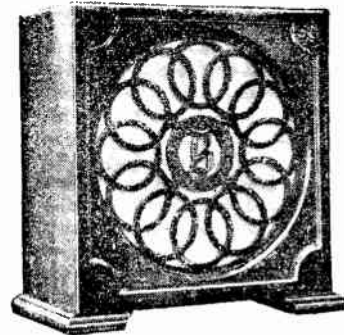
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**FOUND!**



**THE REST OF THE ORCHESTRA**



**H**ERE, at last, is a loud speaker that does not cheat you of half the broadcast! It finds the missing artistes! It reveals instruments hitherto silent. It gives you notes you've never heard before. It is the new Brown Duplex Loud Speaker.

Because it incorporates the latest Brown improvements in design—the wonderful "Vee" movement and the new Duplex cone—this latest Brown triumph gives far more realistic reproduction than any heard before. Every instrument and every note—high and low—is reproduced *true-to-life*. Its tone is sweeter and more mellow. Its volume is richer and more magnificent. In short, if you buy a Brown Duplex Loud Speaker you hear the broadcast in your home *as it is played in the studio*. Ask your Wireless Dealer.

**IN THREE MODELS:**

*Design as illustrated. Mahogany or Oak.*

**V10 £5 10s. 0d. V12 £7 10s. 0d. V15 £12 10s. 0d.**

*Also obtainable by easy payments, ask your Dealer for particulars.*

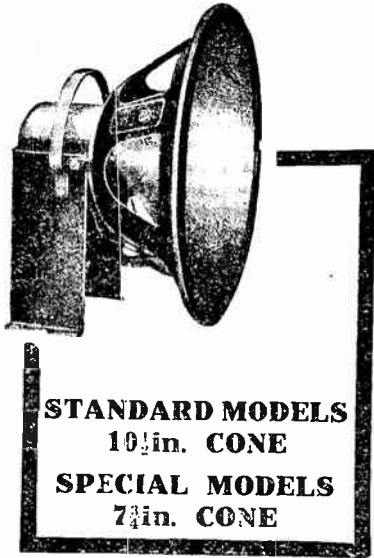
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WONDERFUL**

**Brown  
DUPLEX  
LOUD SPEAKER**



# X-CORE The World's greatest development in Dynamic Speaker Construction

## AGAIN **MAGNAVOX** LEADS THE WAY



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10½ in. Cones

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Magnavox again leads the way with the new X-CORE dynamics. The X-CORE insures perfect alignment of the inner and outer poles and a true concentric gap in which the moving coil may vibrate. The X-CORE is secured in engagement with the main core by means of a bolt running directly through its centre. The new special model with 7½ in. "LEXIDE" Cone is the World's finest Moving Coil Speaker, while the Standard model with 10½ in. "LEXIDE" Core heralds the greatest advance in dynamic power speaker construction.

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Important developments in



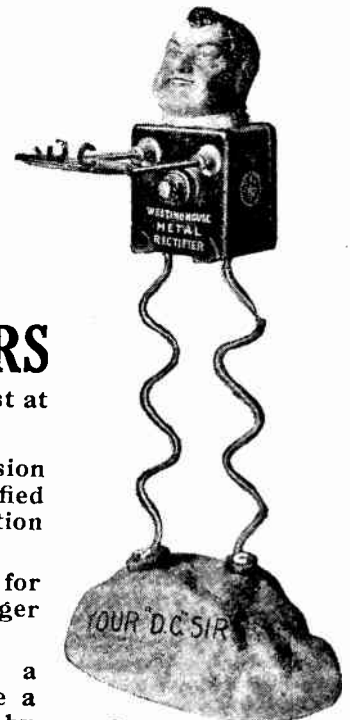
## METAL RECTIFIERS

which created such great interest at Olympia.

The construction of high-tension eliminators is now greatly simplified and cheapened by the introduction of the new units H.T.3 and H.T.4.

Complete range of units suitable for any type of eliminator or charger will be on view.

For those who intend to buy a ready-made mains unit, we have a selection on show of those made by the leading radio manufacturers.



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SEE THEM ON  
**STAND 78**

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MANCHESTER RADIO  
EXHIBITION

and don't forget  
to ask for your  
copy of the new

"All Metal Way 1930"

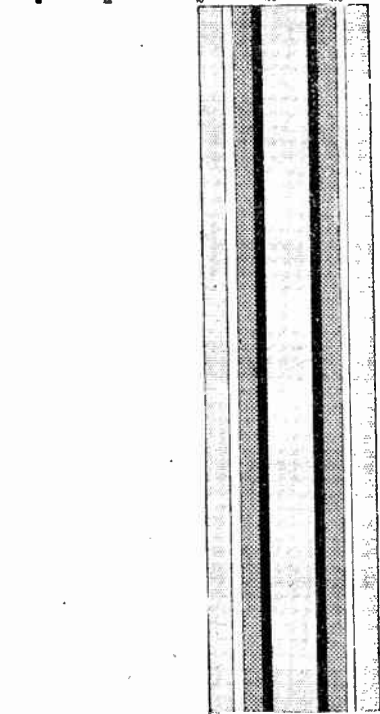
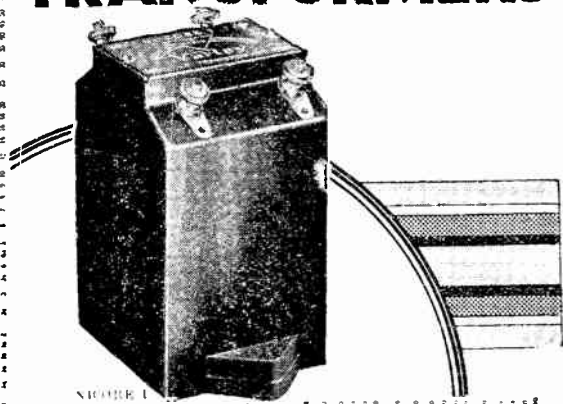
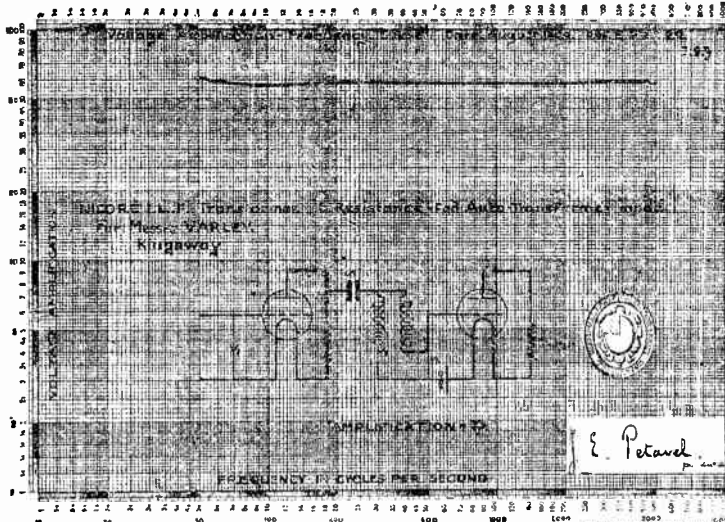
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If you can't call for a copy, send 2d. stamp with your name and address.

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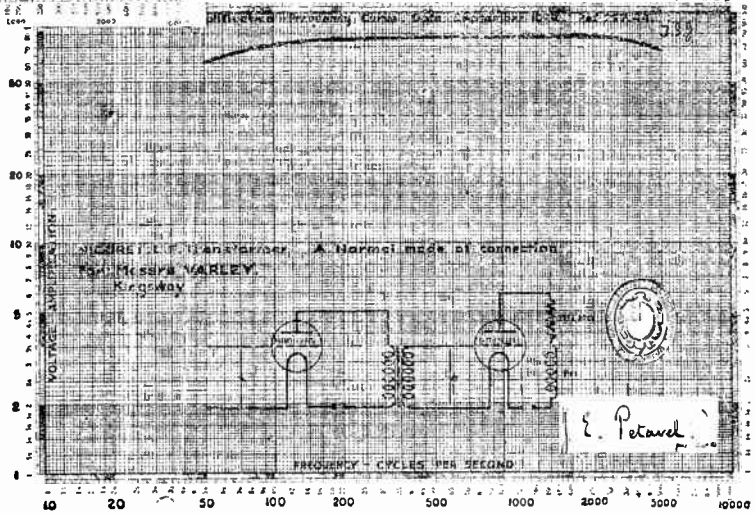
# VARLEY

## — NOW TAKE THE LEAD IN L.F. INTERVALVE TRANSFORMERS



Curve B

Curve A



You have only to look at these curves to see that for yourself. They show what the curves of no other transformer can show—perfect amplification of the deep bass notes, together with constant response at all frequencies from 50 to 5,000 cycles. After all it was only to be expected, for in the early days of broadcasting the coils for most of the well-known transformers were wound by Varley. Then after months of research came our success with the nickel iron alloy core, and to-day we are able to market at an amazingly low price two L.F. Intervalve Transformers whose performance is second to none.

Curve "A" is that of Nicore 1, used in the ordinary transformer arrangement, showing an amplification of the order of 80 between 100 and 5,000 cycles and over 60 at 50 cycles.

Curve "B" is that of Nicore 1, used in the resistance feed auto-transformer arrangement, showing an amplification of 60 and a perfectly straight line between 50 and 5,000 cycles.

No attempt has been made to retain inaudible side-band frequencies; the discerning public will not be slow to realise that our efforts have produced curves which are—like everything else connected with Varley—perfectly straight.

\*Nicore 1 is suitable for the "1930 Everyman Four," described in "The Wireless World" last week.\*

Write for Section D of the Varley Catalogue.

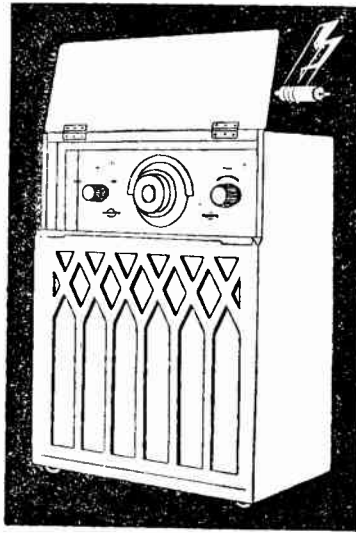
**NICORE 1** (List No. D.P.1)  
Ratio 4-1

Housed in an attractive bakelite case, with convenient terminals and soldering tags.

**£1:0:0**



Advertisement of Oliver Pell Control, Ltd., Kingsway House, 103 Kingsway, London, W.C.2. Telephone: Holborn 5303



## UP IN PERCY'S ROOM

Percy likes jazz music. Dad is a devotee of the Proms. So as soon as the concert is ended, Percy and the boys and the Bowyer-Lowe Portable Five all go upstairs together. Nothing to detach or fix up. No aerial and no earth wire. Everything is contained in the good-looking oak cabinet. You can take this Portable wherever you wish, and the music will come to you as clear as life. Directional operation is made quite easy by the turn-table. The price is astonishingly modest, and you can pay by easy monthly instalments.

Ask your Wireless Dealer about the comprehensive range of Bowyer-Lowe Sets and Components, or write to Headquarters for illustrated literature.

### SIXTEEN GUINEAS

Complete, including royalties

# BOWYER-LOWE

In association with  Recordaphones Ltd.

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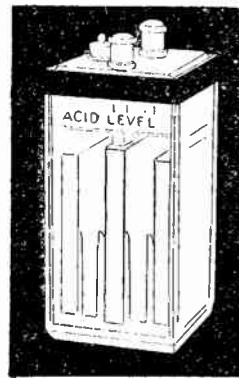
Head Office and Works:

RADIO WORKS, LETCHWORTH, HERTS.

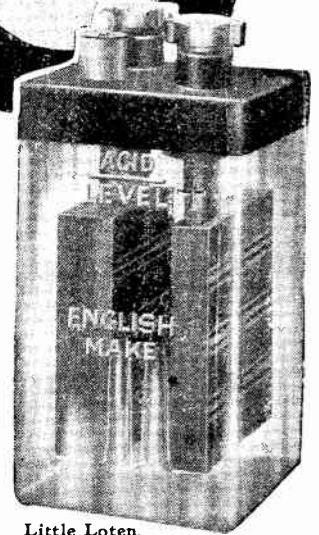
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When you can buy Ediswan Accumulators at these prices!

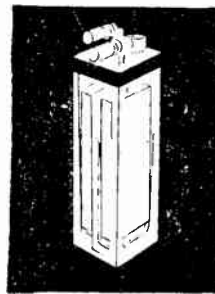
**EDISWAN LOTEN**



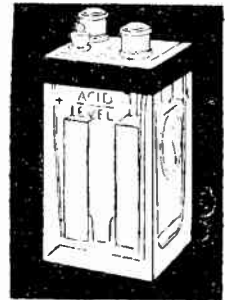
Major Loten.  
70 Amp. hrs. 11/-



Little Loten.  
20 Amp. hrs. 4/3



Midget Loten.  
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Your accumulator worries are ended if you install an Ediswan Loten—your charging bills are reduced, too, because the new mass type plates ensure maximum life per charge. From the lead used in the plates to the glass of the container. Loten accumulators are 100% British.

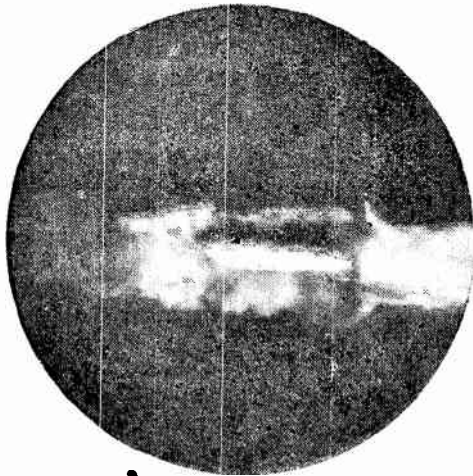
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Ask your radio dealer.

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SHOWROOMS IN ALL THE PRINCIPAL TOWNS.

B.46a

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**A BAD Filament**

**WITHOUT "TENACIOUS COATING"**

Reproduction from an untouched microphotograph showing part of the filament of a badly coated valve before use, showing a serious gap in the coating. A gap such as this starts the valve off in its life with a poor performance. The valve then prematurely fails.

**IT'S MUCH**

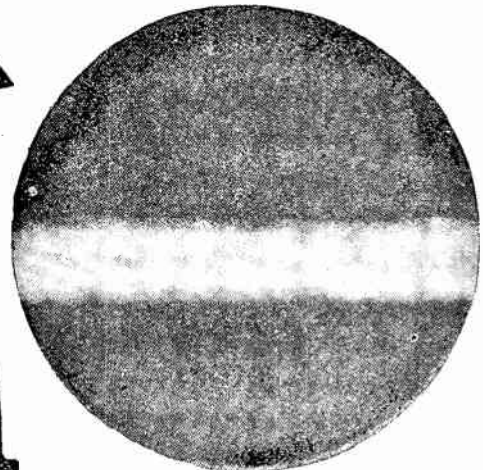
**BETTER TO BE SURE  
WITH THIS**



**A GOOD Filament**

**WITH "TENACIOUS COATING"**

This reproduction shows the coating typical of all OSRAM VALVES. Notice the absolute evenness of the coating. There are no gaps, the coating clings, so that the full benefit of the coating is maintained. The secret is the startling discovery of the scientific process of "TENACIOUS COATING."



**Osram  
Valves**  
with the

**"TENACIOUS COATING"**

MADE IN ENGLAND.

Sold by all Wireless Dealers.

**WRITE** for booklet "OSRAM WIRELESS GUIDE" (1929 edition) giving full particulars of the full range of OSRAM VALVES with the "TENACIOUS COATING." Also helpful wireless information of importance to every listener. Sent post free.

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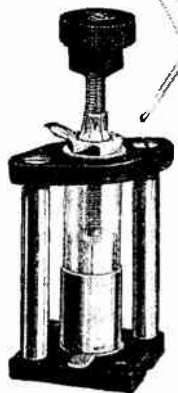
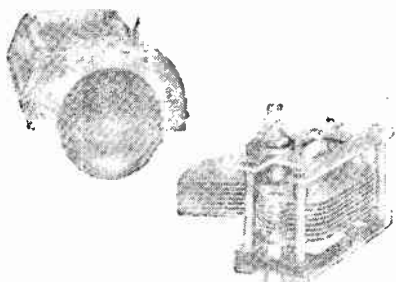
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**PRECISION CONDENSERS**



**now  
as  
always**

In a country where mechanical wonders are becoming more and more frequent, and the standard of workmanship is very high, J.B. Condensers still stand out as examples of precision and finish. Their design, as well as the accuracy with which they are made, have established for them a reputation that exists wherever Wireless is to be found.



**J.B. NEUTRALISING CONDENSER**  
Price **3/6**



**PRECISION INSTRUMENTS**

Advertisement of Jackson Bros., 72, St. Thomas' Street, London, S.E.1.

Telephone: Hop 1837.

**40 STATIONS on a 3-valve set  
USING TWO LEWCOS  
CENTRE TAPPED COILS**



**CENTRE TAPPED COILS.**

*"By far the best." An interesting testimonial from a user of Lewcos Coils.*

"I am using two of your Centre Tapped Coils on my three-valve set, 75, 35 and 300. I find that your Litz wound coils are by far the best, and considering that my set is the usual Det. and 2 L.F., on an indoor aerial I am getting 40 stations (at Putney). I feel certain that the SENSITIVITY AND SELECTIVITY ARE ENTIRELY DUE TO THE LEWCOS COILS."

**LEWCOS C.T. COILS.**

All Lewcos C.T. Coils are Litz wound and have an extraordinary low H.P. resistance which is one of the secrets of successful reception.

With any circuit the inclusion of Lewcos C.T. Coils very materially improves the sensitivity of the set both in volume and purity.

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Lewcos unscreened coil units are supplied in bakelite containers. Each section is operated separately but the construction is such that the units can be placed horizontally (central hole fixing) when the switching mechanism can be operated from the front of the panel, or vertically, when it is necessary to open the cabinet to alter the waveband.

**GLAZITE**  
BRITISH MADE REGD  
**COLOURED  
CONNECTING  
WIRE**  
In 10 ft. coils.  
Price 6d. per coil.

**LEWCOS**  
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**COMPONENTS**

**FOR BETTER RADIO RECEPTION**

THE LONDON ELECTRIC WIRE CO. & SMITHS LTD.,  
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Trade Counter: 7, Playhouse Yard, Golden Lane, London, E.C.1.

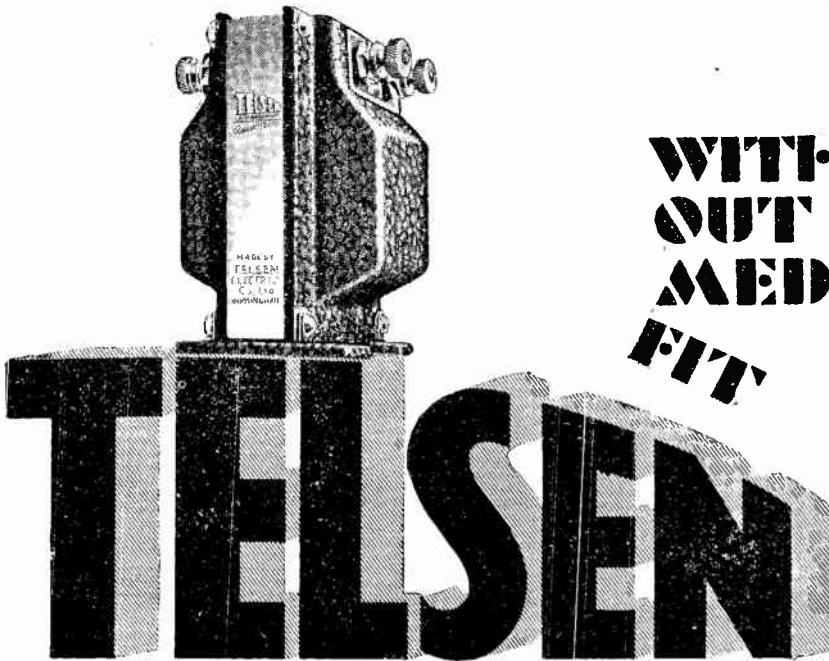


# AMPLIFICATION

FOR

without

# DISTORTION



## WITH MELODY OUT OF THE MEDLEY

### FIT

Get reproduction that is so startlingly near to the original performance, with its real full-toned bass and amazingly faithful renderings of the higher range.

No Component affects the tone of radio reception more than the transformer—insist on Telsens!

Try one now. They are entirely British "Radiogrand" Model. "Ace" Model

12/6

8/6

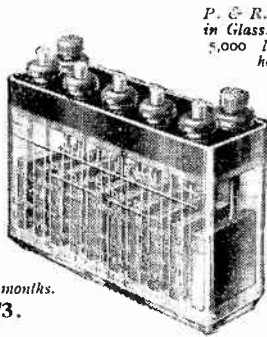
Ratios  
5-1 and 3-1

Ratios  
5-1 and 3-1

# TRANSFORMERS

TELSEN ELECTRIC CO., LTD.

MILLER STREET, BIRMINGHAM.



P. & R. "R.H.T."  
in Glass. 10 volts.  
5,000 Milliamperes  
hours.

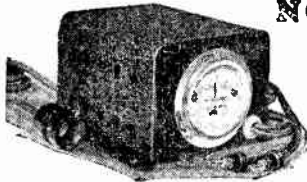
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Price 6/3.

Type L.H.T.,  
filled with  
chords (as  
illustrated)  
Price 7/6.

## Thoroughly well designed

The Peto & Radford R.H.T. High Tension Accumulator was designed by people with 40 years of accumulator-making experience who know a great deal about radio. To give purity of reception the R.H.T.'s internal resistance has been kept low, its voltage remains constant under all variations of discharge. Terminals are hollow, so that 10 volt tappings can be made by wander plugs. The plates are strong and designed to hold charges for long periods.

## Charging will cost NOTHING



Charge your H.T. Batteries off the mains with the P. & R. Trickle Charger. For D.C. or A.C.

Simple. Safe. NO valves. No "hum." Constant voltage. Perfect reception all the time. Uses practically no current. Price complete for D.C. 29/9, or A.C. 49/9.

Send postcard for details of this and the range of P. & R. Batteries (L.T. and H.T.) to

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PETO & RADFORD  
**ACCUMULATORS**

*The beginning and the end in*

**POWER**

T.R.3

This announcement is issued by  
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# M.P.A. COMPONENTS —BEST IN RADIO!



**MADE TO A STANDARD THAT  
SETS A STANDARD!**

## M.P.A. ELIMINATORS

Wide research and experience are behind these new components. Every Eliminator is tested to over 1,000 volts A.C. for breakdown, and complies in every way with I.E.E. regulations.

**UNIVERSAL MODEL A.C.** For input voltages from 200-250 volts. Supplies H.T. in 6 Tappings from 200/60 volts, output at 200 volts 50 mA L.T. (A.C. 4 v.—4 amps.). Grid bias in 20 one-volt steps. Price £12. 10. 0. (Exclusive of Marconi Royalties.)

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**Power Smoothing Choke (Type SM/500). EXCEPTIONAL EFFICIENCY!** **FIRST-CLASS WORKMANSHIP!** Carrying capacity 500 milliamps, suitable for smoothing in power amplifiers. Tested to over 1,000 volts for breakdown. Complies in all respects with I.E.E. regulations. Price 60/-.

## M.P.A. CHOKES

L.F. Maximum inductance at full load. No increase in temperature. Comply with I.E.E. Regulations. Tested to over 1,000 volts A.C. for breakdown.

"A" Series:	Carrying Capacity.
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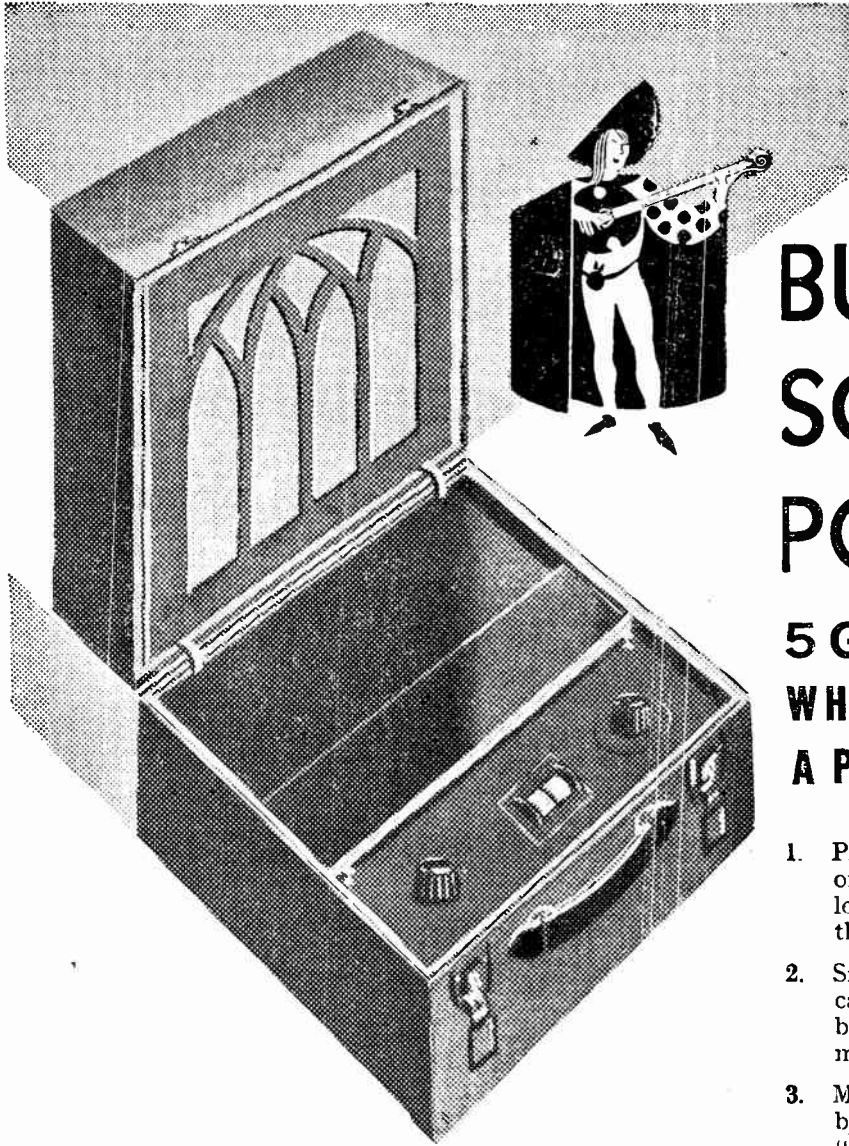
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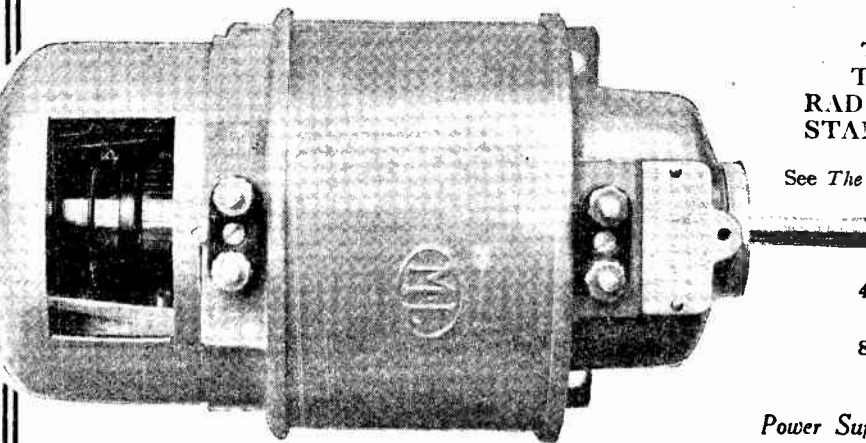
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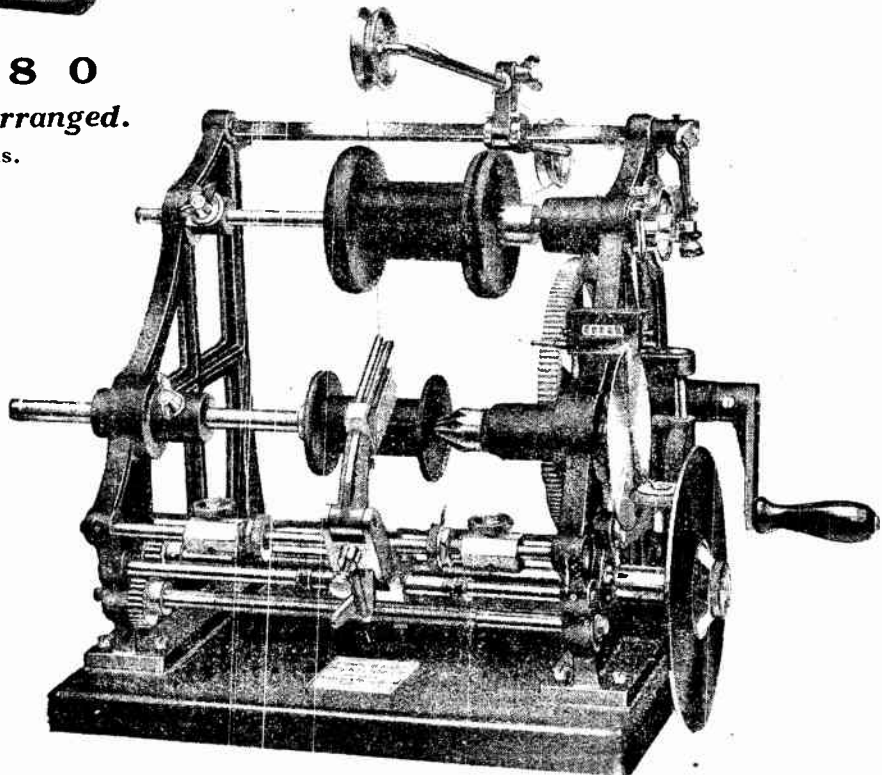
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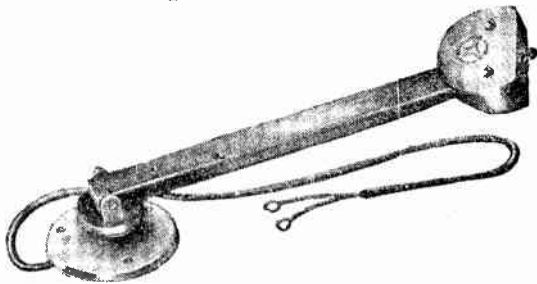


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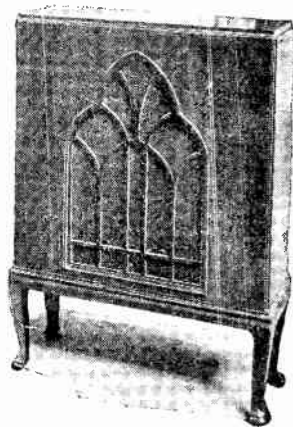
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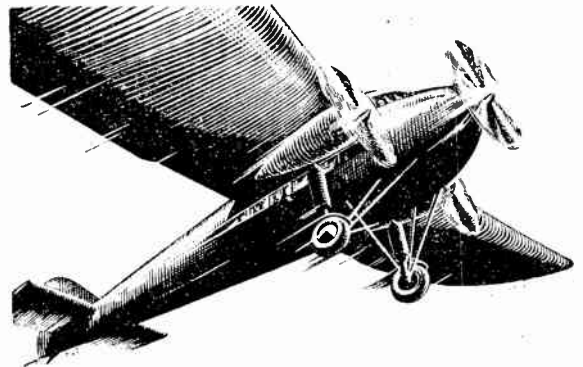
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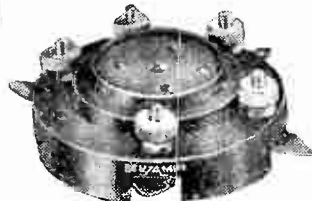
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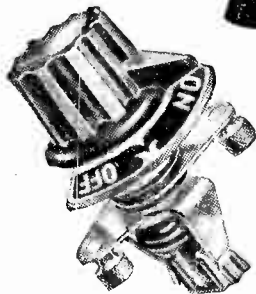
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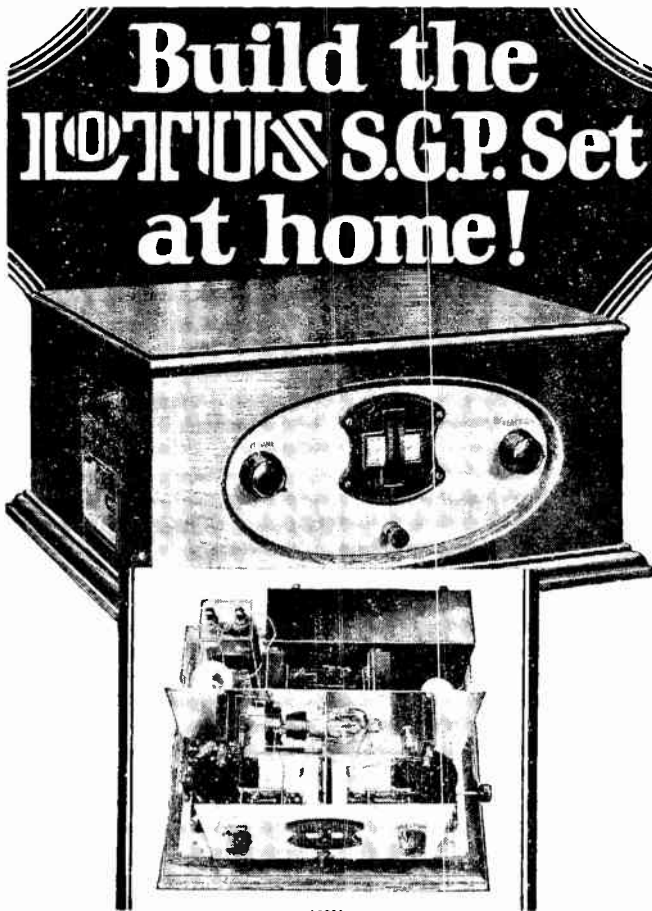
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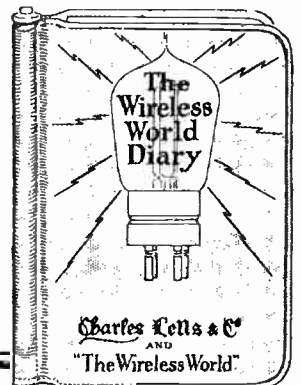
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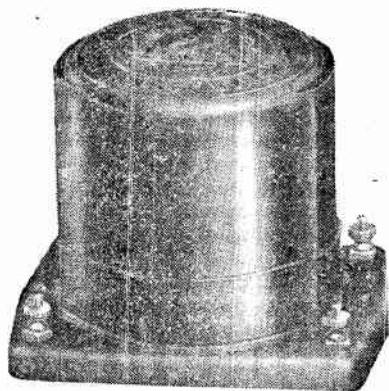
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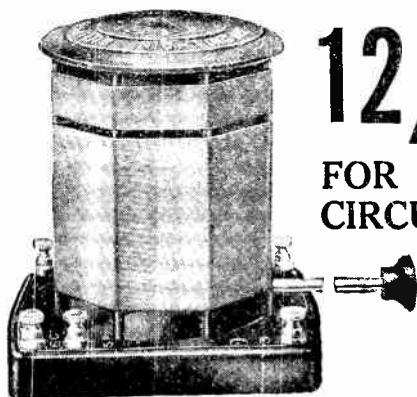
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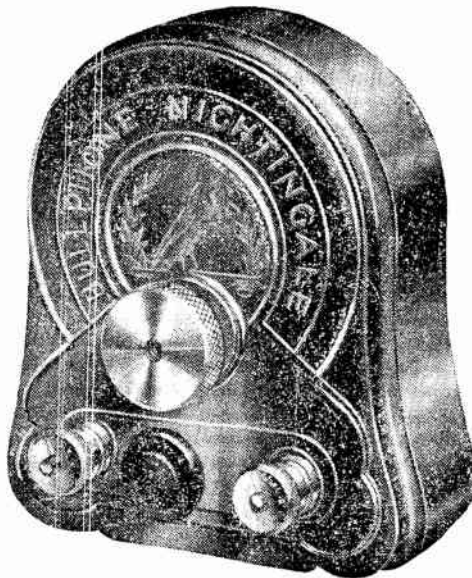
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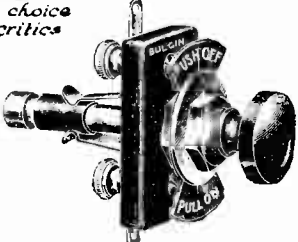


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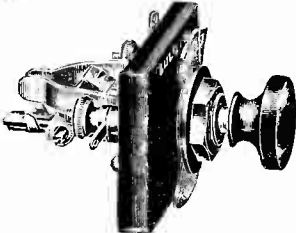
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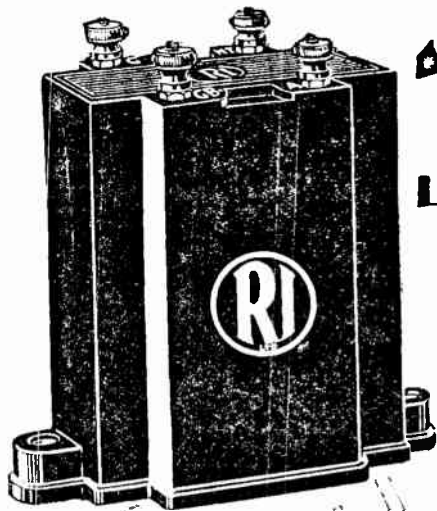


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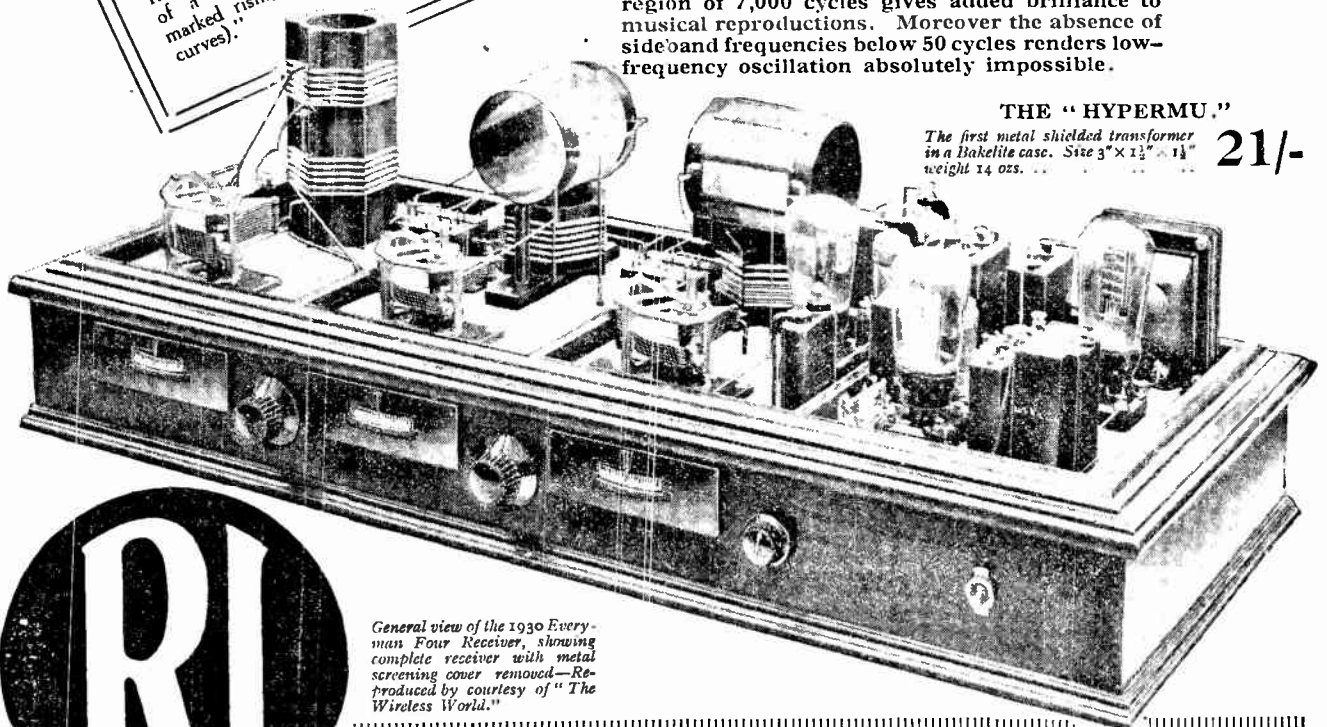
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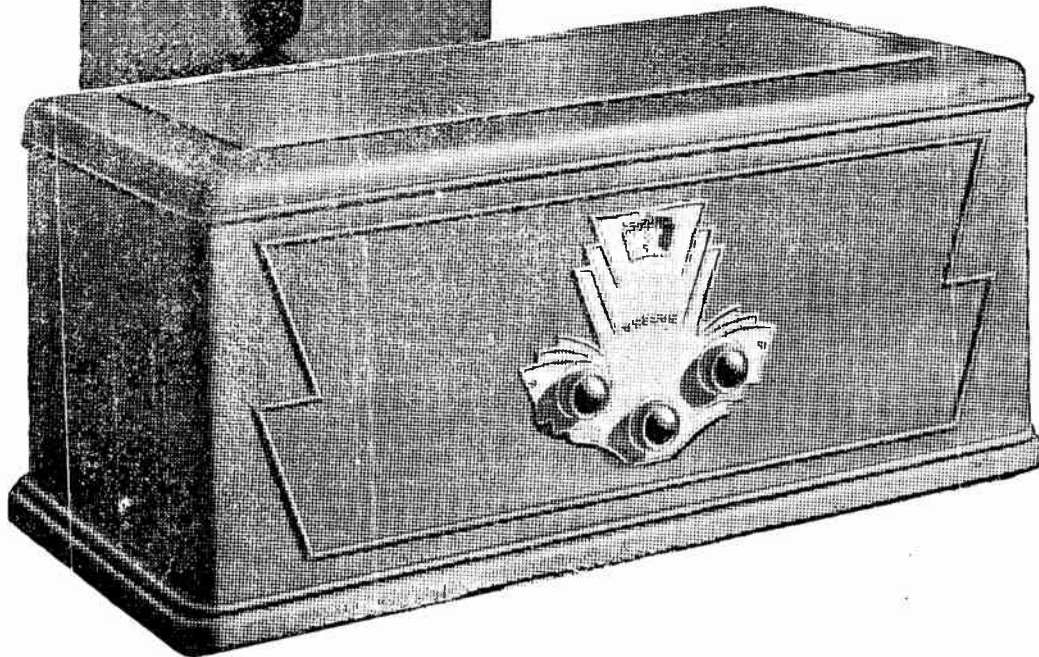


General view of the 1930 Everyman Four Receiver, showing complete receiver with metal screening cover removed—Reproduced by courtesy of "The Wireless World."

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# The Wireless World

AND  
RADIO REVIEW  
(17<sup>th</sup> Year of Publication)

No. 530.

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As many of the circuits and apparatus described in these pages are covered by patents, readers are advised, before making use of them, to satisfy themselves that they would not be infringing patents.

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## EMPIRE BROADCASTING.

A NEW and energetic Government,—a new Chief Engineer of the B.B.C. who has, as yet, not curtailed his future activities by compromising utterances on questions of B.B.C. technical policy,—and it would seem that here we have two factors which offer a brighter outlook for the prospects of a new policy in regard to Empire broadcasting.

There has been ample evidence in the past that the B.B.C. will do nothing in the direction of furthering the cause of Empire broadcasting until they are pressed into doing it, and until they are told what course they should pursue. The suggestion that an Empire broadcasting service should be started originated in a contribution in *The Wireless World*, and later, in our issue of April 27th, 1927, we said: "It is a matter for regret that we should so far have neglected to take advantage of the wonderful opportunity which broadcasting provides for communication with the outlying sections of the Empire." By May of the same year the daily Press had taken up the question, and in an

article which appeared in the *Evening Standard*, of May 5th, 1927, the comment appeared: "If a foreign station can successfully transmit to the Antipodes on a wavelength of 30 metres there seems to be no logical reason why our own Corporation should not begin to delve a little deeper into the possibilities."

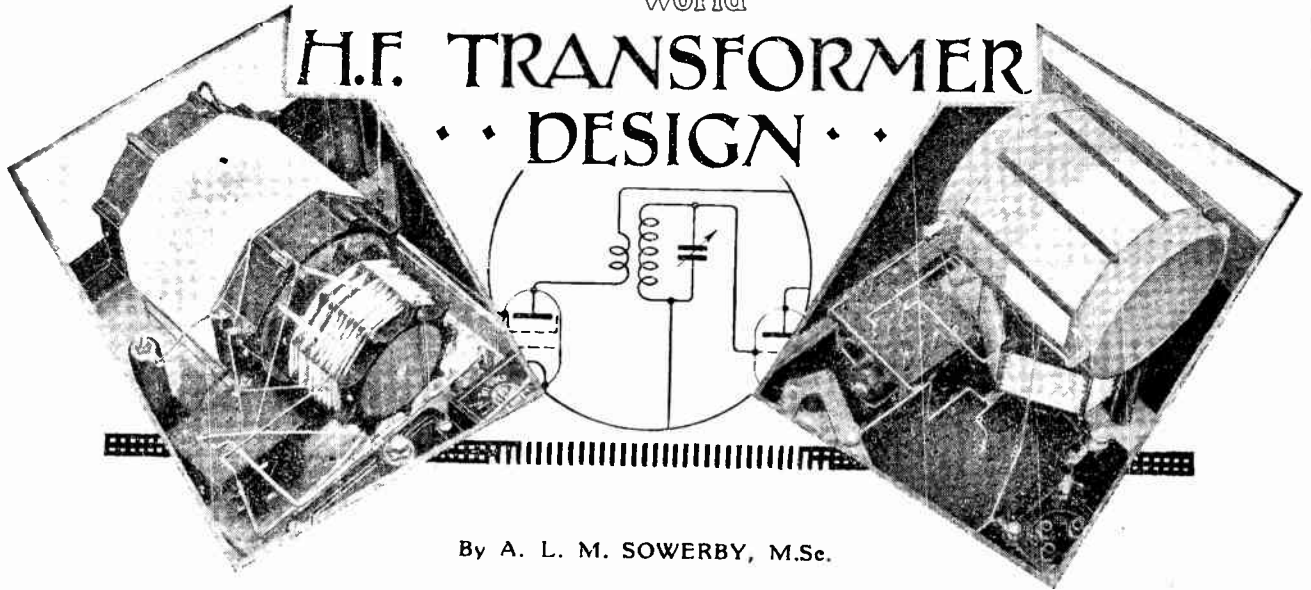
By the end of that month we were able to announce: "The efforts of *The Wireless World* to stir up interest in the subject of Empire broadcasting already show definite promise of bearing fruit in the near future. The daily Press has taken up the subject with interest, and the B.B.C. has issued a statement giving its view of the position." By June 1st, 1927, we were able to state that, "Since the publication of our last issue matters in connection with Empire broadcasting have proceeded apace. The B.B.C. has made an announcement to the effect that they are undertaking the erection of a short-wave station at Daventry."

### How 5SW Started.

In our issue of June 29th, 1927, we criticised the delay in proceeding with an Empire short-wave station and suggested a remedy. The B.B.C. had stated that they were erecting a short-wave station for experimental work at Daventry, but we drew attention to the fact that "The preliminary work of an experimental kind before the first B.B.C. stations were established was undertaken by the big wireless companies, and when a long-wave station (Daventry 5XX) was decided upon it was first established, and all experiments conducted in connection with it, at the Marconi Company's Works at Chelmsford," and we continued: "We sympathise with the attitude of the B.B.C. that it is not justified in incurring heavy expenditure on experimental work; but such experimental work, we believe, would readily be incurred by one of the big commercial companies if the station, when established in going order, and after having passed specified tests, could be handed over to the British Broadcasting Company at an agreed price."

As we know, our advice that the technical development of the Empire short-wave station should be initiated by the Marconi Company on behalf of the B.B.C. was adopted, and we still have, to-day, 5SW located at the Marconi Works at Chelmsford. But there matters have stood still, and we would now urge Capt. Eckersley's successor and his staff to show the same degree of enthusiasm for achieving results with a short-wave Empire broadcasting service as, on other wavebands, has already resulted in a success which has earned for British Broadcasting a reputation second to none.

# H.F. TRANSFORMER DESIGN



By A. L. M. SOWERBY, M.Sc.

## Adjusting Ratio to Compromise between Amplification and Selectivity.

WHEN using a triode as a high-frequency amplifier in conjunction with any reasonable tuned circuit it is quite essential, as has many times been pointed out in the pages of this journal, to use a high-frequency transformer with a secondary winding containing several times as many turns as the primary. Even apart from the question of stability it will be found that a tuned anode circuit or its equivalent provides both lower amplification and worse selectivity than a properly designed transformer.

When using a screen-grid valve with a tuned circuit of normal losses the best number of turns for the primary of the transformer is very nearly the same as the number of turns on the secondary. For example, using a screen-grid valve of A.C. resistance ("impedance")  $R_0 = 200,000$  ohms before a tuned circuit of dynamic resistance  $R = 250,000$  ohms, the optimum ratio, as given by the formula  $n = \sqrt{\frac{R}{R_0}}$  comes out at

1.11. Thus if the secondary contains 70 turns there should be  $\frac{70}{1.11}$  or 63 turns on the primary.

Now, in many cases the use of the tuned anode circuit, or its close equivalent, the tuned grid circuit (Fig. 1), would be preferred to a transformer for the sake of greater ease in wave-band switching or coil-changing. Using a transformer, there are two coils,

primary and secondary, that have to be changed in passing from one wave-band to another, so that a four-connection mount is needed if the transformer is to be changed, while if switching is adopted a two-pole switch is required, as in Fig. 2, to short out the long-wave primary and secondary when receiving on the broadcast band. With either the tuned anode or the tuned grid circuits, on the other hand, the same end is achieved by a two-connection coil or, as in Fig. 1, by a single-pole switch.

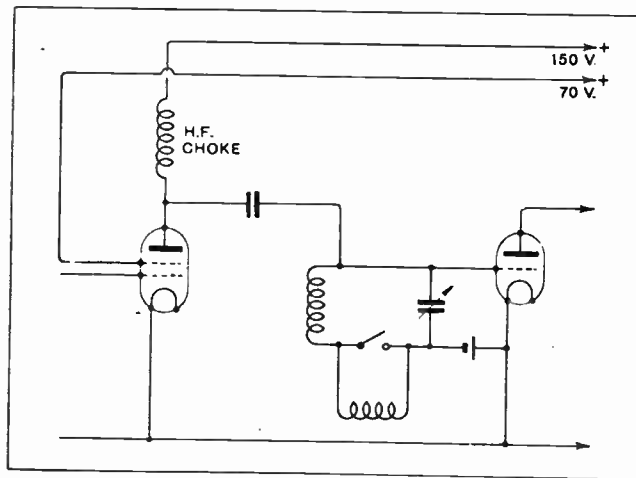


Fig. 1.—The tuned grid circuit, showing simplicity of waveband switching. Range-changing can also be achieved by changing one coil.

### Tuned Anode versus Transformer.

If, in the interests of simplicity, either of these more convenient circuits is adopted, it becomes pertinent to enquire how much of the possible amplification will be sacrificed by employing what is, in effect, a 1:1 transformer (since the same coil now does duty both as primary and secondary) in place of a transformer of the correct step-up ratio.

The appendix contains a calculation that leads to a formula, applicable to all cases, for comparing the amplification yielded by the tuned anode circuit with that given by a theoretically perfect transformer. For greater convenience in reference there is plotted in Fig. 3 a curve from which the desired numerical result can be read off at a glance for any case for which the best transformer ratio is known. In the case taken as an example, and for which the best transformer ratio was found to be 1:1, the curve shows that the

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amplification attained if a tuned circuit were substituted would be 99 per cent. of that to be expected from the transformer. Even the most enthusiastic efficiency hunter would hardly be appalled at the prospect of sacrificing one per cent. of his amplification for the sake of the extra convenience of the simpler circuit! If, however, the correct transformer ratio had been 2, implying a primary with half as many turns as the secondary, the amplification with the tuned anode circuit would be 80 per cent. of the highest attainable with the valve and tuned circuit to be used, while selectivity would also suffer by the change.

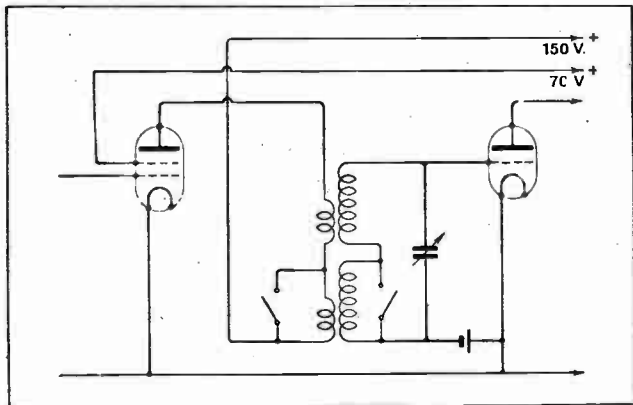


Fig. 2.—Waveband switching with a transformer. The separate switches shown would in practice be combined into a single two-pole switch.

There are, however, some other factors to be taken into consideration. With a transformer having a ratio in the neighbourhood of 1:1 the amplification, though theoretically the same as that yielded by tuned anode, is in practice found to be lower by some five or six per cent., owing to the slightly incomplete coupling between the two windings, and to the losses introduced by the wire of the primary. As a result of this, the theoretical losses due to replacing by tuned anode of a transformer of ratio anywhere between 1 to 1 and about 1.4 to 1 do not appear in practice, so that a tuned circuit having a dynamic resistance anywhere between double and half the value of the A.C. resistance of the valve will yield, with tuned anode coupling, the highest amplification that can be extracted from that particular combination of coil and valve.

**Tuned Grid Coupling.**

If the receiver is to be used with an eliminator it will usually be preferred, for several excellent reasons connected with decoupling, to use the tuned grid circuit of Fig. 2 in place of tuned anode. Although this may theoretically be considered as an equivalent of tuned anode, it is in practice a little inferior owing to the high-frequency losses introduced by the choke. As a first approximation, we may set this off against the small losses that are equally inevitable in the transformer, so that if it is desired to compare the probable performance of the tuned grid circuit with that of a transformer with a primary designed to suit the valve

and coil to be used the curve may be taken as it stands, without the small correction suggested for tuned anode. Unless some care is expended in the selection of a choke a correction in the other direction may be necessary, for the loss in amplification in such circumstances will be a good deal greater than the curve would suggest.

In the formula from which the curve was computed no restrictions were made confining the conclusions to step-up transformers. In terms of receiver design this implies that the curve covers cases such as arise with some of the very high-impedance screen-grid valves now produced, where theory indicates that a step-down transformer should be employed. Suppose we propose to follow a Cosmos AC/S valve, of nominal A.C. resistance 800,000 ohms, with a tuned circuit of dynamic resistance 250,000 ohms. Here  $\sqrt{\frac{R}{R_0}} = \frac{250,000}{800,000} = 0.56$ .

The secondary must have 0.56 times the primary turns, which is a step-down ratio of  $\frac{1}{0.56}$  or 1.79 to 1. Referring to the curve, we find that the tuned anode (or a 1 to 1 transformer) will give 85 per cent. of the amplification that would be attained if the practical difficulties of using a transformer with so large a primary had been satisfactorily overcome. While one may hanker after the lost magnification, one may at least feel consoled that the loss is not, perhaps, so great as one had thought, especially as some of the loss will be made up automatically when, in choosing the best screen-grid voltage, the A.C. resistance of the valve is adjusted to the best compromise with the coil used.

**Poor Selectivity with Screen-grid Valve.**

Those who read the appendix will notice that the expression obtained is symmetrical in  $m$  and  $n$ . This fact further extends the applicability of the curve to cover the inverse problem, which also has considerable practical interest, of finding the loss in amplification incurred through using a step-up transformer when a tuned-anode circuit is theoretically correct. We have all discovered, through practical experience, that the

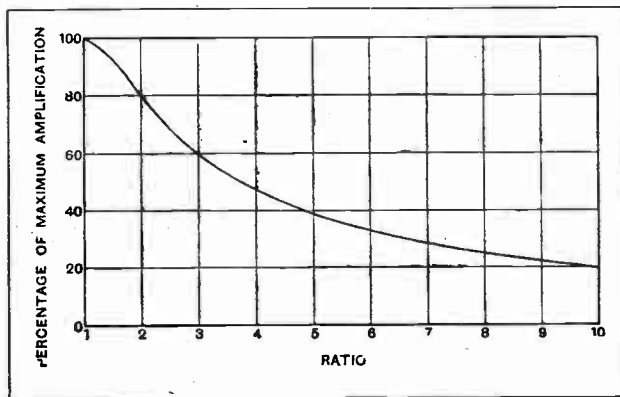


Fig. 3.—(a) When a transformer of ratio  $m$  is correct, and tuned anode is to be used, the percentage amplification yielded is read from the curve against  $m$  on the "Ratio" scale. (b) When tuned anode is theoretically correct, the curve gives the percentage amplification for a transformer of any ratio. (c) When a transformer of ratio  $m$  is correct, and one of ratio  $n$  is to be used, the percentage amplification yielded is read from the curve against  $n/m$  (or  $m/n$ ) on the "Ratio" scale. (See Appendix.)

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screen-grid valve, used with a tuned-anode circuit or its approximate equivalent, makes for a receiver of very poor selectivity, though the theoretical basis for this would appear at present to be obscure. This poor selectivity is usually combated by using a step-up transformer with a primary a good deal smaller than theory, directed towards maximum stage gain, would demand. The gain in selectivity is undoubted—but how about the loss of amplification?

**Combating Loss in Amplification.**

Provided always that the optimum ratio, as calculated from the formula, is 1 to 1, the curve will give straight away the loss of amplification incurred by using a step-up transformer of any ratio that the needs of selectivity may prescribe. To take an example, a 200,000 ohm tuned circuit after a 200,000 ohm valve needs a 1-to-1 transformer if we are legislating for amplification only, and with this transformer the amplification of the stage will be exactly half the " $\mu$ " of the valve. If we decide that a 3-to-1 transformer is necessary to provide the selectivity we require, the stage gain will be reduced, as the curve shows, to 60 per cent. of the possible value, or with a 4-to-1 transformer to 47 per cent., making the actual figure for amplification 60/200ths or 47/200ths respectively of the amplification factor of the valve.

Even when the theoretically correct ratio is not 1 to 1, this remarkably versatile curve does not admit its inability to deal with the problem reasonably simply. Instead of looking up directly on the horizontal scale the transformer ratio that we propose to use, we divide the proposed ratio by the theoretical ratio, and look up the result as before. Two cases are needed to illustrate this point fully.

First let us take the case of a valve of  $\mu=200$ ,  $R_0=200,000$  ohms, used with a tuned secondary of dynamic resistance 300,000 ohms, and a primary which, for the sake of selectivity, shall only contain one-fourth as many turns as the secondary. How much amplification do we sacrifice to selectivity, and what will be the actual amplification of the stage when set up?

The theoretically correct ratio for the transformer is not 4, but  $\sqrt{\frac{R}{R_0}} = \sqrt{\frac{300,000}{200,000}} = 1.23$ . With this an amplification of  $\frac{1}{2}\mu n = \frac{1}{2} \times 200 \times 1.23 = 123$  times would be expected. To find what percentage of this we shall attain with the 4-to-1 transformer, we divide proposed ratio by theoretical ratio, getting  $\frac{4}{1.23} = 3.25$ . Looking

up 3.25 on the curve, we find that this figure corresponds to 56 per cent. of maximum amplification, showing that, even with the 4-to-1 transformer, more than half the maximum attainable amplification is still to be had. The stage as planned will amplify 56 per cent. of 123, or 69 times.

For our second example we will take the AC/S valve again, and assume that we propose to use with it a 2-to-1 step-up transformer having a secondary of 200,000 ohms dynamic resistance. Here the valve

characteristics are  $\mu=1,200$  A.C. resistance = 800,000 ohms. Optimum ratio  $n = \sqrt{\frac{R}{R_0}} = \sqrt{\frac{200,000}{800,000}} = 0.5$  (primary twice as many turns as secondary). This would give an amplification of  $\frac{1}{2}\mu n = \frac{1200}{4} = 300$  times. But we propose, for the sake of selectivity, to use a 2-to-1 step-up transformer, with half as many turns on the primary as on the secondary. Dividing proposed by theoretical ratio we get  $\frac{2}{\frac{1}{2}}$  or 4, which corresponds on the curve to 47 per cent. of maximum amplification. We shall therefore achieve a magnification of 47 per cent. of 300, or 141 times, in our receiver.

**Incidental Reaction.**

In any case where a step-up transformer of comparatively high ratio is chosen, for the sake of enhancing selectivity, to follow a screen-grid valve, the incidental reaction due to the incomplete screening within the valve will also be reduced, as is evident from the fact that set designers often use step-up transformers for the purpose of ensuring stability. This effect, though perfectly amenable to calculation if the necessary data are to hand,<sup>1</sup> cannot be expressed in a simple curve, and is therefore not treated quantitatively in the present note. It is thought, however, that the curve given will be found useful in obtaining a rapid solution to some of the problems incidental to the design on modern lines of a stage of high-frequency amplification.

**Appendix.**

For two transformers, of ratio  $n$  and  $m$ , but otherwise identical, we have

$$A_1 = \frac{n\mu R}{R + n^2 R_0}$$

and

$$A_2 = \frac{m\mu R}{R + m^2 R_0}$$

∴

$$\begin{aligned} \frac{A_1}{A_2} &= \frac{n}{m} \cdot \frac{R + m^2 R_0}{R + n^2 R_0} \\ &= \frac{n}{m} \cdot \frac{R/R_0 + m^2}{R/R_0 + n^2} \end{aligned}$$

if the ratio  $m$  is the optimum,  $R/R_0 = m^2$

For any value of  $n$ ,

$$\frac{A_1}{A_2} = \frac{n}{m} \cdot \frac{2m^2}{m^2 + n^2}$$

$$= \frac{2mn}{m^2 + n^2}$$

$$= \frac{2m/n}{(m/n)^2 + 1}$$

$$\frac{A_1}{A_2} = \frac{2}{m/n + n/m}$$

In the curve of Figure 3,  $\frac{100A_1}{A_2}$  is plotted against  $m/n$  (or  $n/m$ ) from the above expression.

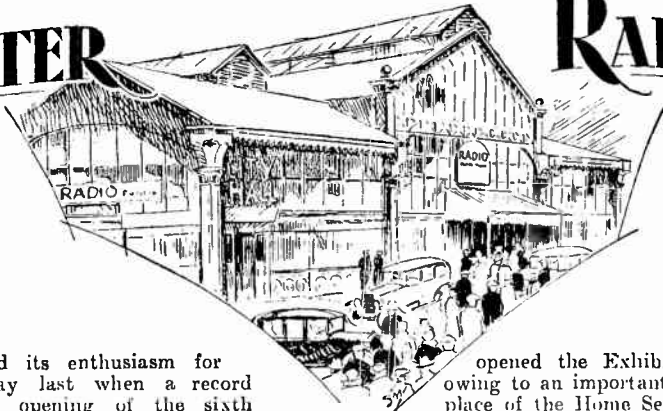
[The formula for amplification upon which this calculation is based will be found in "Radio-frequency Transformers," by N. W. McLachlan, *Experimental Wireless*, October, 1927, p. 597.]

<sup>1</sup> See R. T. Beatty, *Experimental Wireless*, Jan, 1928, p. 3.



# MANCHESTER

# RADIO SHOW



New Items  
of  
Interest —

Seen at  
the  
Stands.

**M**ANCHESTER reaffirmed its enthusiasm for wireless on Wednesday last when a record crowd attended the opening of the sixth annual *Evening Chronicle* Wireless Exhibition in the City Hall.

In a speech which must have reassured many anxious listeners, Mr. Gladstone Murray, of the B.B.C., declared that the opening of the Moorside Edge Regional Station in a year's time would provide the North with a much better broadcasting service than at present. Referring to criticism of the use of the microphone by cabinet ministers, Mr. Gladstone Murray said that neither the present nor the previous Government had misused the microphone, nor was the slightest pressure brought to bear upon the B.B.C. in the conduct of its services.

Mr. J. R. Clynes, the Home Secretary, who was to have

opened the Exhibition, was unable to be present owing to an important Cabinet Meeting. In taking the place of the Home Secretary, the Lord Mayor of Manchester (Colonel Westcott) delivered a rousing speech, in which he congratulated the organisers on the large attendance at the opening of the Exhibition, and referred to the now recognised fact that Manchester is in the forefront of radio development.

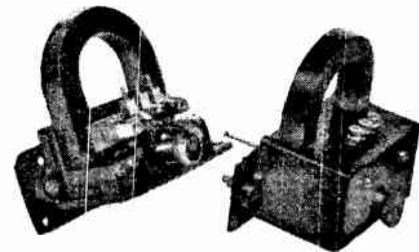
Other speakers included Captain P. P. Eckersley and Mr. Edward Living, Regional Director for the Northern Group of B.B.C. stations.

The following review of the Show forms a comprehensive survey of the "Olympia of the North." The Exhibition will remain open daily until Saturday next, October 26th. Admission is 1s. 2d., including tax.

*Apparatus exhibited at many of the stands has already been described in detail in the recent report of the Olympia Show. To avoid repetition, attention has been devoted in particular to sets and components now shown for the first time.*

## AMPLION. (32)

In addition to the new apparatus described in our Olympia Show Report, an Amplion balanced armature loud speaker drive unit—Type B.A.2—has just been



New Amplion balanced armature loud speaker unit, with and without cover.

introduced. This component will be examined with more than usual interest, as it embodies features not to be found (the writer believes) in any other unit yet available. In the first place, there are three input terminals, so arranged that the user has a choice of three distinct resistance values of 500, 700 and 1,200 ohms, corresponding to impedances at 1,000 cycles of, respectively, 4,500, 6,500, and 20,000 ohms. The high-resistance winding is stated to be specially designed for use in conjunction with a pentode output valve.

The vibrating reed is held in position between two restraining springs, one of which is adjustable, while the other is normally fixed. When sent out from the

works, this is set so that the sensitivity of the unit is fairly high, but its capabilities in the matter of power handling is not in excess of normal requirements; where exceptionally great outputs from the receiver are available, this second spring may be easily adjusted, so that the unit will be capable of delivering greater volume without "chattering"; at the same time, sensitivity will be reduced.

A removable back plate is supplied with the unit, in order that it may be mounted on a cone chassis drilled in accordance with several standard arrangements.

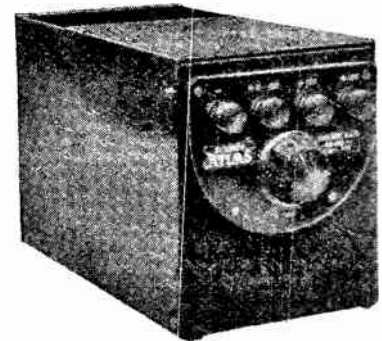
Graham-Amplion, Ltd., Slough, Bucks.  
Sales Offices, 25-26, Savile Row, London, W.1.



Aeonic portable receiver.

## ATLAS. (41)

The new Clarke Atlas H.T. eliminator, Type A.C.16, seems to be admirably suited for supplying anode current for any of the more popular circuit arrangements of the present day. It is for use



Atlas H.T. eliminator with outputs arranged to suit the most popular modern circuits.

with an alternating current supply, includes a valve rectifier, and is mounted in the neat type of olive green finished metal container which is always associated with the products of this firm.

Three voltage outputs are provided; the first, variable up to 100 volts, is regulated by means of a potentiometer, so it is quite suitable for supplying the screening grid of an H.F. amplifying valve. A fixed output of 120 volts is obtained through a series resistance, which can be

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pressed into service for preventing anode circuit interaction when suitably connected to the receiver. Lastly, there is a main output tapping rated at 150 volts, 25 mA.

This eliminator costs £4 10s.; a similar model for D.C. mains, with the same arrangement of output terminals, is sold at £3 10s.

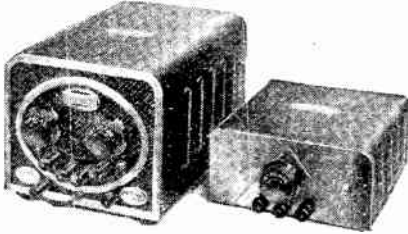
Atlas plug-in coils and Pirtoid coil formers are again exhibited, together with a new compression-type variable resistance, having a continuous adjustment between about 200 ohms and 1 megohm. This latter component is stated to be capable of dissipating 10 watts.

*H. Clarke and Co. (Manchester), Ltd., Atlas Works, Old Trafford, Manchester.*

**BEARDSALL. (2)**

This company act as agents for Regentone products, well known for "radio-from-the-mains" components and accessories.

A large number of A.C. and D.C. eliminators are being shown, also combined chargers. For those who have replaced their ordinary filament valves by the type with indirectly heated cathodes and who already have an H.T. eliminator, there is a filament transformer available at 12s. 6d., giving an output of 4 amps. at 4 volts. Separate filament and anode mains transformers have a certain amount to be said in favour of them, on the score of regulation.



Two Regentone eliminators. (Left) W2A type. (Right) W1C type. Exhibited by Beardsall.

The Regentstat is a British-made non-wire-wound continuously variable resistance with a dissipation not to exceed 10 watts. It does not contain graphite and mica, and it is claimed that it does not "pack"; the price is 7s. 9d.

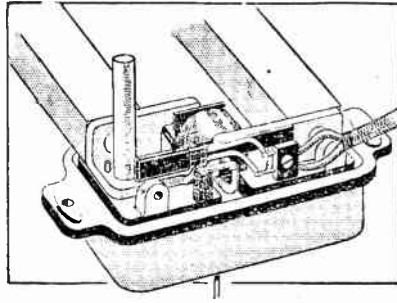
The W.I.C. eliminator for A.C. mains at £3 15s. represents good value for money. A Westinghouse copper-oxide rectifier and liberal filtering equipment are included. The total output at 120 volts is 18 mA., which is delivered from two tappings, the first of which is variable, allowing for the feed to a screen-grid valve. The W.2A eliminator is an elaborate unit, selling at £7 15s., and capable of giving 50 mA. at 160 volts. There are three tappings, two of which are variable; the unit is thus suitable for feeding a set having an S.G. valve and an anode bend detector.

A range of power chokes and mains transformers is being shown.

*W. E. Beardsall and Co., Ltd., 3-5, Victoria Bridge, Manchester.*

**BLUE SPOT. (30)**

The Blue Spot loud speaker unit is too well known to require description here.



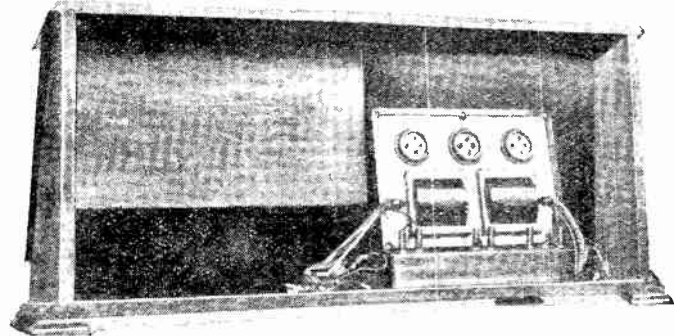
Interior of the new Blue Spot movement.

It is to be noted at the stand that a new model has made its appearance, known as the Type 65K. While externally resembling previous models, it has been modified to handle more input. The differential armature assembly provides for generous displacement and the winding has a resistance of 1,500 ohms. The impedance is given as 10,000 ohms at 1,000 cycles, and the winding has a mean D.C. current-carrying capacity of 25 mA. One appreciates the concise information given in the four-page pamphlet which accompanies the unit. This describes in a very practical way the building of two forms of cone loud speaker.

*H. C. Rawson (Sheffield and London), Ltd., 100, London Road, Sheffield. (F. A. Hughes and Co., Ltd., 204-206, Great Portland Street, London, W.1.)*

**BROWNIE. (38)**

A three-valve receiver that is proving popular is the Dominion Console which, complete with self-contained loud speaker but without valves or batteries, is priced at £9. The three-valve receiver amplifier is built as a single moulded unit

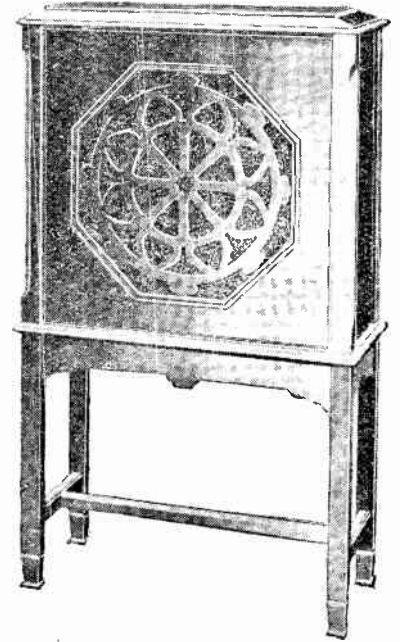


Interior view of the Brownie Dominion Console receiver showing the unit construction of the amplifier.

carrying three terminals for aerial and earth connections, terminals for gramophone pick-up, as well as a pair of terminals for connecting an external loud speaker. As the components are completely protected the back of the instrument is left open, which probably gives

an advantage as regards the performance of the loud speaker, this being a 12in. cone driven by an adjustable 4-pole balanced armature.

*Brownie Wireless Company of Great Britain, Ltd., Nelson Street Works, Mornington Crescent, London, N.W.1.*



The Celestrola loud speaker. A moving-coil model, manufactured by Celestion.

**CELESTION. (42)**

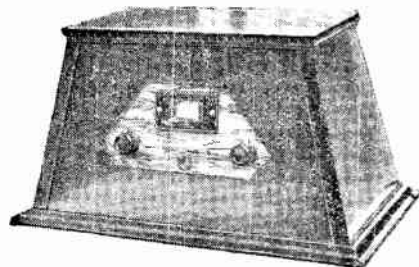
The loud speakers made by this firm need little introduction to readers. The well-known "C" type have been reduced in price; the "C12," for instance, is now £5 12s. 6d. A new series has been introduced this season, known as the "Z" class; the reinforced diaphragm

is retained, but there is a new electromagnetic movement which it is claimed gives an even wider frequency response than that in former models. The "Celestrola" (erroneously called the "Celestrola" in our Olympia report) is a moving-coil instrument capable of

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giving a very large acoustic output. There are a number of models with suitable field design for D.C., A.C., or battery operation, and in each case the speech coil is centred by three flexible metal strips.

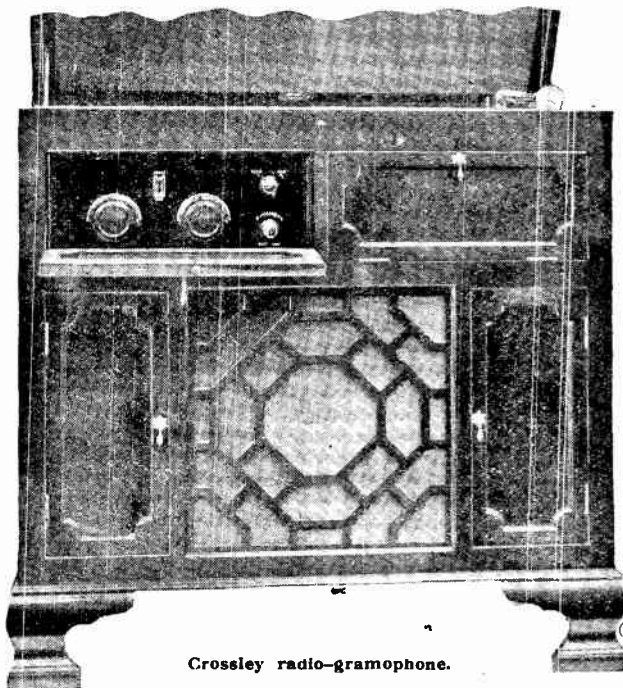
*Coleston, Ltd., London Road, Kingston-on-Thames.*



The new Chmax Chellose. A two-valve all A.C. mains-operated receiver.

**CROSSLEY. (89)**

The Croelectro 4-valve radio-gramophone, besides being a beautifully finished piece of furniture, will delight the heart of the student who follows the latest trend in radio technique. The gramophone equipment includes a B.T.H. electric motor and pick-up, the latter being switched into the detector grid cir-



Crossley radio-gramophone.

cuit. The whole set derives H.T., L.T., and bias from A.C. mains, and, except for the output stage where raw A.C. is used (a common practice to-day), valves with indirectly heated cathodes are employed. The outside aerial is coupled by a double circuit to a Mazda AC/SG valve, which in turn is coupled to the anode bend detector (a Mullard 164 V.)

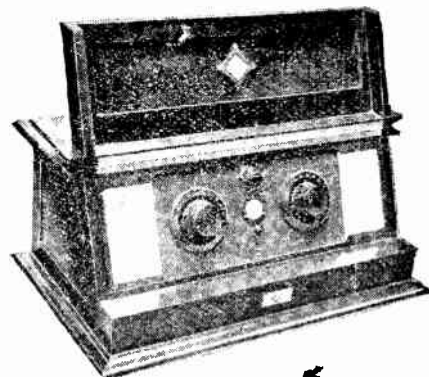
by a Litz 3in. transformer with a small step-up ratio. No reaction is employed, and the screening in three planes is very complete. The volume control for both radio and gramophone is a variable resistance across the primary of the input push-pull transformer which directly follows the detector. Two Mazda P.650 valves are coupled to a Rice-Kellogg moving-coil speaker by means of an output push-pull transformer. A separate Westinghouse metal oxide rectifier provides grid bias and avoids the necessity of elaborate anti-motor-boating devices. The instrument is built on sound lines and contains those fine points in design which make for high sensitivity and good quality of reproduction.

*Geo. Crossley and Son, Ltd., 4, South Street, Manchester.*

**DUBILIER. (33)**

Practically every component necessary for the construction of a wireless receiver is manufactured by this company. In addition to the well-known comprehensive range of condensers with both mica and paper dielectric, also anode resistances, R.C.C. units, chokes and grid-leaks, there is being marketed this season a series of dry-cell H.T. batteries known as the "Superior" and "Supreme" types. The recommended load for the former is 6, and the latter 16mA. The life curve submitted by the makers shows a drop to

anode bend principle, reaction is used and applied to the interstage coupling. The valves in order are AC/SG, AC/HL, and AC/P, and the rectifier is a U.30/250. A purchaser of the D.C. model can have it converted to A.C., when his mains supply is changed, for the sum of £6.



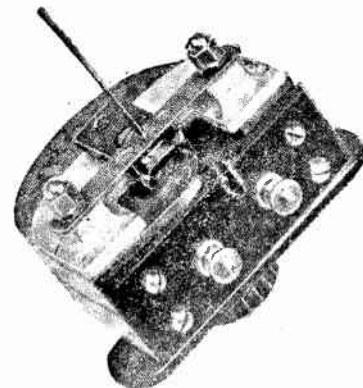
Dubilier 3-valve receiver for A.C. mains.

*Dubilier Condenser Co. (1925), Ltd., Ducon Works, Victoria Road, North Acton, W.3.*

**DYNAMAG UNITS. (121)**

Among the components shown is a new cone unit working on the balanced-armature principle, and a large range of Mansbridge condensers of high-voltage test for eliminators.

A series of well-designed permanent magnets made by Swift Levick are exhibited. There are also a number of grid



Cone unit shown by Dynamag Units, Ltd.

leaks and anode resistances, having wire end connectors, thus enabling these components to be suspended in the wiring without the use of holders and clips.

*A. M. E. Sherwood, 58, Hatton Garden, E.C.1.*

**EDISWAN. (27 and 28)**

(Incorporating B.T.H. and Metro-Vick.)

In view of the fact that this stand contains the radio products of three well-known firms, there are such a large number of sets and components that space

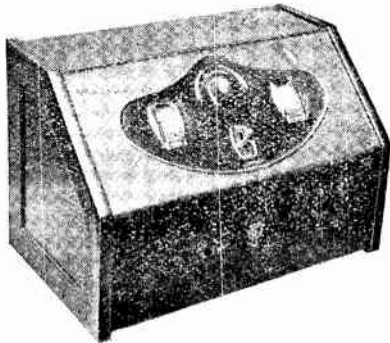
only 0.8 volts per cell after 1,000 hours. The 108 volt battery of the "Superior" series, for instance, costs 12s. 9d., whilst the 60-volt "Supreme" model is 13s. 6d.

The new all-mains 3-valve receiver can be obtained for D.C. or A.C. supplies at £25. The aerial and interstage inductances are toroidal transformers, and although the detector works on the

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forbids the description of more than a few. The reader is referred to the Olympia Stand-to-Stand report. The new Mazda valves, which have remarkable characteristics, are being exhibited. Perhaps the most striking member of this series is the AC/SG valve, in which the inter-electrode capacity has been lowered to what would appear to be the irreducible limit of 0.0045 mmfd. Such minute feedback occurs through the valve that the coils on either side of it (i.e., grid and anode) can be made of so small a high-frequency resistance that the valve does not oscillate until a stage amplification of about 250 times is attained. This figure, when compared with a maximum of about 80 with screened valves of last year, is very striking.

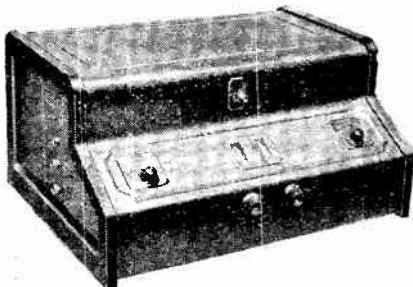
The 215 S.G. is a battery-fed screened valve with which it is possible to obtain a stage amplification of about 150 with stability if the external screening is carried out with great care.



Ediswan 3-valve battery receiver.

The two-volt battery valves, one of which has a mutual conductance approaching 4 mA. per volt, should prove popular both for the portable set and for the man who has to carry his L.T. accumulator any distance to the charging station. There are new Mazda pentodes and a range of indirectly heated cathode valves for every position in a receiver.

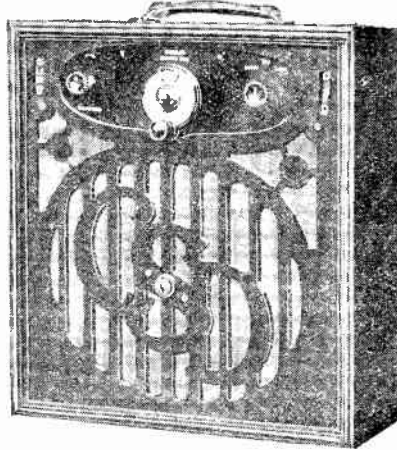
The all-mains receivers merit the careful attention of prospective set buyers, as their design is the result of the combined resources and experience of the Ediswan Company, the B.T.H. Company, and Metro-Vick Supplies. A three-valve battery-operated receiver, selling at the



Ediswan 3-valve all-electric receiver.

popular price of £9 12s. 6d., has interesting points in design and incorporates the Mazda 215 S.G. valve.

Edison Swan Electric Co., Ltd., 123-125, Queen Victoria Street, E.C.4.

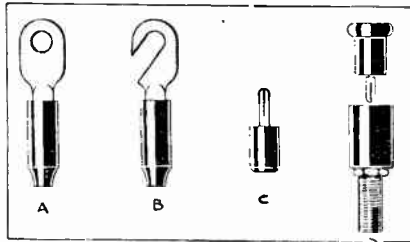


Dunham transportable receiver.

**EELEX. (101)**

Besides distributing the products of well-known radio manufacturers, this company exploits a number of components of their own. A shock-proof eliminator terminal in which contact is made within a countersunk insulator should find considerable application now that so much attention is being paid to all-mains equipment.

There is a treble-duty terminal to take every variety of spade and pin connector; also a series of split-eyelet connectors so



Eelex connectors. (A) Eyelet type. (B) Slotted eyelet. (C) Midget wander-plug. (D) Shock-proof eliminator terminal.

fashioned as to make it difficult for the terminal and the wire leading to it to part company, even if the holding-down screw has become loose.

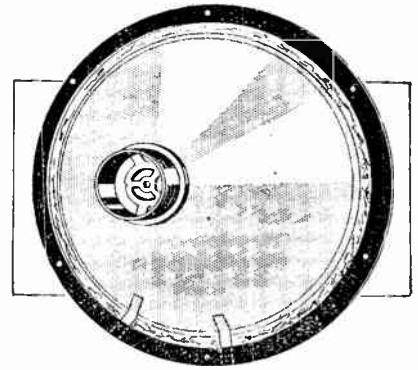
For portable sets, where space is limited, a midget wander plug being shown should prove useful.

J. J. Eastick and Sons, Eelex House, 118, Bunhill Row, E.C.1.

**EPOCH. (103)**

Since the Olympia Show an addition has been made to the range of Epoch loud speakers by the production of the Model 99. The usual form of edge suspension is here dispensed with, and instead locating pieces are provided. The

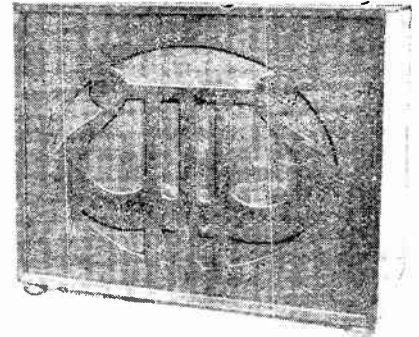
freedom thus obtained largely removes resonances within the cone itself. The surround is, however, effectively sealed



The new Epoch free-edge cone as fitted in the Model 99 loud speaker.

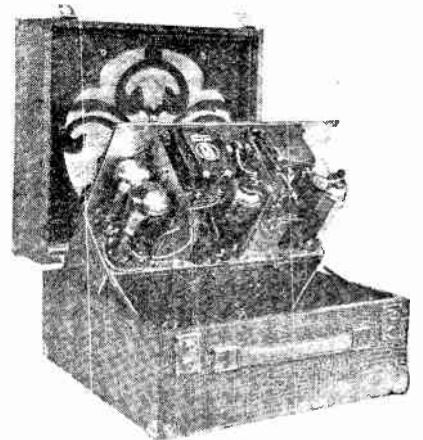
to prevent air leakage between the two faces of the diaphragm.

Moving-coil loud speakers of the permanent magnet type and remarkable for



A popular priced loud speaker cabinet with grille at back and front (Epoch).

their high flux density are attracting the attention of those who seek quality but have no mains supply.



The well-arranged interior of the Metro-polis portable. It is a five-valve super-heterodyne produced by the Empire Electric Company.

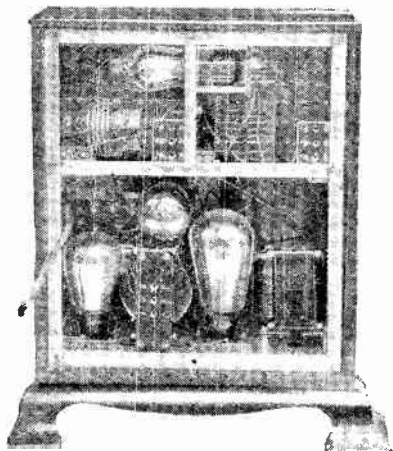
**Manchester Radio Show.—**

Loud speaker cabinets in various grades with or without loud speaker are available in a wide range of prices covering all requirements.

*Epoch Radio Manufacturing Co., Ltd.,  
3, Farringden Avenue, London, E.C.4.*

**FERRANTI. (52, 53 and 115)**

In view of the recent detailed description given in respect of the range of Ferranti products shown at Olympia, mention need only be made here of new items of interest.



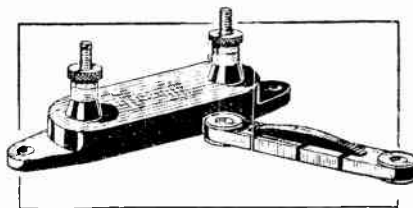
Interior view of the new Ferranti mains-operated receiver.

The Ferranti A.C. mains receiver Model 31, while now being shown in a new and attractively finished form of cabinet, may be carefully inspected as to its interior make-up. Liberties have not been taken in the direction of cheapening the construction of this complete receiver, and the specialised Ferranti components are of standard form. In the tuned circuits associated with the indirectly heated screen-grid valve we find coils carried on slotted ribbed formers. An interesting detail is the adoption of a Bowden wire coupling to rotate the reaction coil. As a long-range receiver leaky grid detection is provided, maximum amplification being produced by the use of the newly introduced AF6, an intervalve transformer with a 1 to 7 ratio, and which is actually larger than the well-known AF5. The output valve is a P.625, and is associated with a double ratio transformer permitting of the use of loud speakers having either high or low resistance windings. Grid biasing is obtained by an independent Westinghouse rectifier, the H.T. supply being provided by a valve rectifier, the U.5. Volume control is by adjustment of grid bias of the H.F. valve. A safety switch disconnects the current when the instrument is opened. The consumption from the mains is about 50 watts, and the undistorted signal output rating is 700 milliwatts.

Small mica condensers and high resistances of the grid-leak type now make

their first appearance. The leaks, which are made of high resistance material, have a current-carrying capacity up to about 5 mA., and are available in the resistance values of 20,000 ohms to 5 megohms. These resistances, which are not easily broken, are accurately adjusted by reducing the cross section. Their price is 1s. 6d.

Apart from the new 1 to 7 intervalve transformer, which is specially intended



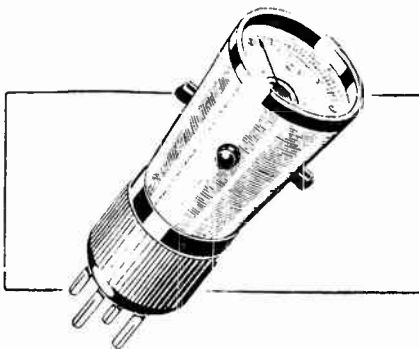
Ferranti grid condenser and leak.

for use following leaky grid detection, there are four eliminator transformers. Type P.10 gives (a) 4 volts 4 amps., (b) 6 volts 3.2 amps., (c) 45 volts at 5 milliamps. This transformer meets the popular demand for converting a set for mains operation. Price 32s. Type B.V.4, giving 250 volts at 50 milliamps when used with the U.5 rectifier. Price 25s. Type P.9, which, with a Westinghouse rectifier type A.3, will give a battery charging rate of 1 ampere, and is suitable for energising the field coil of a moving-coil loud speaker. Type M.3 has been introduced to suit the Westinghouse rectifiers types H.T.3 and H.T.4, and in connection with the condenser voltage doubling arrangement gives respectively 120v. 20 mA. and 180v. 30 mA.

*Ferranti, Ltd., Hollinwood, Lancashire.*

**FONTEYN. (130)**

This firm are agents for several French and Belgian manufacturers, and are showing a quantity of apparatus which is of interest as being representative of present-day practice in those countries. The "Radio Controller" is a neat two-range voltmeter mounted on a standard valve base, the pins of which can be inserted in any of the valve sockets of a receiver.



Fonteyn's "Radio Controller": a 2-range voltmeter with valve socket fitting.

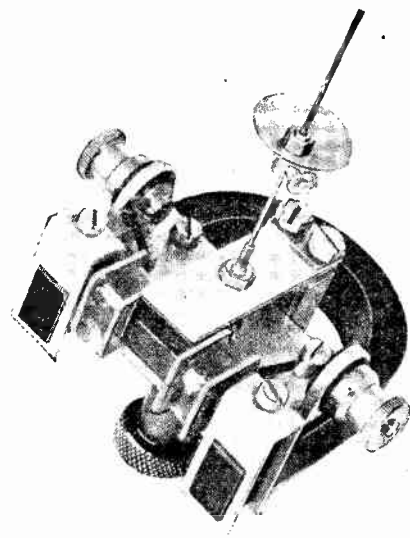
Push-button switches are so arranged that low-tension or high-tension voltages may be checked: of course, the reading of the latter will be affected by the ohmic resistance of whatever coupling component may be connected in the anode circuit, and will only be correct when dealing with a high-frequency amplifier. Nevertheless, any deflection of the needle will show continuity, and an accurate indication of voltage can readily be obtained if the anode coupling component is temporarily short-circuited, should it be of sufficiently high resistance to warrant this course.

A number of inexpensive low-frequency transformers, sold under the trade name of "Cifel" at prices between 3s. 6d. and 8s. 6d., are also exhibited, together with ebonite panels, also exceptionally low in cost.

Messrs. Fonteyn are agents for meters made by the firm of Guerpillon and Sigogne, of Paris, and show a number of these instruments, both of the moving-iron and moving-coil type. There is also a gramophone pick-up supplied complete with adaptor for insertion into a detector valve socket: this instrument is provided with a variable damping control.

Other exhibits include a trickle charger with an indicating lamp acting as a fuse, in which a Westinghouse metal rectifier is used, and also a larger model for service stations. There is also a combined H.T. and L.T. charger with valve rectification, selling at £4 10s. complete.

*Fonteyn and Co., Ltd., 2, 4, 5 and 6, Bradford Mews, Baker Street, London, W.1.*



G.E.C. Stork loud speaker unit.

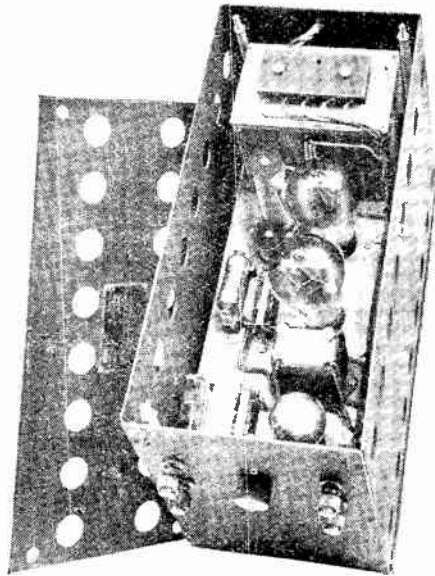
**G.E.C. (48)**

Apart from the new Osram valves which have recently been described in detail in these pages, the principal exhibit is the Screen-Grid Four Portable. The model shown is finished in Cambridge blue, and its equipment includes the use

## Manchester Radio Show.—

of both screen-grid and generous output valve. This portable is priced £24 3s.

For those wishing to build an inexpensive loud speaker there is the Stork loud speaker unit as fitted in Gecophone loud speakers. An interesting device shown is a power amplifier unit for use with A.C. supply. This is intended for connection to the radio receiver in lieu of an existing amplifier or, alternatively, it will convert a standard gramophone to one of the electrically reproducing type. It is all-metal enclosed and has a particularly generous output valve, the L86A, while its rectifier is the U.8. This mains-operated amplifier is intended for operating a moving coil loud speaker.



Mains-operated amplifier for use following a detector valve or gramophone pick-up (Gecophone).

Home constructors are showing a keen interest in the Music Magnet receiver, a detailed description of which recently appeared in these pages.

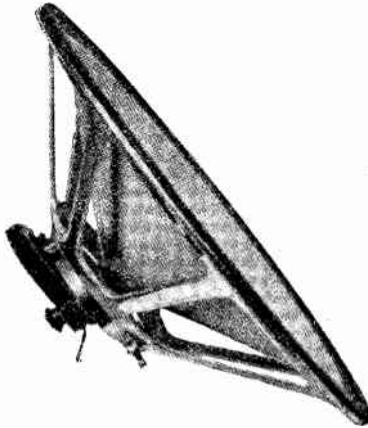
General Electric Co., Ltd., Magnet House, Victoria Bridge, Manchester. (Magnet House, Kingsway, London, W.C.2.)

## GILMAN. (113)

With the help of such labour-saving components as are shown by this company, it is possible for the home-constructor to make a complete loud speaker in a comparatively short time and for a small outlay. There are available two aluminium chassis, one with an 18in. "Power" cone, and another with the standard 11½in. cone, to which can be fixed by three-point suspension a plate so shaped as to be attached easily to all the well-known cone units on the market. The three-point attachment allows perfect centring. The periphery of the metal chassis is drilled to enable the complete unit to be screwed to a

baffle or cabinet, and a felt washer is interposed to reduce the chances of resonance. The edge of the cone floats on a supple fabric suspension. The smaller cone unit with adjustable plate sells at 15s. 6d., and the large power model at 22s. 6d.

J. S. Gilman, 63, Basinghall Street, E.C.2.



Gilman 18-inch cone assembly.

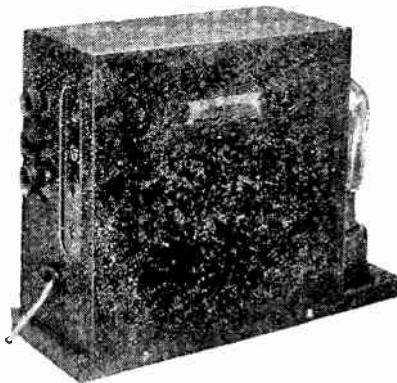
## GOLSTONE. (16)

As in previous years, a large part of this stand is devoted to radio wire and battery cord assemblies; among the latter is a connecting cable just produced for the Mullard "Orgola" receiver.

The Golstone five-valve portable set embodies a fairly conventional 2-v-2 circuit, but its frame aerial is built into a hinged flap forming a rear cover, so that it can be set for direction without swinging the receiver as a whole.

A combined H.T. and L.T. eliminator has just been introduced. This instrument, which is for operation on A.C. mains, makes use of a Philips double-wave rectifying valve, and has rated filament and anode supply outputs of, respectively, 2½ amps. at 4 volts, and up to 150 volts at 35 milliamperes.

The Golstone radio-gramophone includes a Mullard "Orgola" receiver (A.C. mains model), an electric turntable motor,



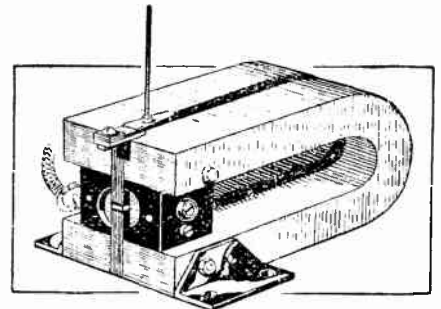
Golstone H.T. and L.T. battery eliminator.

B.T.H. pick-up, and Mullard loud-speaker. There is an extra control for regulating the volume of gramophone reproduction.

Ward and Goldstone, Ltd., Frederick Road, Pendleton, Manchester.

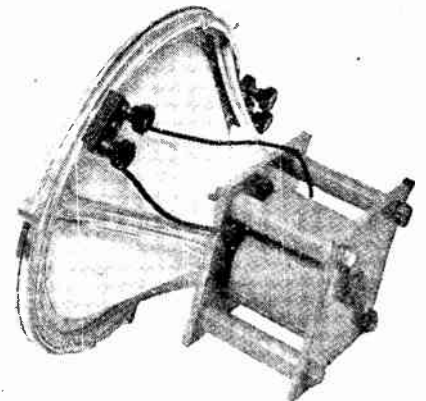
## GOODMANS. (84)

Several entirely new models are to be seen, in particular the "Invincible" moving coil loud speaker which follows the end-plate form of construction. By this means it is all-steel built, permitting of high flux density, while the winding is well ventilated. With the use of a particularly small gap and positive centring adequate flux density is obtained when a winding requiring only 50 mA. at 100 volts is used. Such a winding may serve as a smoothing choke.



Goodman balanced-armature loud speaker movement. The adjustable feet provide an easy fixing.

The Goodman differential loud speaker movement is unique in the use of a pair of particularly large magnets of generous cross-section. Four extension poles are presented to the neutral armature, which is surrounded by a 2,000-ohm hobbin. The drive is transmitted to an auxiliary reed. Adjustable and reversible feet



New type Goodman moving coil speaker.

permit of the unit being mounted in a variety of positions to suit most requirements. The price is 29s. 6d.

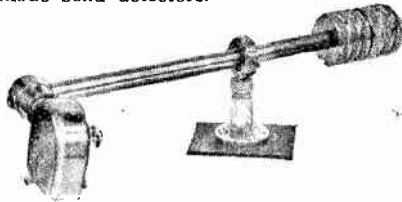
Goodmans, 27, Farringdon Street, London, E.C.1.

## GRAMO-RADIO. (83)

The chief exhibits on this stand, besides a series of radio gramophones, are

**Manchester Radio Show.—**

a range of "Coruso" reed-driven cone loud speakers built into attractive cabinets. There are also a number of eliminators for A.C. mains, provided with voltage tappings suitable for the critical requirements of screened valves and anode bend detectors.



Gramophone tone arm with adjustable balance weight, shown by Gramo-Radio Co.

A gramophone pick-up and tone arm with adjustable balance weight which can be locked, should assist in reducing record wear.

*Gramo-Radio, Ltd., Commercial Works, Church, Accrington.*

**GREEN and CO. (75)**

A range of Sure-a-lite dry batteries is shown on this stand. High-tension units are made in four capacities, the largest being capable of supplying currents up to 25 mA. Grid bias batteries of conventional dimensions are manufactured, as well as units with voltages up to 30, in square form, which are more economical of space, and consequently suitable for mounting inside the cabinet of receivers with high-power output valves demanding a considerable negative bias.

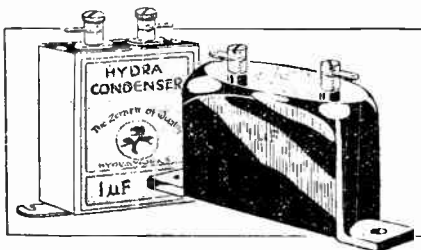
The new Telsen L.F. transformers, described in our Olympia Show Report, are also exhibited, as are several well-known sets in which these components are included as standard.

There is also a display of the new Cleatron valves with improved coated filaments.

*Green and Co., 94-96, Hurst Street, Birmingham.*

**HOLZMAN. (57)**

With the large stage amplifications now obtainable with screen-grid valves, it is becoming more and more evident that con-

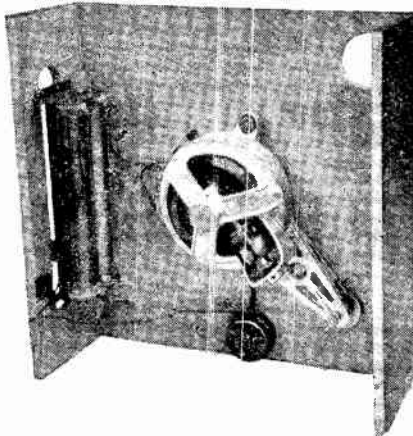


(Left) One mfd. Hydra condenser in metal case. (Right) Non-inductive condenser in bakelite case (Holzman).

densers to be used in decoupling schemes must have a low high-frequency resistance, that is to say, a good power factor. Thus, it is interesting to note that

this firm are showing a range of Hydra paper-dielectric condensers with capacities from 0.001 to 4 mfd. with non-inductively arranged foil. In bakelite cases and with a working voltage of 240 D.C., the price of the lowest capacity condenser already referred to is 1s. 6d., while the 4-mfd. type is 5s. Where surge voltages considerably greater than the nominal voltage of the supply mains are encountered, particularly in D.C. eliminators, the Hydra series of condensers tested at 1,000 volts D.C. for an A.C. working voltage of 300 should find considerable application. The 2-mfd. condenser of this type retails at 4s. 9d.

There is being shown a vertical scale double-reading volt milliammeter. It is a moving coil instrument with a resistance of 250 ohms per volt and the scale readings are 0.240 volts and 0.60 mA. Besides having a minimum projection from the front of the panel, the meter should harmonise with thumb control tuning dials. The price is 22s. 6d.



Insol universal electric gramophone motor, shown on Holzman's Stand.

The Insol gramophone motor and turntable for A.C. mains contains a squirrel-cage motor which runs at 1,750 r.p.m. The drive is by rubber belt from a tapered spindle, and the speed is made variable by  $\pm 6$  r.p.m. by means of a control which causes the belt to run on a larger or smaller diameter of the taper. It is claimed that the running is particularly silent. The price is £6. There is also a universal model for D.C. or A.C. supplies

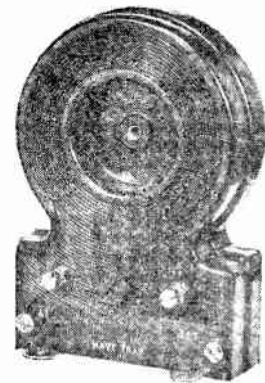
Besides tapped condenser blocks, which it is now appreciated are more economical where eliminator smoothing filters are concerned, there is being marketed a double buffer condenser of  $2 \times 0.1$  mfd. for shunting across the secondary of a mains transformer. Tested at 1,000 volts A.C., this component sells at 3s. 3d.

*Louis Holzman, 37, Newman Street, W.1.*

**IGRANIC. (50)**

New components introduced since the opening of the Olympia Exhibition include a wavetrap, of which the coil and

variable condenser (the latter of the compression type) are built into a brown bakelite moulding provided with feet so that it may be secured to the baseboard of an existing receiver.

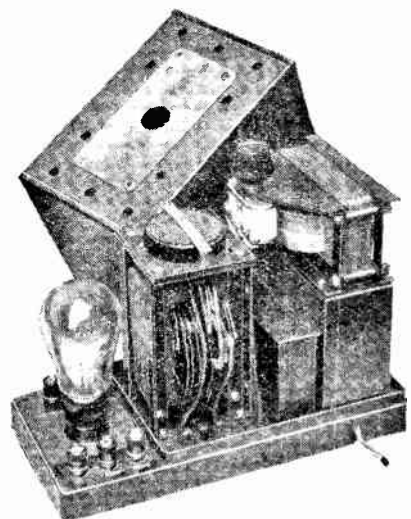


Igranic wavetrap.

The "Megastat" variable high resistance has been modified to render it more suitable for mounting in radio gramophones or for controlling volume in sets fitted for gramophone reproduction; it is now available in types having maximum values of 50,000 ohms, 500,000 ohms, 1 megohm, and 5 megohms.

Indigraph vernier dials are now fitted with a reduction gear giving a ratio of 15:1; the 4in. pattern has a slightly higher ratio.

A new battery charger, incorporating the Igranic-Elkon metal rectifier, has been introduced; it delivers current up to 3 amps. The same rectifier, working in conjunction with an electrolytic condenser, is used in an L.T. supply unit, which is suitable for supplying up to seven valves rated at 4 or 6 volts. Valve rectification is included in the new Igranic H.T. unit, which also supplies



Igranic H.T. eliminator, which also supplies current for the heating elements of A.C. valves.

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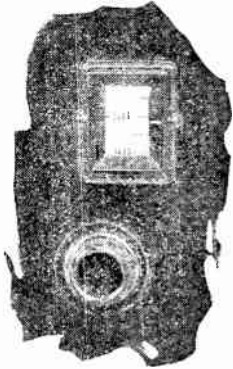
raw A.C. at 4 volts for feeding the heaters of A.C. valves.

The "Q.M.B." switch is intended for mains-fed receivers; it has wide-break contacts, heavy insulation, and an ebonite control knob.

*Icyonic Electric Co., Ltd., Elstow Works, Bedford.*

**ISOMONO. (106)**

A wide range of "Iso" dials are exhibited on this stand, including several new models. Some are provided with a catgut band drive, and several patterns have an illuminated scale; in one case the lamp is controlled by a neat and inconspicuous switch forming part of the

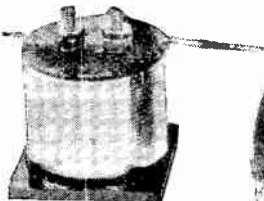


A neat Isomono drum dial with knob control.

escutcheon plate. These dials are manufactured in both drum and disc types, double and single, and their appearance when fitted is in keeping with modern tendencies.

There is also a very wide selection of imported components at most attractive prices. One of the most interesting is a wire-wound potentiometer of 30,000 ohms resistance, selling at 6s. 3d. This should be most useful in regulating eliminator voltage output, particularly for screen-grid valves.

Wave traps are coming into prominence, and for the more efficient type it is customary to use a small inductance and a comparatively large value of tuning capacity. As variable condensers of more than 0.0005 mfd. are not readily obtainable, it is convenient to add a fixed



Some compact components shown by Haw & Co. From left to right: air-dielectric fixed condenser, 30,000 ohm potentiometer, and 0.0003 mfd. variable condenser.

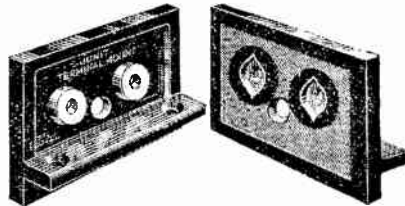
shunt capacity, and the air dielectric components shown by this firm would appear to meet the case admirably. They are made in capacities of from 0.00005 to 0.001 mfd., and are extraordinarily compact and but little more expensive than the better type of mica-dielectric condensers.

Other components on show are chokes power transformers, very small condensers, both with air and paxolin dielectric, fixed condensers, and trickle chargers with Kuprox rectifiers selling at 30s.

*Haw and Co., Ltd., 20, Cheapside, London, E.C.2.*

**JUNIT. (70)**

A neat push-pull switch for metal panels is being shown. The spindle contains two bow-springs, which ensure good electrical contact without unduly impeding the movement of the plunger. There is another model available, in



The Junit vertical terminal mount with horizontal fixing flange.

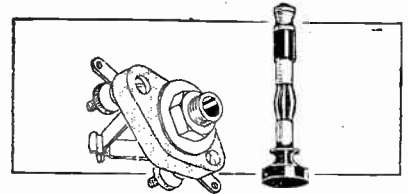
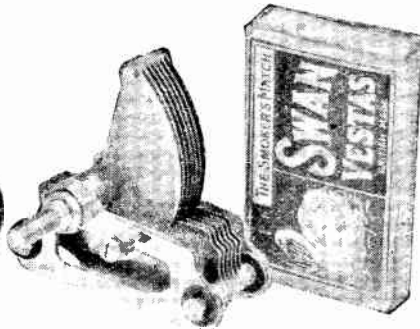
which all contact points are insulated from the spindle and fixing bush. The price of these switches, one of which is specified for the Mullard Orgola set, is 1s. 6d. A vertical terminal mount, sold at 8d., which has a right-angled drilled flange, is arranged to screw into the horizontal surface of a baseboard, and thus the danger of splitting is avoided.

There is also a universal 5-pin valve holder and a multiple contact switch.

*Junit Manufacturing Co., Ltd., 2, Ravenscourt Square, W.6.*

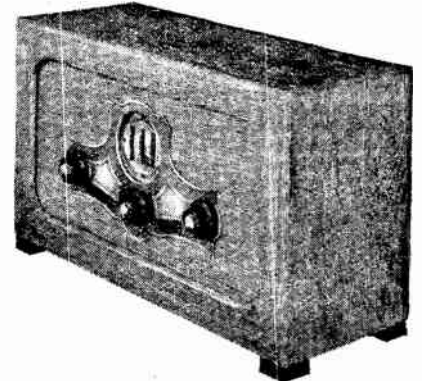
**KOLSTER-BRANDES. (74)**

For the new season this company has embarked upon the manufacture on a large scale of popular-priced receivers. As an example, the K-B 161 can be said to give good value for money. It is a 3-valve receiver entirely driven from



Junit push-pull switch. Note the bow-springs on the spindle.

A.C. mains. A double-tuned circuit is employed, which makes for good selectivity, and greater sensitivity is obtained by the use of reaction on to the secondary of the high-frequency transformer, which links the AC/SG valve to the leaky grid detector. On the low-frequency side there is a transformer coupled pentode, the filament of which is heated by raw A.C. The set is well screened and decoupled. The feed to the screen of the SG valve is through a potentiometer, which is in keeping with the best practice. A valve rectifier is used for the anode supplies and the "free" positive grid bias is obtained from a potentiometer across the H.T. Thumb controls are used and the receiver is housed within a well-finished oak cabinet. The price is £17 10s., including valves and royalties.



K-B 163 receiver; a Kolster-Brandes product at a popular price.

A battery model (the K-B 163), on the same lines, sells at the moderate figure of £10 15s. complete.

*Kolster-Brandes, Ltd., Cray Works, Sidcup, Kent.*

**LOTUS. (31)**

A carefully prepared folder showing the construction of the Lotus S.G.P. receiver is attracting interest. Its large constructional drawings show in precise detail the building of a well designed three-valve set. Wiring is simplified by full scale drawings showing the bending of every lead. The circuit is in every way up to date, including all those refinements appreciated by the enthusiast.

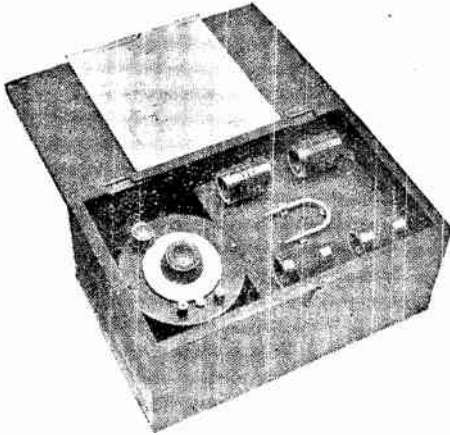
*Garnett, Whiteley and Co., Ltd., Lotus Works, Mill Lane, Liverpool.*



**Manchester Radio Show.—**

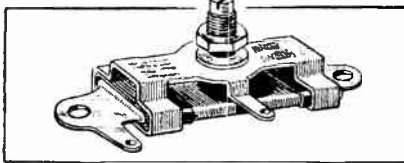
**CLAUDE LYONS. (96)**

The products exhibited at this stand principally include specialised components for the transmitting amateur, practical laboratory test gear for the manufacturer as well as generous amplifier equipment. The apparatus is mainly that of General Radio, together with a selection of components from the American market.



General Radio frequency meter on the stand of Claude Lyons, Ltd. This model has been specially introduced to meet the Post Office requirements governing the issue of transmitting permits.

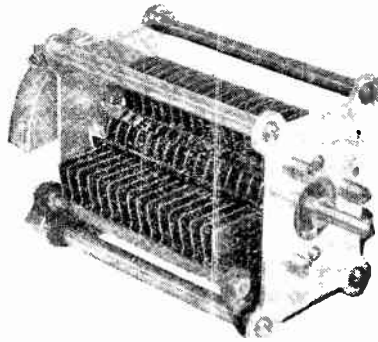
For the transmitting amateur faced with the difficulties of conforming to Post Office requirements a special type of absorption wavemeter has been introduced. This instrument, type 558P, has



The "Hum Dinger" an adjustable potential divider for use in the construction of mains-operated sets. Shown on the stand of Claude Lyons, Ltd.

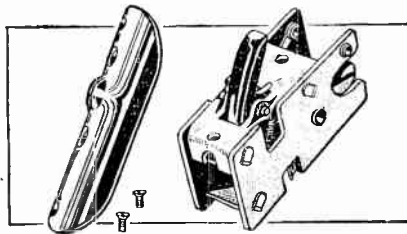
been approved by the Post Office, and will, in use, permit of an accuracy greater than the stipulated  $\pm 0.25$  per cent. Its five scales have optimum frequencies of

5, 10, 20, 40 and 80. The price is £5. This instrument includes a special condenser which is also available as a com-



General Radio transmitting condenser. The losses have been reduced to a minimum to permit of its use on very short wavelengths. (Claude Lyons, Ltd.)

ponent. By arranging for only a few of the plates of this condenser to produce a change of capacity it gives a particularly open scale over a limited range while maintaining a suitable L/C ratio. For the transmitting enthusiast also special condensers are shown primarily designed to



A useful catch switch for breaking the supply circuit on opening a mains connected receiver. (Claude Lyons, Ltd.)

possess minimum losses at the ultra high frequencies. These are specially intended for use in transmitting circuits, and are available in three capacities, 0.00005 mfd., 0.0001 mfd., 0.00025 mfd., the last mentioned selling at 35s.

Small components include Centralab and Clarostat products, while among

bigger equipment is a specimen Pam speech amplifier.

Claude Lyons, Ltd., 76, Old Hall Street, Liverpool.

**M.P.A. (21 and 22)**

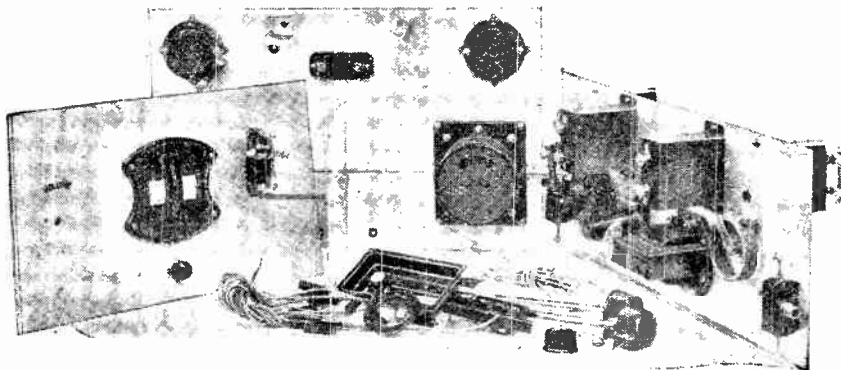
The "Eclatropé Exchange," an ambitious radio-gramophone combination, may perhaps best be described as a "next year's set." It includes an ingenious arrangement whereby a series of circuits tuned to any one of four stations—chosen by the purchaser—may be put into operation by manipulation of the appropriate switch. There is clear evidence that this simplified method of tuning already appeals to many listeners, and it is bound to be still more popular when the new scheme of alternative programme transmissions comes into being. It may be urged that the buyer of a comparatively elaborate set will think himself justified in demanding a wider choice of stations; this objection is adequately met, in the case of the receiver in question, by providing a switch for disconnecting the automatic tuning device, thus allowing of operation in the normal manner.

Indirectly heated valves are fitted in this set, which is intended for an A.C. supply; the variable condensers tuning the circuits associated with its two H.F. couplings and the frame aerial are completely "ganged." The detector is followed by two L.F. stages, with parallel output valves. A moving coil loud speaker is built into the base of the large gramophone-style containing cabinet, which also accommodates the medium- and long-wave frame aerials; these are mounted at right angles, the whole assembly being rotated by means of an edgewise drum protruding through the side.

Provision is made for connection of one or more external loud speakers, and a microphone can be used for addressing large audiences.

The new A.C. transportable sets are completely self-contained except for a connection to an electric supply. Four indirectly heated valves, including one high-frequency amplifier, are used.

M.P.A. Wireless, Ltd., High Road, Chiswick, London, W.4.



Garnett Whiteley Kit Set. The components are supplied assembled as shown here so that the constructor is only required to carry out the wiring.



New Marconiphone Octagon cone loud speaker.

**McMICHAEL. (54)**

As at Olympia the McMichael "Super Range Portable Four" is the principal

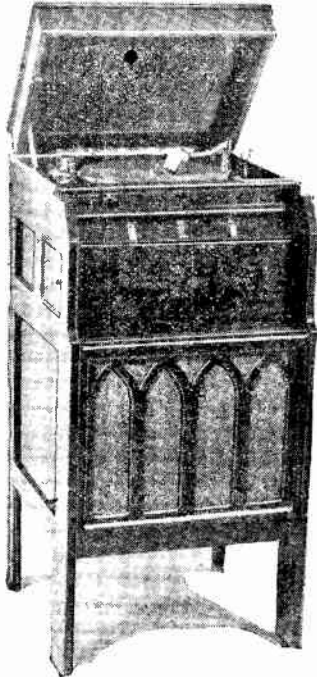
**Manchester Radio Show.—**

exhibit here. An exposed chassis shown at this stand reveals the interior construction which, to those who are acquainted with the performance of this set, satisfies the inducement to carefully study the principles involved.

*J. McMichael, Ltd., Danes Inn House, 265, Strand, London, W.C.2.*

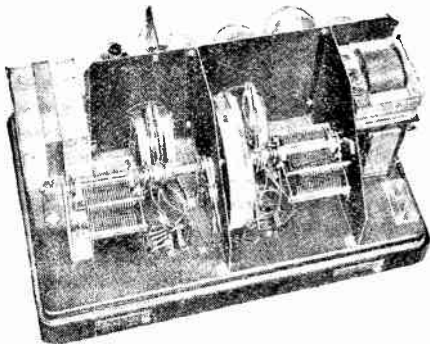
**MOORES. (8)**

An interesting exhibit on this stand is a radio-gramophone including a Philips Type 2514 receiver—an H.F.-det. pentode all-mains set for operation on an A.C. supply, with which many readers will be



Moores' radio-gramophone cabinet, which includes a Philips set.

familiar. The gramophone turntable is rotated by a Garrard double-spring motor, and an external volume control is provided. A cone loud speaker is built into



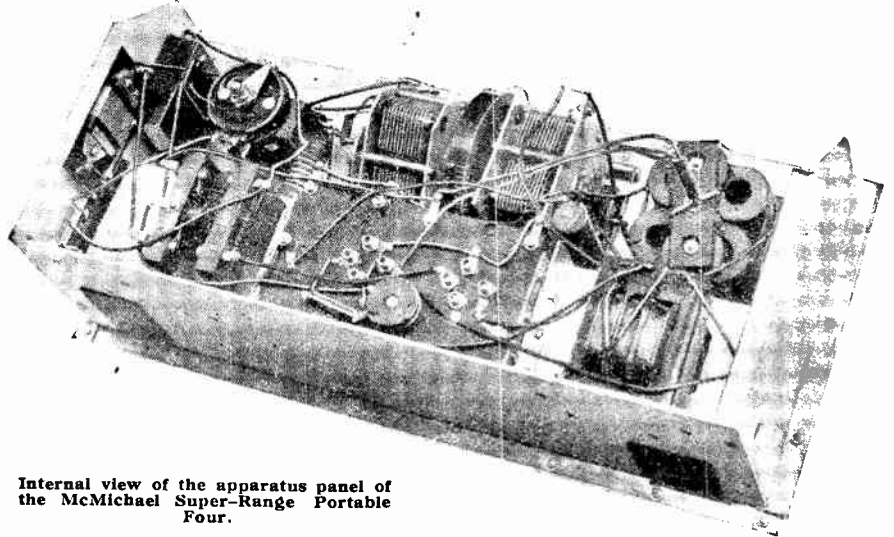
Pressed metal chassis of the Marconi-gramophone Model 47 A.C. receiver.

the base of the cabinet; an Ormond instrument is customarily fitted, but any other pattern can be supplied to order.

This instrument is sold complete at £45; those who already own a Philips set

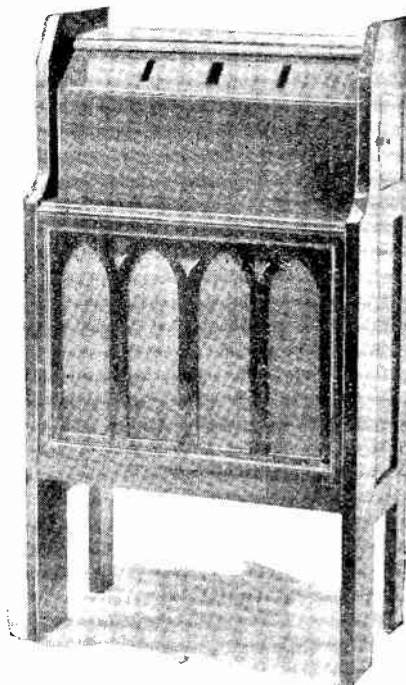
but has no gramophone turntable. There is ample room in the base for any make of cone loud speaker.

*J. Moores and Co., Raval Street Works, Salford.*



Internal view of the apparatus panel of the McMichael Super-Range Portable Four.

may obtain the cabinet ready wired and fitted in such a way that the receiver may be mounted in position and connected up by the veriest novice; this fitted gramophone cabinet costs £22 complete—except, of course, for the receiver itself.



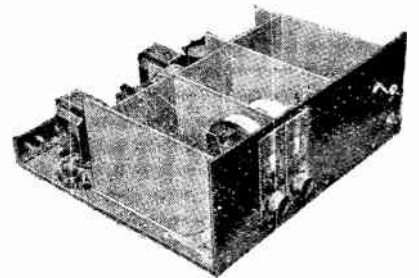
Upright cabinet for Philips' 3-valve A.C. set shown by J. Moores and Co.

Another upright cabinet, of similar design but of reduced depth, is arranged to take the above-mentioned Philips set,

**NORTHERN STEEL and HARDWARE CO., LTD. (104)**

Wholesale distributors to the trade of the products of well-known manufacturers such as Philips, Marconi, Mullard, Amplion and Cossor. A representative range of receivers, loud speakers, and eliminators is to be seen on this stand.

*Northern Steel and Hardware Co., Ltd., 1-3, Southgate, Deansgate, Manchester.*



Mullard Orgola Senior receiver.

**OLDHAM. (43)**

While having been described in detail when they were exhibited at Olympia, mention might again be made of the Oldham auto-power units. These instruments function as L.T. and H.T. battery eliminators, but are, in fact, batteries that are automatically recharged. They can, therefore, be used with any receiving set without trouble or complication. Units are available for use with A.C. or D.C. supply, and their adoption renders a set virtually all-mains operated.

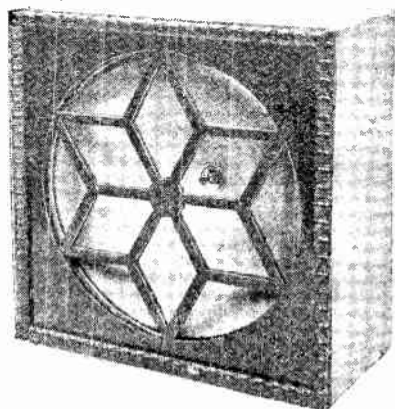
*Oldham and Sons, Ltd., Denton, Manchester.*

**Manchester Radio Show.—**

**ORPHEAN. (6)**

The chief products of this company are cone loud speakers. The smaller speaker, housed within a cabinet 11in. square, contains a 9in. cone partly concealed by an oak grille; it is marketed at the popular price of 30s. Another model embodies a 9in. cone attached at its periphery to a square bakelite plaque with a burr walnut finish. The whole speaker is so constructed that it can hang from the picture rail or stand on the table. The price is 29s. 6d.

A plug and jack connector for loud speaker connection in a house wiring scheme is exhibited; it has the advantage that the insertion and withdrawal of the plug is nearly parallel and not at right-angles to the wall of the room. This renders the whole component inconspicuous.



Orphean popular cone speaker. (London Radio Manufacturing Co.).

London Radio Mfg. Co., Ltd., Trafalgar Works, Station Road, Merton Abbey, S.W.19.

**PERTRIX. (37)**

It can safely be said that the percentage of listeners who have an electric lighting supply in their houses is below 25; the number of sets, therefore, still relying on batteries for their anode supply must be exceedingly large. The special depolariser and electrolyte used in the Pertrix batteries is said to prevent chemical action from continuing after the load is removed; furthermore, it is claimed that as the cells drop in voltage the internal resistance does not rise, this state of affairs being brought about by the harden



Pertrix battery cell showing the grooved carbon and sacless depolariser.

ing of the depolariser, which does not increase its resistance with age.

There is a representative range of radio batteries exhibited from the 9-volt bias type to the heavy-duty H.T. batteries capable of giving a 50 millamp. discharge. The 60-volt battery of the popular type, selling at 8s., has been tested in *The Wireless World* laboratories and found to have a useful life of about 470 working hours when the initial discharge is 8 mA.

A feature of interest, especially in connection with portable sets, is the provision of a number of 1½ volt tappings at the negative end to enable grid bias to be taken from the H.T. battery.

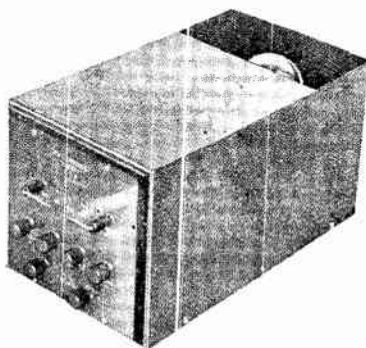
Pertrix, Ltd., Britannia House, 233, Shaftesbury Avenue, W.C.2.

**PETO-SCOTT. (45)**

This firm, which specialises in the supply of complete sets, kits of parts, and accessories, either for cash or on the deferred payment system, are showing a singularly well-chosen assortment of the better makes of apparatus.

There is also to be a kit of parts for an ambitious six-valve receiver with three tuned H.F. stages. Although a complete model had not arrived at the time of visiting the stand, the chassis assembly of four variable condensers for this set was examined with great interest. Each condenser is rotated individually by means of its own control knob, but all are coupled together through worm gearing so that they may be operated simultaneously; there is a slipping clutch fitted to each condenser spindle. This is a promising development of the semi-gang control principle, and is obviously applicable to any set with two or more tuned circuits.

Peto-Scott Co., Ltd., 77, City Road, London, E.C.1.



Phillipson A.C. battery eliminator. It has a valve rectifier, while terminals are provided for supplying current to indirectly heated valves.

**PHILIPSON. (123)**

The activities of this company are devoted exclusively to the production of H.T. battery eliminators for use with A.C. and D.C. supply. It is understood that the various voltages are obtained by the potential dividing method, while the A.C. models adopt valve rectification. These eliminators are well finished and

all-metal enclosed and sell at popular prices.

Phillipson and Co., Ltd., Astley Bridge, Bolton.

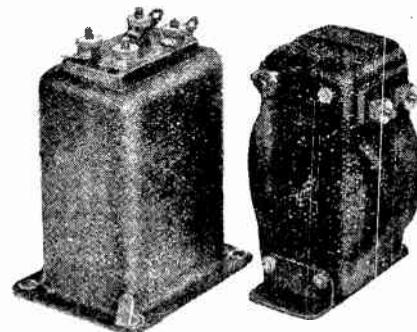
**POTTER. (62)**

Manufacturers and wholesalers of ebonite sheet, known as "Parfait." Moulded ebonite to various requirements can now be undertaken on a new plant just installed. Ebonite sheet is being shown with six different surfaces, namely, matt, black, polished various mahogany finishes, and a cube surface.

H. B. Potter and Co., Ltd., Station Buildings, Rochdale.

**PYE. (51)**

The Pye radio-gramophone, of which details were not available for our Olympia Show Report, is an interesting example of modern practice. It is an A.C. mains set with two H.F. stages (one tuned and one aperiodic), and a detector followed by resistance- and transformer-coupled L.F.



New Pye L.F. transformers.

amplifiers. The apparatus is completely self-contained (except for a mains connection), the internal frame aerial being rotated by a knob mounted near the record turntable. There is a "local station damper," and the built-in loud speaker is of the moving coil type.

Pye receivers, Type 460 and Type 350—the first for batteries or D.C. mains and the second for A.C. supplies—have already been described, and are well worth examining, if only because they go to prove that up-to-date high-efficiency circuit arrangements can be embodied in sets produced on a manufacturing basis.

A National Physical Laboratory curve is issued with respect to the new low-priced Pye L.F. transformer, and shows an exceptionally good performance for a component sold at only 12s. 6d. Another transformer with a mu-metal core, has a shroud of the same material which, it is stated, is effective in preventing induction troubles, particularly in all-mains receivers.

Pye Radio, Ltd., Paris House, Oxford Circus, London, W.1.

**RADIOVIM. (84)**

This company operates a battery hire and maintenance service, and delivers low- and high-tension accumulators to residents within ten miles of either Manchester or Liverpool. Full details of the service are given in a booklet issued on the stand; as an indication of cost, it may be stated that a freshly charged 30

**Manchester Radio Show.—**

ampere-hour two-volt cell is supplied once a fortnight for a shilling.

*Radiovim, Ltd., Sundford Street, Ancoats, Manchester, and 24, The Elms, Dingle, Liverpool.*

**REDFERN. (24)**

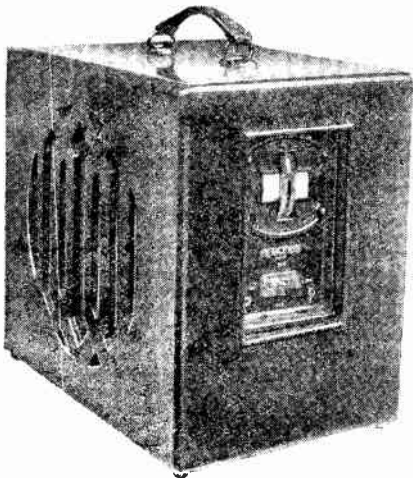
Two new types of ebonite coil formers have been introduced since the Olympia Exhibition. One of these has a mean external diameter of 3in. with nine deep ribs (approximately  $\frac{1}{2}$ in.), and, as in the case of the earlier 6-ribbed product of this firm (which, by the way, is still available), is particularly suitable for use in the construction of section-wound coils of almost ideal proportions; the extra ribs make for easier winding and for a better looking and slightly more efficient coil.

There is also a new former with a diameter of 2 $\frac{1}{2}$ in. and six ribs.

*Redfern's Rubber Works, Ltd., Hyde, Cheshire.*

**RIALTON. (117)**

The Melva transportable 5-valve receiver contains an interesting and unconventional circuit. There are three



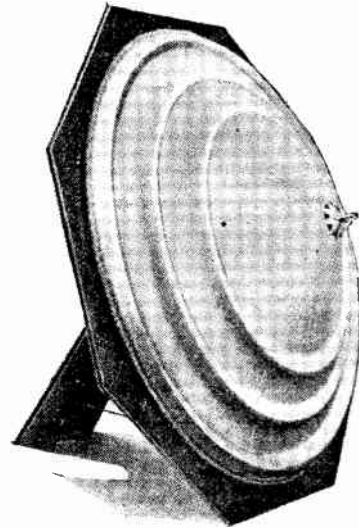
Rialton 4-valve S.G. portable.

screen-grid valves in a modified super-heterodyne arrangement, whereby a good measure of H.F. amplification is got without the necessity of elaborate screening. The first screened valve acts as a separate oscillator and the second and third valves are coupled as intermediate frequency amplifiers with aperiodic transformers. There is only one detector, which is coupled to a pentode output valve. The S.G. portable set, selling at 19 guineas, is extremely compact, and is one of the smallest 4-valve sets on the market. Its dimensions are 15in. x 9in. x 10in. The first valve—a screened valve—is aperiodically choke-coupled to a triode which in turn is aperiodically coupled to the leaky grid detector. There is one L.F. valve—a pentode. The set is well finished in polished grained oak, and has a small recess on one side in which the drum dials are placed.

*Rialton Radio, 21a, Barbican, E.C.1.*

**RIDGED CONE COMPANY. (96)**

A complete reed-driven cone loud speaker at 25s. and its two essential components—the magnetic unit and the fabric cone—are being exhibited on this stand. The cone, which is seamless and sells at 3s., has three prominent ridges, which it is claimed assist in strengthening and allow the cone to vibrate as a whole over the normal range of frequencies



Cone assembly by the Ridged Cone Co.

The "R.C." unit, selling at 13s. 6d., has four large magnets with laminated poles and an adjustable reed. The D.C. resistance is 2,000 ohms. The twin-transmission regional scheme will demand the cutting down in length of outside aerials; in fact, in a great many cases it

a replica of that used in the original model, and is of suitable size to accommodate any of the conventional H.F.-det.-L.F. circuits. Channels are provided along the lower edges of the metal cover, and are arranged to engage with strips forming part of the base. This affords a good electrical joint, as, thanks to careful workmanship, all clearances are small. Sealing should be sufficiently good for any type of circuit likely to be set up in this size of cabinet.

A similar method of construction is employed in building the larger type of cabinet used for the Kilo-Mag Four, Record III, and 1930 Everyman Four sets. Due to the fact that the screening cover is considerably larger, and has three crosswise partitions, clearances of the base joints are of necessity somewhat larger, and in cases where an exceptionally high magnification is aimed at it might be necessary to provide additional sealing, say by placing lengths of springy metal braid in the channels.

These cabinets are thoroughly well made, and the metal work is nicely finished in rosewood, walnut, dark oak, or imitation leather.

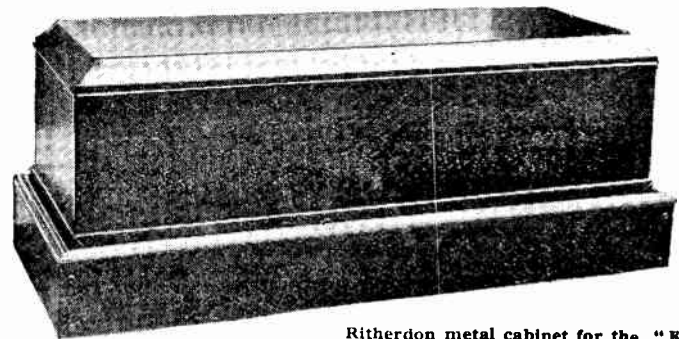
The large and small containers cost, respectively, £2 6s. 6d. and £3 in wood finish, and a few shillings less in imitation leather.

A large number of other metal containers are exhibited, including a neat inexpensive box with a horizontal partition, which would be suitable for a two-valve all-mains receiver.

*Ritherdon and Co., Ltd., North Bridge Mill, Dransgate, Bolton.*

**ROYAL RADIO. (86)**

A mains-operated three-valve transportable receiver (H.F.-det.-L.F.) has been introduced since the Olympia Show.



Ritherdon metal cabinet for the "Kilo-Mag Four" receiver.

will probably be necessary to use indoor aerials. With this in view the Ridged Cone Company have produced a number of complete indoor aerial equipments with insulators, etc., selling at popular prices.

*Ridged Cone Co., Ltd., York House, Southampton Row, W.C.1.*

**RITHERDON. (108 and 109)**

Metal cabinets constructed on the lines suggested by contributors to these pages are exhibited by this firm. A container for *The Wireless World* Kit Set is

This set includes a built-in loud speaker and frame aerial, and has provision for a gramophone pick-up. An external aerial may be used if desired. Models for A.C. or D.C. supplies are each priced at 28 guineas.

All the receivers shown at Olympia are available, and the radio-gramophone has been improved by fitting a moving coil loud speaker.

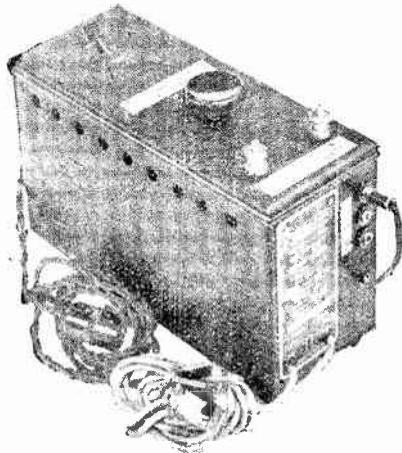
*Royal Radio Company, 4 and 5, Dorset Mews North, Upper Gloucester Place, London, N.W.1.*

**Manchester Radio Show.—**

**RUNBAKEN. (127)**

In view of the increasing interest in radio-from-the-mains, the series of automatic and semi-automatic battery chargers and testers exhibited should have considerable appeal.

The Ardwick charger contains a vibrator rectifier and, for H.T., sells at 49s. 6d. A charging rate as high as 350 mA. can be maintained. The combined L.T. and H.T. instrument is marketed at 95s., and is capable of giving 3 amps. at 6 volts. It should find application to car as well as radio accumulators. The automatic charger for A.C. is designed to remain permanently in circuit with the mains supply, the set and the L.T. accumulator. As soon as the radio set is switched off, the charger automatically comes into



**Runbaken automatic charger.**

action, and vice versa. The battery is thus kept in a healthy condition by reason of the taper charge given to it. The price is 75s. A semi-automatic type, which is not interposed in the L.T. switch circuit of the set, costs 65s. There is a variety of chargers with dry copper-oxide rectifiers.

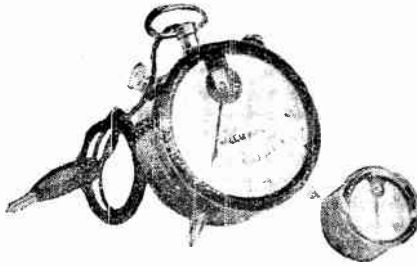
An unbreakable hydrometer in which the float-spindle is guided by a thin horizontal drilled washer to prevent surface tension effects with the inside wall, should provide a means of measuring specific gravity accurately. Battery testers to give reliable results should first place a load across each cell before reading voltage. In fact, the best indication of the state of charge is obtained by noting the no-load to full-load voltage ratio. With the Runbaken tester a 12-amp. load is taken from small accumulator cells, whilst for car starting batteries experience shows that a cell is in good condition if it reads 1.5 volts at a load of 200 amps. This company is also showing loud speaker and telephone magnetisers.

*Runbaken Magneto Co., Tipping Street, Ardwick, Manchester.*

**SIFAM. (11)**

A new pocket volt-milliammeter with ranges suitable for the average domestic

receiver and selling at 10s., should prove of interest to readers. The 15-volt range is for L.T. and bias measurements, while the 150-volt and 50 mA. scales will cover normal anode requirements. There is available a new range of baby meters for

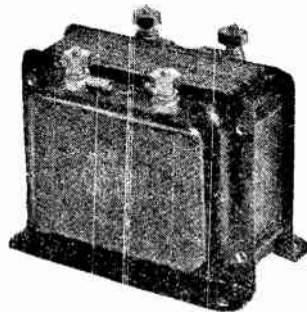


**(Left): New Sifam pocket volt-milliammeter. (Right): Miniature milliammeter measuring only 1in. diameter.**

flush mounting, which measure in diameter only one inch. It is remarkable that such a large amount of material can be got into such a small space. There are only ammeters and milliammeters in this series with centre-zero marking for charging purposes. The price of each model is the same, namely, 7s. 6d.

A new moving coil meter, with knife edge pointer, is being put on the market, and there is also available a hot wire instrument especially suitable for measuring heater voltages for indirectly heated cathode valves. For valve filament protection a new type of radio fuse is being shown. The fusing points are from 150 mA. to 6 amps.; they are sold at 1s. 3d. and 1s. The eliminator voltmeter with a resistance of 100,000 ohms, and known as the "Elimeter," is being retained for the coming season.

A 3 to 1 L.F. transformer, called the "Hevicore," and selling at 17s. 6d., is among the exhibits; it is stated to be suitable to follow valves having an impedance not exceeding 25,000 ohms.



**Sifam "Hevicore" L.F. transformer.**

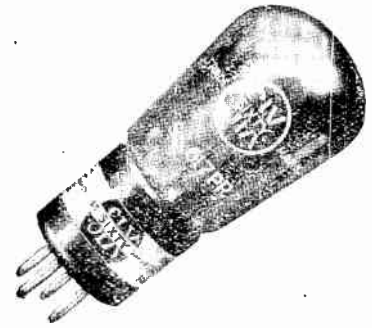
Besides the special meters referred to, there is a comprehensive display of moving coil and moving iron meters with conventional scale readings; there is, in fact, on this stand a meter for every radio purpose.

*Sifam Electrical Instrument Co., Ltd., Bush House, Aldwych, W.C.2.*

**SINQUERS. (124)**

Long life from accumulators is only obtained if careful attention is paid to maintaining the specific gravity of the electrolyte at the correct value. Charge indicators showing a rough value of the acid density are provided by specially constructed pellets known as "Sinquers," the red and blue coloured varieties of which sink at different states of discharge of the cell into which they are dropped. A pellet of each colour dropped into a fully charged accumulator will float on the surface of the acid, but if the cell is half discharged the red ball only will float, while the blue will sink. Should both balls sink the battery requires an immediate charge.

*Fiddian, Bawtree and Co., Gem Works, Oakhill Road, Sutton, Surrey.*



**Six-Sixty power output valve.**

**STANDARD INSULATORS. (71)**

A new material for panels has just been introduced by the Standard Insulator Company. It consists of a bakelite base coated on each side with a veneer of wood—birch, walnut, or mahogany—the whole being subjected to a bakelising process which imparts a highly finished glossy surface, and, what is perhaps more important, improves its electrical properties. It is stated that panels can easily be drilled, tapped or machined, and specimens on the stand show that it can be engraved in the ordinary manner.

In appearance, these panels are indistinguishable from real wood—indeed, there is no reason why they should be, as the visible part is actually wood. The new material is known as Hivoltsit Veneer Bakelite, and is stated to withstand an average pressure of 13,000 volts per millimetre thickness. Its resistance per cubic centimetre is given as  $1.48 \times 10^{12}$  ohms. It seems probable that these panels will find a ready application, particularly in the construction of high-grade receivers where good appearance is considered to be essential.

*The Standard Insulator Co., Ltd., Winsley House, Wells Street, Oxford Street, London, W.1.*

**STOTT. (125)**

The "Pegasus-Scout" portable receiver, of more or less conventional design, should have a performance well above the average; its layout is exceptionally neat

**Manchester Radio Show.—**

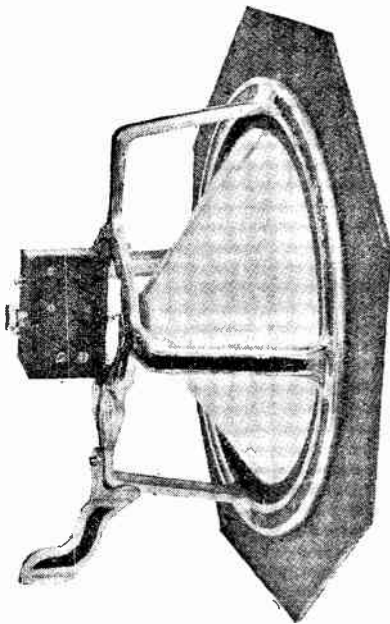
and workmanlike, and all the components used in its construction are of high grade. Its anode circuits are decoupled—a refinement not yet by any means universal in sets of its class—and in consequence there is but a single positive lead to the H.T. battery.



The Pegasus portable receiver with back cover removed.

Provision for a gramophone pick-up is included, and an upright cabinet with grille front, turntable, pick-up arm, and space for the receiver is also supplied, in order that the set may be converted into a radio-gramophone. The fitted cabinet costs 13 guineas, while the receiver itself is priced at 17 guineas.

This firm are Northern agents for the Mic Wireless Co., of Wellingborough, and



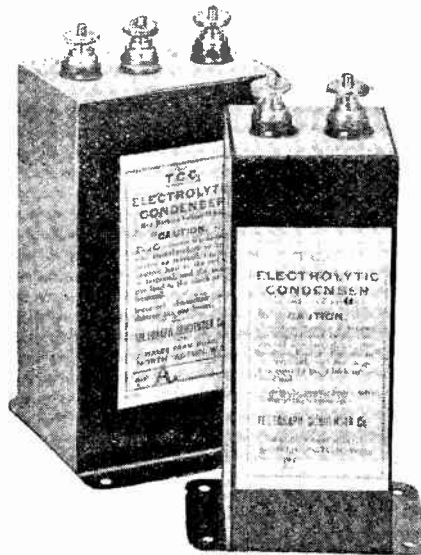
The Squire aluminium cone cradle. This is exhibited as an octagonal hanging lamp shade with bead fringe.

are showing specimens of the new "Zampa" components and accessories described in our Olympia Show Report.

*J. E. Stott, 15, Clare Hill, Huddersfield.*

**T.C.C. (83)**

In addition to the wide range of fixed condensers for every purpose in a radio set, there has been introduced this season a single type electrolytic condenser for a maximum working voltage of 40; the minimum capacity is 500 microfarads, and the price £1. The electrolytic condensers shown are of the dry polarised type, and must be connected to the correct poles. The importance of good power factor, especially in condensers which have to bypass H.F. energy in a divided circuit, is not being overlooked by this company, who are spending much time in research on non-inductive connection of condenser foils.



T.C.C. electrolytic condensers for L.T. eliminators.

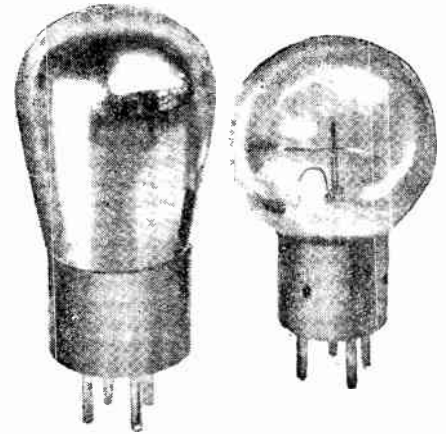
A range of tapped condenser blocks for eliminators is to be seen on this stand. The company are to be congratulated on having been chosen by the B.B.C. to supply a number of high-voltage smoothing condensers for the new station at Brookman's Park.

*Telegraph Condenser Co., Ltd., Wales Farm Road, North Acton, W.3.*

**TUNGSRAM. (10)**

Pamphlets available at the stand give complete technical data of the valves made by this well-known lamp manufacturing concern. Among the details given it is interesting to note the inclusion of anode conductance (reciprocal of impedance) as well as power output in milliwatts. While the range of valves is very extensive, it does not, as yet, include the screen-grid and pentode types. As a gauge to the performance of these valves one might take a typical L.F. type such as the P.215. Passing 0.15 ampere at 2 volts it has an amplification factor of 5 with an impedance of 3,300 giving a

mutual conductance of 1.5 mA/v. Among 6-volt power valves there are the P.615 and P.614. The former has an amplification factor of 10 with an impedance of



Specimen Tungram power valve and photocell.

3,300 ohms, and the latter an amplification of 6 with an impedance 1,900, so that the mutual conductance in each case reaches the high figure of about 3 mA/v. These valves are priced at 7s. 3d. and 8s. respectively. The range includes directly and indirectly heated valves for use with A.C. supply. As an example in this class we might take the general-purpose valve A.G.4100. Like other valves the heater unit takes 1 ampere at 4 volts, and the amplification factor is 16 with an impedance of 8,000 ohms, giving a mutual conductance of 2 mA/v. The price of this valve is 8s. 6d.

Much interest is now being taken by amateurs in the experimental use of photocells, and shown at the stand is the Tungram "Nava" cell. It is a sodium cell of the hard variety, and is therefore stable. An interesting feature is the provision of a filament within the cell. This is used in the process of forming the sodium coating, though in normal use the filament is not heated, but is used as an anode. The wavelengths of light to which this cell responds represent a band between violet and orange, while another cell is available covering the spectrum from the blue to the red. The prices of these cells are 50s. and 57s. 6d. respectively.

*Tungram Electric Lamp Works (Great Britain), Ltd., 72, Oxford Street, London, W.1.*

**TUTILL. (14)**

There are several new and interesting products to be seen on this stand. Perhaps the most ambitious is the "Tinol" radio-gramophone, which is supplied for operation on A.C. or D.C. mains. It includes a five-valve receiver working with an external aerial, with one high-frequency valve, detector, and two L.F. stages with push-pull output. The two circuits are tuned by a Utility balancing condenser, reaction control is on the differential principle, and there is

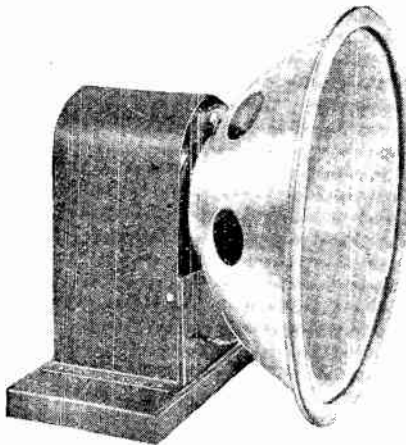
**Manchester Radio Show.**—

a volume control operative on both radio and gramophone reproduction.

An unusual refinement is the provision of a tone control; with the regulating lever at the normal position no correction is applied to the amplifier, but movement to either side introduces a degree of attenuation of the bass or treble as may be desired.

This instrument is fitted with a moving coil loud speaker, and is supplied either in a walnut or mahogany cabinet at £65 for A.C. and £55 for D.C. supplies. Extensive precautions are observed towards the prevention of low-frequency reaction.

In spite of its extremely low price—the battery and D.C. models cost but £2 19s. 6d.—the Liberty moving coil loud speaker is well constructed and designed on sound lines. An easily adjusted paper “spider” is provided for centring, and the cone is supported by a surround of closely woven fabric, stated to be unaffected by climatic changes. As a step-down transformer is mounted in the base the instrument as supplied is complete and ready for mounting in a cabinet or on a baffle board. An A.C. model, with Westinghouse rectifier and electrolytic smoothing condenser, is sold for £5 15s.



The Liberty moving coil loud speaker.

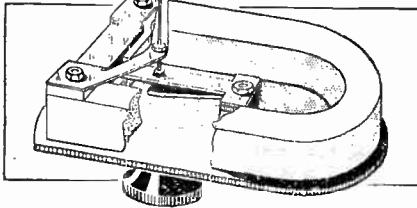
The “Kukoo” loud speaker drive unit, manufactured by the Sheffield Magnet Co., is also exhibited. This promising component is of exceptionally heavy and solid construction, and employs two large cobalt steel magnets.

*Tutills, Ltd., 7-9, Swan Street, New Cross, Manchester.*

**W.B. (7)**

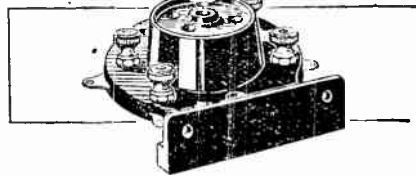
While the mounting of loud speakers in large moulded bakelite housings is a common practice, the new W.B. cone speaker, which is built in a bakelite case, is distinctive. It is probably the only bakelite mounted loud speaker of the “clock” design and its grained moulding gives a finish superior to that of polished wood, and is, of course, infinitely more durable. The bakelite back plate supports the adjustable differential reed movement. In spite of the generous use

of bakelite the price of the complete speaker is 42s.



Interior of the W.B. balanced-armature loud speaker movement. The cover is of moulded bakelite.

For the home construction of an inexpensive cone loud speaker the balanced-armature movement is available for 12s. 6d. Double-ended extension shoes are attached to the poles of a cobalt steel magnet, and the armature is neutrally set through the axis of the bobbin.



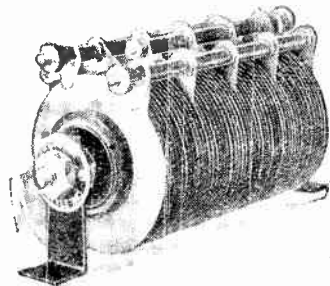
The new W.B. valve holder for side or baseboard mounting.

W.B. five-pin valve holders are well known to readers, and a modified pattern has now been introduced which, by means of a side plate, provides for horizontal or vertical mounting. The feature of W.B. valve holders is the expanding nickel-silver leg sockets. Like the circular pattern valve holder the price is 1s. 3d.

*Whiteley, Boneham and Co., Ltd., Nottingham Road, Mansfield, Notts.*

**WESTINGHOUSE. (78)**

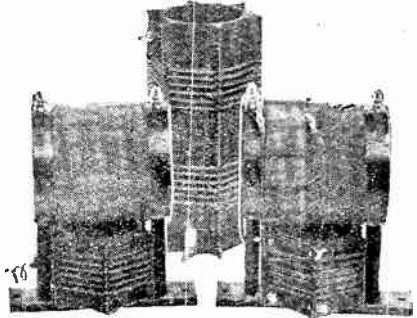
Besides the H.T.1 and H.T.2 metal rectifiers, which have been reduced in price and the L.T. chargers and trickle chargers, there have been introduced for this season two new units for H.T.



Westinghouse A.4 rectifier, giving 2 amps. at 9 volts.

The H.T.3 is a half-wave instrument giving a voltage of 120 when the maximum load of 20 mA. is applied. Such a rectifier is useful for kit sets having a screened valve followed by leaky grid detector and triode output. The transformer feeding the H.T.3 should not give more than 140 volts on open circuit. The

H.T.4 rectifier is designed to be used in a voltage doubling bridge circuit with two 4 mfd. condensers (if the capacity is less the output is considerably reduced). Although the transformer for use with this rectifier must not develop more than 135 volts, the D.C. output is about 180 volts 30 mA. There is thus a step-up irrespective of the transformer. The H.T.4 gives full-wave rectification and sells at 7s. 6d.



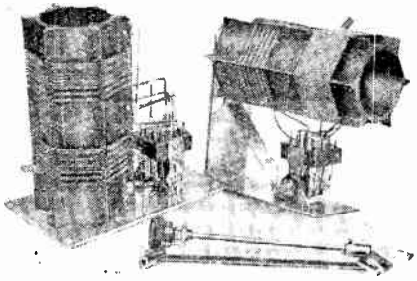
Coils for the 1930 Everyman Four (Wright & Weaire).

The A.4 unit, giving 2 amps. at 9 volts, is capable of charging large wireless batteries and is quite useful for car batteries.

*Westinghouse Brake and Saxby Signal Co., Ltd., 82, York Road, King's Cross, N.1.*

**YAGERPHONE. (85)**

Portable receivers and radio-gramophones are the chief products of this firm. The majority of these instruments are for all-mains operation, as much attention being paid to D.C. as A.C.



Coils with switches incorporated for “The Wireless World” Kit Set. (Wright & Weaire).

As an example of a moderately priced radio-gramophone for use with an outside aerial, mention should be made of the “Popular” model for battery operation, at £28 10s. There are three valves, arranged as two L.F. resistance stages following a regenerative leaky grid detector. This circuit allows of simple one-dial tuning. A cone speaker is built into the base of the cabinet and is hidden by an ornamental grille. There is a spring-driven Garrard gramophone motor with automatic stopping device. The cabinet work of the radio-gramophones exhibited is superb.

*Yagerphone, Ltd., 28, Charlotte Street, E.C.2.*

"RADIO" and "The Air" are our names for the broadcast transmissions, and I should say they are as good as any; although it is said by some that, in the late presidential election in the U.S.A., Governor Smith, the unsuccessful candidate, lost a number of votes because he spoke of the "Raddio"!—so powerful is the influence of the ether.

Here in British Columbia, a way up country, we are within reach of a really large number of broadcasting stations both Canadian and American; but our mountain ranges and our lakes run for the most part north and south, so it is the American stations that come in best. Our Canadian stations lie east and west of us. Calgary, in the province of Alberta, comes in fairly well; Vancouver only sometimes.

If, therefore, we want an evening's straightforward radio, we switch on to one of the American stations; and that means Salt Lake City, Seattle, San Francisco or Los Angeles.

We are a very English community here in the Okanagan Valley, so that if you know anything at all of English people out of England you will know that we are very strong in our likes and dislikes, and when we have been listening, say, to a whole winter's programme from these American stations, it will be readily understood that "things are said." I think we are very grateful for the really marvellous range of programmes provided for us, and I have never once heard anything from any of the big American stations that could cause a moment's discomfort or uneasiness to the man who listens in this side of the border. The programmes are arranged by the various mercantile corporations, and they are essentially a means of advertisement. The nature of the broadcast and the amount of advertising matter will therefore vary according to the character of the firm or the corporation.

Some of the best things are put on by the banks and by the powerful oil companies; and a very few words about the bank's business, or about the advantages of the oil, are all that accompany the symphony concerts which are the speciality of these institutions.

But they all have their turn, even down to So-an-So's pickles, a particular line of underclothing, or the This-and-That washing machine. Quite a small experience of radio will make you wary! You are listening, may be, to the "Venusberg" music from "Tannhäuser," beautifully rendered; the "Pilgrim's Chorus" is to follow; but before that begins the announcer must give you a cute little dissertation on the merits of X's soap, taking it for granted that there is no other kind of soap in the world, and that you certainly have never enjoyed a decent "wash" unless you have come across this particular brand. This is quite legitimate advertising, no doubt; but you listen to the "Pilgrim's

Chorus," when it does come on, with a vague feeling that you have got a dirty neck.

The kind of English spoken by the American announcers is not of the quality which you hear from ZLO. If not exactly infinite in their variety, the voices are greatly diversified, and we all have our favourites. There is the voice with a smile, that is cheering to hear

for a few nights, but which palls dreadfully after a time. There is the pained, hurt and aggrieved voice, as of a man having to read his own death sentence; and there is a voice for every stage between these extremes. Only very rarely do we hear the soft Southern drawl which in itself is perfect music.

This past season we have suffered from a superfluity of soprano singers. Some are good

and worth listening to; others, many others, are neither good nor worth listening to; and it is sad to hear courtly and gallant old gentlemen switching off in disgust and muttering threats and slaughterings against "these squawking females." Indeed, these sopranos are so rife that many of us would prefer a saxophone, than which no more powerful indictment could be framed.

But our greatest grumble is that the announcer will not leave our poor intelligence alone. We are not allowed to listen to a Chopin's Nocturne without being told who Chopin was (presumably it is he who is meant by "Show-pang"), and we must be informed what a nocturne is. And then, perhaps, we are told that we are to hear "Nocturne," by Chopin—as though he wrote one only!

To have our intelligence improved in this way is bad enough; it is worse when our emotions are got hold of and straightened out. For instance, they are going to play a Minuet of Beethoven's, but before we get to it we are told what our reactions should be to "this piece," and so stereotyped is this kind of advice that in nine cases out of ten a man may safely wager that he will hear, at least once, phrases such as "delicate cadences," "swinging lilt," "felicitous movement," "swaying rhythm," "charm," "romance," "quaint." These grumblings, after all, amount to very little in comparison with the abundance of the musical feast provided by the many stations we tap here in the North-West.

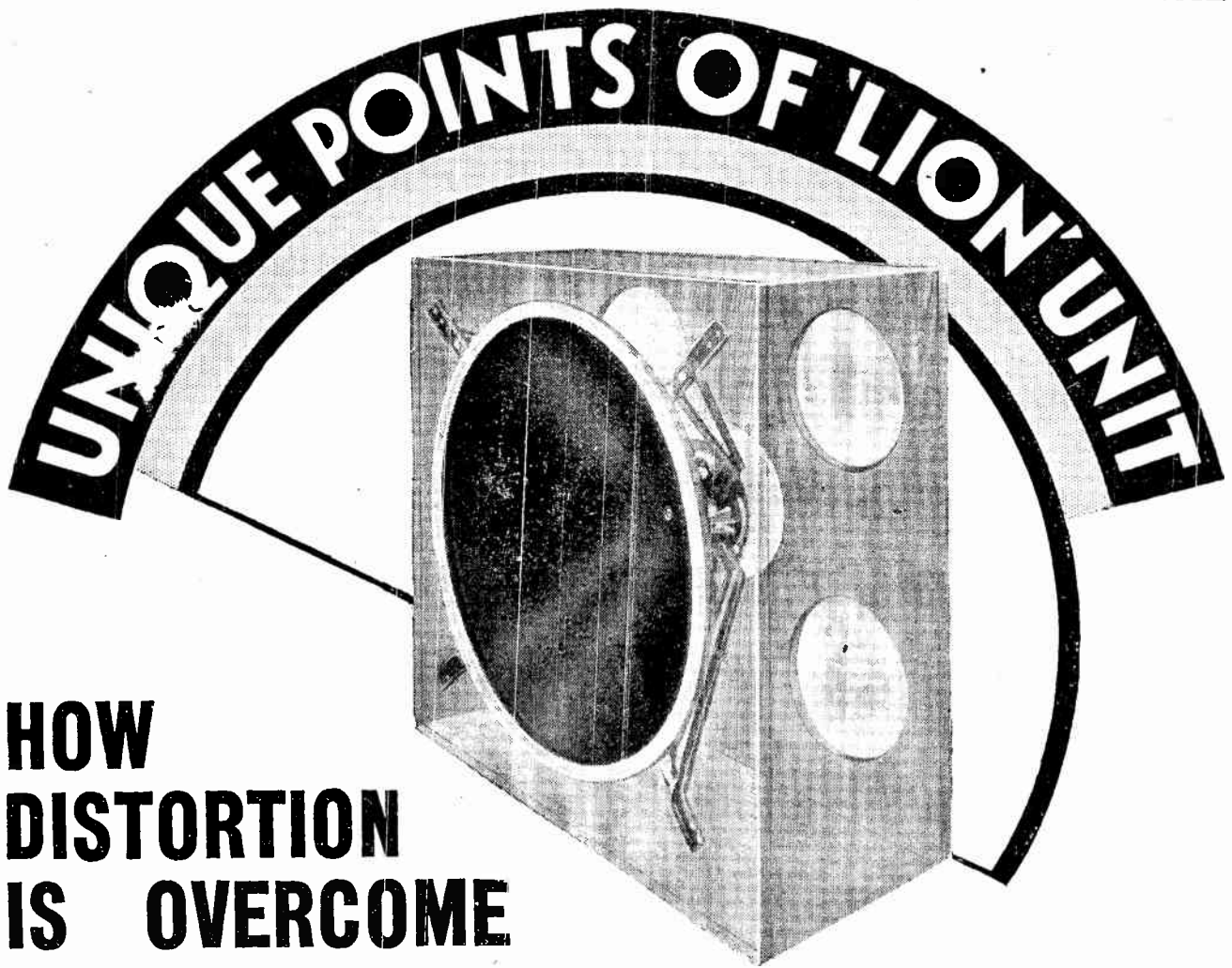
The most impressive broadcast I ever heard was late on the last night of the Old Year, when New Year messages were being sent out from the Edmonton Station to listeners in away up among the isolated settlers and officials in the Yukon and the North-West Territories, close by the Arctic Circle. Many a heart-ache must have been lifted that night when those lonely people heard over the radio the names of their home-folk who remembered them.

The Spirits of the Air fulfil their kindly mission nowadays, not only in fairy-tales but in real life.



By OUR CANADIAN CORRESPONDENT.





## HOW DISTORTION IS OVERCOME

The Amplion 'LION' Speaker has definitely established its superiority. For over a year now the critics have been watching and their opinion remains as it was in their first enthusiastic reception.

In the 'LION' movement the increased magnetic pull on the reed, as it gets near the magnet is accompanied by an equivalent diminution of leverage. This results in the abolition of distortion and instead of the

muffled and disguised output of the average speaker, we get the full and convincingly natural volume of sound in its native purity. By an equally ingenious method the Amplion movement is enabled to reproduce with accuracy the sudden beginnings of sounds and to render correctly what musicians call "attack." The Cone, too of the Amplion "LION" Speaker is different and there are other features.

Let us send you our explanatory booklet ZW.L.37A full of interesting facts—written by one of our expert technicians.

### CHASSIS MODEL FOR THE HOME CONSTRUCTOR

The chassis model, which can easily be fitted to a baffle board or cabinet of your own make, is available in two sizes for the Home Constructor.

*All Amplion Equipment to the value of £8 and over may be obtained on convenient terms of payment.*

# AMPLION

**"LION" SPEAKER  
CHASSIS £6 and £8  
CABINET MODELS  
£8 to £16 . . . .**

GRAHAM AMPLION, LTD., 25/26, SAVILE ROW, LONDON, W.1. WORKS: SLOUGH 

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was kept  
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High Tension  
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At last the high tension battery for which the world has waited...gives over 60% longer service...is incapable of "crackle."

No sal-ammoniac...therefore no corrosion...therefore no loss in idleness.

Every wireless user ought to know why "Pertrix" is the only one dry battery to be used today.

SEND FOR FULL PARTICULARS



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# CURRENT TOPICS

Events of the Week in Brief Review.

## HIGH POWER BROADCASTING IN IRELAND.

Following the B.B.C. example, the Irish Free State Postal and Finance Departments are considering the erection of a high power broadcasting station in Athlone. It is not yet clear whether the Athlone station will supersede those at Dublin and Cork, but it is certain that it will be designed to include practically the whole of the Irish Free State in its service area.

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## MOTOR CAR WIRELESS.

A time when every car will carry a receiver, if not a transmitter, is suggested by the news that the Radio Corporation of America and General Motors have organised a new concern, known as General Motors Radio Corporation, for the manufacture of motor car wireless sets.

Wireless may soon be an indispensable "gadget."

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## WHY CRIMINALS HATE WIRELESS.

The increased use of wireless by Scotland Yard has been carefully watched by the French police. In the coming Budget funds will be specially allocated for the erection of a wireless station in Paris to link up with the frontiers, ports and provincial police stations.

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## THE STORY OF THE VALVE.

A talk on "The History of the Thermionic Valve" will be given from the Dublin broadcasting station at 10.30 p.m. on October 30th by Mr. H. A. Donisthorpe, of the General Electric Co., Ltd.

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## RADIO BEACON'S SUCCESS.

The new Air Ministry rotating wireless beacon at Orford Ness, Suffolk, has proved so successful that, as from Sunday last, October 20th, the beacon works continuously throughout the 24 hours instead of from 6 a.m. to midnight. The revised timing will continue for two months.

The Trinity House observers state that out of 21 observations only five showed an error of 1 degree. In tests as to the accuracy of its time-keeping, the National Physical Laboratory found that the accuracy was well beyond the limit of accuracy of the ordinary chronometer or stop-watch.

Practically correct results have been obtained on a vessel off Beachy Head, 100 miles distant.

## BRITISH GEAR FOR SPANISH-ARGENTINE SERVICE.

The new Spanish-Argentine radio telephone service recently opened from Seville by General Primo de Rivera is the only service of its kind in the world, with the exception of that between Great Britain and America, in which subscribers are connected at each end by means of the ordinary telephone service. Complete secrecy is obtained by transmitting in a distorted form unintelligible to ordinary receiving stations. The transmitters and receivers for this new radio link were manufactured by Standard Telephones & Cables, Ltd., in their factories at Woolwich and Hendon.

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## MORE LISTENERS IN GERMANY.

Registered listeners in Germany now number 2,843,569, an increase of 16,941 in three months.

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## SAD CASE.

The pirates' repertoire of excuses has been added to by a Doncaster delinquent who pleaded last week that he thought

the second-hand receiver he had purchased was already licensed, like a car.

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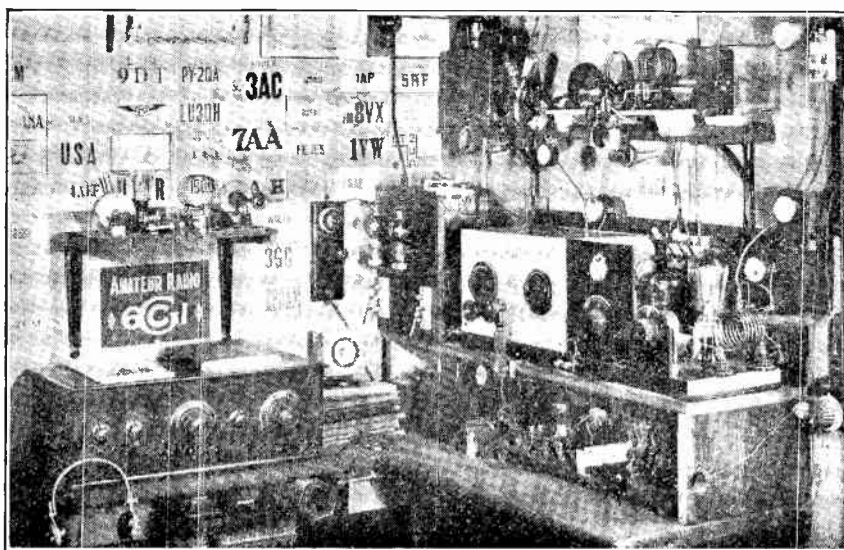
## RADIO IN RANGOON.

To popularise wireless in rural India the Burma Legislative Council has voted 3,000 rupees for the installation of receiving sets in twelve villages within 100 miles of Rangoon. The Rangoon broadcasting station is operated by the Burma Radio Syndicate on a wavelength of 398 metres.

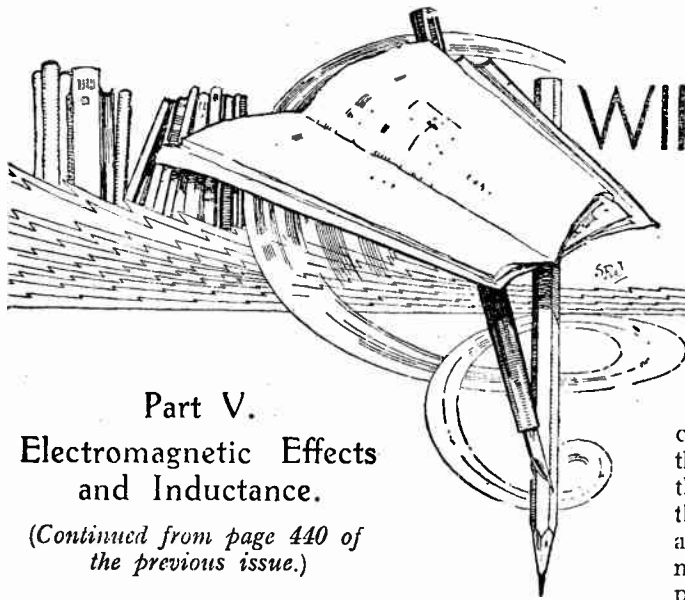
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## LECTURES FOR RADIO-GRAMOPHONE DEALERS.

Under the auspices of the Gramophone Co., Ltd., a special course of sixteen lectures in radio-gramophone re-production is being given at the London Polytechnic, Regent Street, by Mr. S. T. Short, A.M.I.E.E., for the benefit of dealers, salesmen, service staff and others engaged in the radio-gramophone industry. Similar courses are to be given in various provincial centres. Particulars of the courses and of a special correspondence course for those unable to attend the lectures, are obtainable from The Gramophone Co., Ltd., 363, Oxford Street, London, W.1.



A MODERN AMATEUR STATION. The transmitting and receiving apparatus of G 6CI, owned by Mr. B. W. Warren, of Coventry. As the QSL cards indicate, G 6CI has practically a world-wide "service area."



# WIRELESS THEORY SIMPLIFIED

By S. O. PEARSON, B.Sc., A.M.I.E.E.

## Part V.

### Electromagnetic Effects and Inductance.

(Continued from page 440 of  
the previous issue.)

**B**EFORE we can proceed further with A.C. theory it will be necessary to know something about that type of circuit in which considerable magnetic effects are produced when a current of electricity flows through it. It will be seen later what a very important part inductance plays in A.C. circuits.

Whenever a current of electricity flows through a circuit a magnetic field is set up in the vicinity of the conductors. With the aid of a miniature compass needle, lines of force can be detected and the directions in which they act determined. The intensity of the field depends on the nature of the circuit and the strength of the current flowing through it. For instance, if a long insulated wire is wound into the form of a coil or solenoid, a relatively powerful magnetic field is produced when a current is passed through it. The lines of action of the forces pass through the coil parallel to its axis at the centre, and spread out brush-wise at the ends.

If such a coil could be arranged so that its axis lies on a plane surface, as shown in Fig. 1, the lines along which the magnetic forces act could be traced out with the aid of the little compass needle. If any one line is followed completely round, it is found to be a closed loop, so that we have in a magnetic field a large number of closed loops of magnetic force linked with the turns of the coil.

The total magnetic influence passing through the

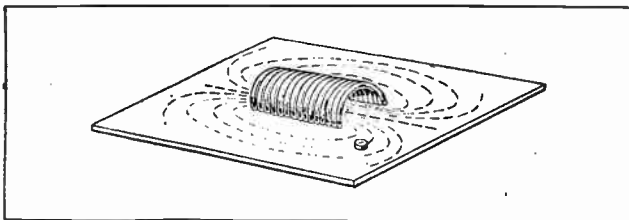


Fig. 1.—Showing how the lines of magnetic force produced by a coil can be traced by means of a miniature magnetic compass.

centre of the coil parallel to its axis is referred to as the *magnetic flux*, and the amount of flux which passes through one square centimetre of area at right angles to the lines of force represents the field strength or intensity at that point. It is expressed in lines per square centimetre or *gauss*. If a current of  $I$  amperes could be passed round a single circular wire loop one centimetre in radius, the field strength at the centre of the loop would be  $0.2\pi I$  lines per square centimetre or *gauss*.

#### Electromagnetic Induction.

If the current flowing through the coil is varied, the magnetic flux linked with the coil varies in direct proportion, and this changing of the flux has a peculiar effect on the circuit. It actually causes an electromotive force to be *induced* in the turns of the coil, this being the property known as *self-inductance*.

The explanation of self-inductance will be made simpler if we first consider the action of a permanent magnet on a coil of wire. In Fig. 2 is shown a permanent magnet of the horse-shoe pattern with lines of magnetic force passing between the poles from N to S. Close to the magnet is a coil so placed that one pole of the magnet can be lowered into it, and across the ends of the coil is connected a sensitive galvanometer or millivoltmeter. When the magnet is lowered, the lines of force passing between the poles are "cut" by the turns of the coil, and just as this is happening a reading is obtained on the millivoltmeter, showing that an E.M.F. is being induced in the coil. This is Faraday's original experiment, and explains the principle of electromagnetic induction.

The important feature is that the E.M.F. is induced in the coil only so long as the magnet is moving relatively to the coil; as soon as the magnet comes to rest the E.M.F. disappears, no matter what the relative positions of the magnet and coil are. The value of the induced E.M.F. is exactly proportional to the rate at which the lines of force are being cut, i.e., to the

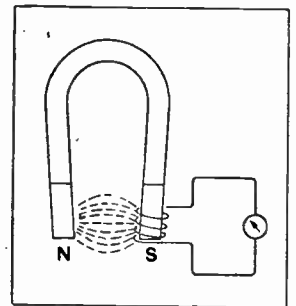


Fig. 2.—Faraday's experiment for demonstrating the principle of electromagnetic induction.

**Wireless Theory Simplified.—**

number of lines being cut per second, and therefore to the rate at which the flux linked with the coil is changing.

Reverting to the case in which the magnetic flux linked with a coil is produced by a current in the coil itself, it will be clear that an E.M.F. will be induced in the coil whenever the current is changing, because the magnetic flux is proportional to the current. In any circuit where the changing of the current causes an E.M.F. to be induced into the circuit itself, self-inductance is said to be present.

From the foregoing it follows that inductance will be present in any circuit where a magnetic field is produced by a current passed through the circuit.

**Unit of Self-inductance.**

The practical unit of self-inductance is the *henry*, and a circuit is said to have a self-inductance of one henry if one volt is induced in it when the current is changing at the rate of one ampere per second. The self-inductance expressed in henrys is called the *coefficient of self-induction* of the circuit, and is usually denoted by *L*.

Suppose that in a circuit where the inductance is *L* henrys the current is changing at a steady rate and increases from  $I_1$  to  $I_2$  amperes in *t* seconds.

Then the rate of change of current is  $\frac{I_2 - I_1}{t}$  amperes per second, and the self-induced E.M.F. will be  $e = L \times \frac{I_2 - I_1}{t}$  volts.

**Electrical Inertia.**

Before we can make full use of this expression it is necessary to know in what direction the induced E.M.F. acts. Lenz's law states that the induced E.M.F. always acts in such a direction as to oppose the changing of the current. This means that if the current is increasing, the induced E.M.F. will be opposing the applied E.M.F. actually producing the current, and when the current is falling in value the self-induced E.M.F. acts in such a direction that it tends to maintain the current. The self-induced E.M.F. is very often referred to as a *back E.M.F.* or counter electromotive force when it acts in opposition to the applied E.M.F.

A similar law exists in ordinary mechanics—a heavy body resists the taking up of motion when a force is applied to it on account of its *inertia*; there is a back pressure proportional to the mass of the body and the rate at which its velocity is changed. Once the body is set in motion, it tends to continue moving even after the original driving force has been removed. A railway wagon on a level track could be taken as an example.

Owing to the similarity of the laws of an inductive circuit and those of inertia, self-inductance is very often referred to as "electrical inertia." Since the induced E.M.F. is proportional to the rate of change of current and acts in opposition, it follows that in a circuit possessing self-inductance the current can never be changed instantaneously. If the E.M.F. applied to the ends of the circuit is suddenly changed, the current will *gradually* acquire its new value just as, if the

throttle of a motor car running at slow speed is suddenly opened wide, the car does not attain its full speed instantaneously, but gradually accelerates.

**Energy Stored in a Magnetic Field.**

If an electromotive force is suddenly applied to the ends of an inductive circuit, power is expended not only in heating the circuit through the medium of its resistance but also in overcoming the back E.M.F. during the time that the current is building up. When the current has reached its final steady value, the back E.M.F. disappears, and the whole of the in-going energy is being converted into heat. It is clear then that just as the current is building up, a certain amount of energy is put into the magnetic field. When the current is reduced to zero again, the induced E.M.F. of self-induction acts in the same direction as the falling current, and hence the stored energy is given back again to the circuit. In the case of a very powerful field such as that of a large dynamo, the stored energy is so great that it is positively dangerous to switch off the magnetising current suddenly. Even in the case of the pot magnet of a moving-coil loud speaker precautions are usually taken to dissipate the stored energy gradually when switching off.

**Calculation of Stored Energy.**

Suppose that we have a coil whose inductance is *L* henrys and that a current is caused to build up in it from zero to *I* amperes in *t* seconds. The average rate of growth of the current will be  $\frac{I}{t}$  amperes per second, and, since the induced E.M.F. is equal to the product of the inductance and the rate of change of current, the average back E.M.F. during this time will be  $e = L \times \frac{I}{t}$  volts. Now, the power consumed in building up the magnetic field is given by the product of back E.M.F. and current at any instant. But the current is varying from zero up to *I* amperes, and therefore its *average* value during the time of growth is  $\frac{1}{2}I$  amperes (see Fig. 3). Thus the average power expended on the field whilst it is being built up is

$$e \times \frac{1}{2}I = L \times \frac{I}{t} \times \frac{1}{2}I \\ = \frac{1}{2} \frac{LI^2}{t} \text{ watts.}$$

The time during which this power acts is *t* seconds, and so the energy put into the field is

$$W = \frac{1}{2} \frac{LI^2}{t} \times t = \frac{1}{2} LI^2 \text{ watt-seconds or joules}$$

(the energy represented by a power of one watt expended for one second is called one *joule*).

The energy stored in the field at any instant is thus seen to be proportional to the inductance of the circuit and to the *square* of the current at that instant. It is assumed that the energy thus stored takes the form of a sort of strain in the ether in which the magnetic field is situated.

**Mutual Induction.**

Sometimes two circuits are so arranged that when a current in one of them is varied it causes an electro-

**Wireless Theory Simplified.—**

motive force to be generated in the other. Under these conditions *mutual inductance* is said to exist between the circuits. It should be fairly obvious then that if a current in one circuit causes lines of magnetic force to be linked with a second circuit, mutual inductance will be present, because any variation of current in the one will result in an induced E.M.F. in the other.

As an example, we may consider two coils  $L_1$  and  $L_2$  arranged as shown in Fig. 4. When a current is passed through  $L_1$  from a battery B it will produce a magnetic field, part of which links itself with the turns of  $L_2$ . If the current is varied by changing the value of the regulating resistance R, the flux linked with  $L_2$  will be altered, and an E.M.F. is induced in it during the process.

The mutual inductance between the coils is said to be one henry if one volt is induced in one of them when the current in the other is changing at the rate of one ampere per second. The mutual inductance in henrys is usually denoted by M, and is sometimes called the coefficient of mutual induction. The coil  $L_1$  in which the current flows is called the primary (coil), and  $L_2$  is called the secondary. The mutual inductance between the two coils is the same, no matter which is used as the primary; its value depends only on the dimensions of each coil and their relative positions.

When the mutual inductance is M henrys, the E.M.F. induced in the secondary coil is given by

$$e_2 = M \times (\text{rate of change of primary current}).$$

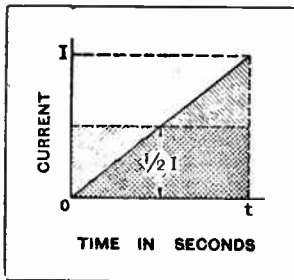


Fig. 3.—When a current is increased from zero to I amperes at a uniform rate the average value is  $\frac{1}{2}$  I amps.

If an alternating current is passed through the primary coil, an alternating magnetic flux will act upon the secondary coil, and so induce in it an alternating voltage of the same frequency as the primary current. When two coils are used in this way they are said to be magnetically coupled together, and the combination is known as a transformer, a subject to be dealt with separately at a later date.

**Degree of Coupling.**

The two coils are said to be tightly coupled when they are brought close together so as to obtain a relatively high mutual inductance, and *vice versa*. The degree of coupling is expressed as the ratio of the mutual inductance to the square root of the product of the separate self-inductances, this ratio being known as the coefficient of coupling,

$$\text{i.e., coefficient of coupling} = \frac{M}{\sqrt{L_1 L_2}}$$

In theory the coupling coefficient can never be greater than unity, and in practice never reaches this value. The coupling would be unity if the whole of the magnetic flux produced by a current in one coil linked itself with the whole of the turns on the other. In low-frequency transformers the coupling is made as great as possible by winding the two coils on a common iron core so that the total flux is constrained as far as possible to be fully linked up with both windings. That fraction of the total flux which fails to link with both coils is termed leakage flux.

(To be continued.)

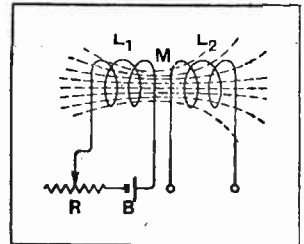


Fig. 4.—Mutual inductance exists between two coils if a current in one affects the other magnetically.

**Peckham Radio Society.**

Many South London amateurs have derived benefit from the Peckham Radio Society, which has now opened the winter session with meetings on Thursday evenings at 7.30 p.m.

Hon. Secretary, Mr. A. E. Pettet, 192, Hollydale Road, S.E.15.

**Informality in Wireless Meetings.**

A request that the informal nature of its meetings should be maintained was made by members of the South Croydon and District Radio Society at the recent Annual General Meeting. It was felt that the ordinary owner of a wireless set derived most benefit when he could discuss his radio troubles and experiments with a minimum amount of formality. A feature of the new session is the arrival of a large contingent of new members. More vacancies still exist, however, and the Hon. Secretary, Mr. E. L. Cumbers, 14, Campden Road, South Croydon, will be glad to receive applications.

**A Topical Lecture.**

"Mains Apparatus—Its Design and Operation" was the title of a lecture given by Mr. Garstide, of Messrs. Ferranti, Ltd., at a recent meeting of the Kensington Radio Society.

The Society's meetings are held at 136, Holland Park Avenue, W.11. Hon. Secretary, Mr. G. T. Hoyes, 71a, El-sham Road, Kensington, W.14.

**Bec Radio Society.**

The programme of the Bec (Streatham-Tooting) Radio Society, which has commenced the new session, includes weekly lectures and demonstrations, visits to places of wireless interest, and

**CLUB NEWS.**

tests with members' sets and apparatus. Meetings are held every Tuesday, from 7.30 to 9.30 p.m., at the Literary Evening Institute, Bec School, Beechcroft Road, S.W.17. Hon. Secretary, Mr. A. L. Odell, 171, Tranmere Road, S.W.18.

**Meetings Twice Weekly.**

The Alma Radio Society, which recently opened a new session, holds meetings twice weekly, on Tuesdays and Thursdays, from 7.30 to 9.30 p.m., at the Bermondsey Men's Evening Institute, Southwark Park Road, S.E.15, under the direction of Mr. S. F. Harris (G5SH). The club possesses a good collection of tools and wireless apparatus. An attractive syllabus has been prepared, and full particulars can be obtained from the Hon. Secretary, Mr. A. J. Hopkins, 41, Trafalgar Road, S.E.15.

**Wireless in the Isle of Wight.**

Readers in the Isle of Wight will be interested to learn that the Ryde Radio Society has resumed meetings, its headquarters being Mount House Hall, George Street, Ryde. An interesting programme has been prepared and includes lectures by representatives of leading radio manufacturers. There will also be a "query" night and a "surprise" night.

The meetings take place every Tuesday at

8 p.m. Applications from prospective members will be gladly received by the Hon. Secretary, Mr. Ivor Goddard, "Brinkleiff," Sandown.

**For Muswell Hill Readers.**

One of the most active of the London Societies last year was the Muswell Hill and District Radio Society, which has resumed meetings at Tollington School, Tetherdown, Muswell Hill, N.10, on Wednesday evenings at 8 o'clock. Hon. Secretary, Mr. C. J. Witt, 39, Coniston Road.

**A Refractory Receiver.**

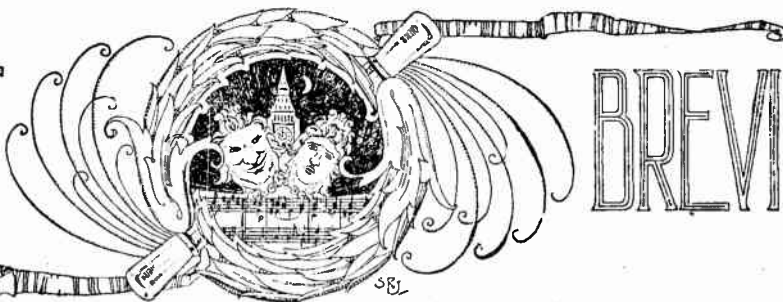
A unique set, the circuit diagram of which puzzled even the veterans present, was demonstrated by Mr. Newington at the last meeting of the South Croydon and District Radio Society. Piquancy was added by the fact that the set at first refused to function, but after an animated discussion it was discovered that by changing the position of two variable condensers the trouble was overcome!

Hon. Secretary, Mr. E. L. Cumbers, 14, Campden Road, S. Croydon.

**An October Field Day.**

Six members of Slade Radio (Birmingham) succeeded in tracking down a hidden transmitter on the occasion of the Society's field day on October 13th. Thirty-five members and friends took part in the hunt. After the test the company enjoyed an alfresco tea, which was followed by the distribution of prizes. Full particulars of the Society's activities will be gladly supplied by the Hon. Secretary "Enville," Warren Road, Erdington.

BROADCAST



BREVITIES

By Our Special Correspondent.

### What of the Twin Transmitter?—Continental Relays.—B.B.C. Finance.

#### The Sleeping Partner.

Despite rumours to the contrary, I understand that it is extremely unlikely that London Regional No. 2 will have anything to tell the world until mid-December. Why there should be such a delay is rather difficult to fathom, for the second station is already in working order, and the B.B.C. has the Postmaster-General's permission to go ahead with alternative transmissions.

One would have thought that even the cautious conservatism of the B.B.C. engineers would have been outweighed by their anxiety to discover as soon as possible whether twin-wave working from the same site can be a practical success. So far, its practicability is only theoretical.

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#### Weekly Relays from the Continent.

Those long-distance listeners who are threatened with a curtailment of their activities owing to the enormous power of the new regional stations will wonder whether there is any special significance behind the fact that the B.B.C. is urgently negotiating for a series of regular relays from Continental stations.

I hear that present plans provide for a weekly "Continental" evening during the coming winter. The new La Panne-Thanet cable will form the connecting link with the Continent. It is hoped that programmes will be available from Belgium, Holland, Germany and France.

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#### The Money Question.

Tales have been going the rounds that the B.B.C. is desperately "hard up." It would be doubtful policy for Savoy Hill to contradict such statements, but I can definitely say that it is not money troubles that loom largest in the official mind at the present moment. At the end of next year, however, some heavy calls will be made on the exchequer, including the cost of the Moorside Edge Regional Station, and it would not be surprising if the B.B.C. were then to demand an enquiry into the existing system of allocating licence moneys whereby both the Post Office and the Treasury reap more than an adequate profit.

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#### Work Begins at Moorside Edge.

The contract for the erection of the station buildings at Moorside Edge has

been secured by the Anglo-Scottish Construction Co., Ltd., of Victoria Street, Westminster. Work on the site will begin almost immediately.

It is hoped that the station will be ready to start exactly a year hence.

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#### The B.B.C.'s Chief Spokesman.

Mr. Gladstone Murray, who poured oil on the troubled waters of political broadcasting at the opening of the Manchester Show, is becoming recognised as one of the leading spokesmen of the B.B.C. Since 1927, when he was appointed Assistant Controller of Broadcasting at the age of 34, Mr. Gladstone Murray has been the close assistant of the Director-General, an experience which has given him a probably unrivalled insight into the countless problems affecting the control of a monopolistic broadcasting service.

I venture to suggest that before long we shall hear a good deal more of Mr. Gladstone Murray.

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#### Sir Oliver Lodge's Point of View.

Sir Oliver Lodge will give listeners his views on passing events in a broadcast from a London studio on November 1st.

#### FUTURE FEATURES.

##### London and Daventry.

OCTOBER 30TH.—"Aida" (Verdi).  
OCTOBER 31ST.—Hallé Concert from Manchester.

NOVEMBER 2ND.—A Burlesque Talkie.

##### Daventry Experimental (5GB).

OCTOBER 27TH.—"The Golden Legend," an oratorio by Sullivan.

OCTOBER 29TH.—"Michael," a play by Miles Malleson adapted from "What Men Live By" (Tolstoy).

##### Cardiff.

NOVEMBER 2ND.—Popular Concert relayed from National Museum of Wales.

##### Manchester.

OCTOBER 28TH.—"Establishing Relations," a comedy by W. W. Jacobs.

OCTOBER 31ST.—Hallé Concert relayed from Free Trade Hall.

##### Glasgow.

OCTOBER 20TH.—"The Jolly Beggar," a Cantata, words by Robert Burns, music by W. A. Henderson.

##### Aberdeen.

OCTOBER 30TH.—Scottish Instrumental Concert and Songs.

##### Belfast.

OCTOBER 28TH.—"At the Sign of the Tabard," a Song and Story Programme.

NOVEMBER 2ND.—"Sax Appeal," a saxophone musical programme.

This is the sixth half-hourly talk in the "Points of View" series, which has aroused so much discussion, favourable and unfavourable, amongst the public.

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#### Dilemma in Belfast.

Belfast listeners are still wondering what actually happened at 2BE on a recent Sunday. I can now tell the story, which must surely rank as a broadcasting epic. Owing to heavy rains the land lines connecting the studio with the transmitter were put out of action shortly before the Sunday afternoon programme was due to begin. As all S.B. lines terminate at the studio it was impossible to broadcast the London programme as announced. But all Belfast was waiting for a programme.

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#### Rehearsing in a Power Station.

Nothing daunted, the engineers transported a gramophone to the transmitter, together with two large amplifiers and 500 volts of high tension, and in an amazingly short time an impromptu programme was being radiated. While this was going on a "studio" was hastily rigged up in a small office in the adjoining power station, and at 8 o'clock it was possible to transmit a religious service with gramophone records of hymns, and later a programme by the Whiteway String Quartet. I am told that it was one of the sights of the century to see this hurriedly assembled combination rehearsing in the power station, surrounded by huge turbo-generators, switchboards and rotary converters! Normal working was not resumed until Tuesday.

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#### Copyright Music at Cenotaph Service.

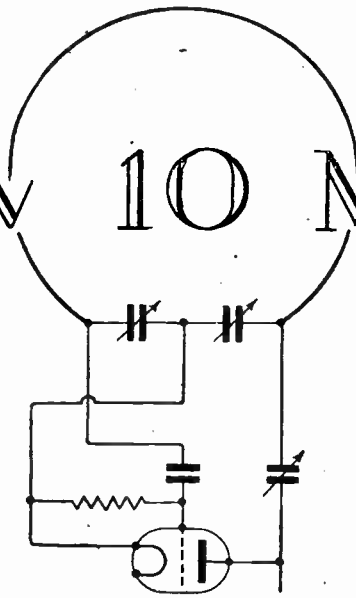
The B.B.C. issues a hint to those persons who may be arranging for the re-diffusion of the Cenotaph broadcast on Armistice Day ("re-diffusion" is a word commonly used at Savoy Hill in reference to loud speaker reproduction in public places). Whilst it is felt that no action would be taken for infringement of copyright, the B.B.C. disclaims all responsibility in the matter. But we may assume that no copyright holder would assert his claims on such a special occasion, and organisers of public gatherings on November 11th would be well advised to proceed with loud speaker arrangements without worrying themselves with questions of copyright. Far more important is the question of good reproduction.

# Below 10 Metres

**A**PPARATUS characteristic of the latest practice in the transmission of ultra-short waves has already been described<sup>1</sup>; it remains to deal in this article with the methods adopted for their reception.

There is nothing radically new in the design of receiving apparatus for use on very short wavelengths, the main difference from receivers suitable for longer wavelengths being a general reduction in inductance and capacities. Stray capacities become very important at frequencies of the order of 50 million cycles per second, and very careful layout of the components is necessary. Before describing in detail any specific receiver it will be useful to review the various types of receiver which have been used with success on longer wavelengths. The simplest type of receiver which has found widespread use on wavelengths below 100 metres is that employing a single-valve detector with variable capacity retroaction. For the reception of modulated continuous waves this retroaction can be set critically at a point just below that at which the valve oscillates, while at a point just above this the receiver is in a very sensitive condition for the reception of continuous waves. Any valve circuit, therefore, which will oscillate freely at the working frequency and can be controlled by suitable adjustment of the retroaction may be made to serve for reception purposes. Where additional sensitivity is required the possibilities of direct radio-frequency amplification immediately arise. Considerable experience has shown that it is extremely difficult to obtain any appreciable amplification on wavelengths shorter than about 15 metres.

In receivers using one or more stages of amplification at these high frequencies, it is usually found that any amplification obtained is got at the expense of the retroaction setting of the detector, and that if the high-frequency stages are removed this retroaction can be increased so that there is little overall loss in sensitivity. To avoid this decrease in available retro-



## Some Experimental Receiving Apparatus for Ultra-short Waves.

By R. L. SMITH-ROSE, D.Sc., A.M.I.E.E., and J. S. McPetrie, B.Sc.

action when using high-frequency stages, certain investigators have developed the super-regenerative type of circuit. In this arrangement it is possible to use more retroaction as the valve is prevented from dropping into oscillation by the quenching action of a supersonic oscillation at a lower frequency than that of the signals to be received.

Little work has been done on the development of the supersonic heterodyne receiver for wavelengths less than 10 metres, although this would appear to offer the greatest possibilities. It is a comparatively simple matter to obtain considerable voltage amplification at an intermediate frequency of the order of 100 kilocycles per second (3,000 metres). In order to use such an intermediate frequency amplifier in a short-wave receiver, it is necessary merely to precede it by a frequency changing unit, which generates oscillations of such a frequency as to heterodyne that of the incoming signals. By the substitution of different frequency-changing units it would appear possible to extend the range of such a receiver down to the shortest

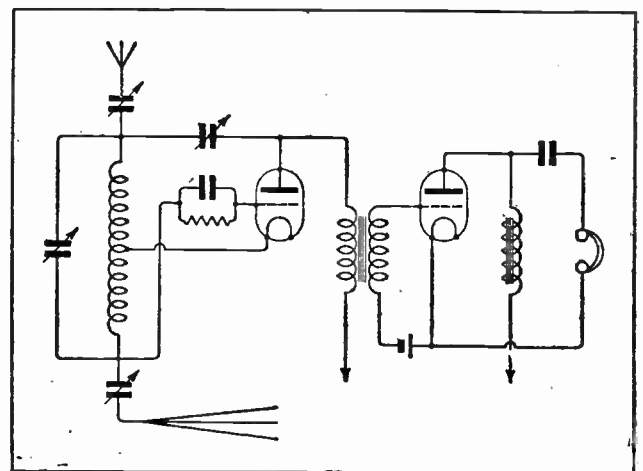


Fig. 1.—Circuit diagram of a two-valve short-wave receiver using a centre-tapped input coil capacity-coupled to aerial and counterpoise.

<sup>1</sup> *The Wireless World*, Oct. 9th, 1929, p. 398.



**Below 10 Metres.—**

wavelengths at which receiving valves may be made to oscillate.

**A Receiver for Use with Aerial and Earth Connections.**

The two receivers described below were developed by the authors to meet the requirements of the simplest type of receiver which could be used in a study of the propagation of very short waves. For these receivers the single-valve retroactive detector has been employed, followed by one stage of transformer-coupled low-frequency amplification.

The circuit diagram of one of these receivers is given in Fig. 1. In this the tuning inductance is centre-tapped, as at this point there is no alternating potential, and by connecting the centre of the coil through a suitable battery to the negative end of the filament any required bias may be applied to the grid of the detector valve without interfering with any alternating electromotive forces in the tuned circuit. An open aerial can be coupled to one end of the coil by a variable condenser having a capacity of about 50 micro-microfarads. If a definite earth connection is employed, this should be made to the centre of the coil for the same reasons as given above for the centre-tapping. If, on the other hand, an insulated counterpoise system is preferred, this may be coupled to the other end of the coil from the aerial through a condenser of similar dimensions to that used for the aerial.

It is important to observe that in this circuit both ends of the inductance coil are at high alternating potentials, and the aerial and counterpoise connected to them should be so adjusted that they have potential variations impressed by the incoming signals at the ends coupled to the tuning inductance. It is important, therefore, that the length of either should not be an odd multiple of a quarter of the wavelength, since this would provide a potential node at the receiver. The condition for optimum reception with this type of circuit involves the adjustment of the length of the aerial and all the controls of aerial coupling, retroaction, and, of course, tuning. The correct adjustment of aerial coupling is particularly important since, if it is too great the radiation resistance of the aerial, which at these short wavelengths is high (of the order of 50-80 ohms), will prevent the detector from oscillating, while if it is too small a loss in sensitivity will result.

**Variable Condensers for Short Waves.**

For wavelengths between 5 and 10 metres a condenser having a maximum capacity of 50 micro-microfarads is suitable for the main tuning condenser. This condenser should have reasonably small linear dimensions, as at this short wavelength the inductance of the plates themselves becomes important. Another advantage of such a small condenser is that there is usually less stray field to create losses in the insulators sup-

porting the plates. A condenser of similar capacity and design is suitable for retroaction purposes and for coupling the aerial and counterpoise to the coil. The grid condenser should be fairly large as it was found that it tended to stabilise the oscillations: a fixed condenser having a capacity of about 1,000 micro-microfarads will be found suitable. The grid leak should have low self capacity, and have a resistance of between 0.5 and 2 megohms according to the valve used. The time an electron takes to travel from the filament to the anode should always be small compared with the period of the wave which the valve is receiving: for this reason it may be found necessary to use short-path valves for wavelengths below about 5 metres. Small diameter wire has an appreciable inductance, and so to avoid unnecessary reactance in the leads at very high frequencies all wiring should be made in reasonably thick wire, say, No. 16 S.W.G. Such wire has the additional advantage of rigidity, an essential feature at these high frequencies. Suitable coils may be made

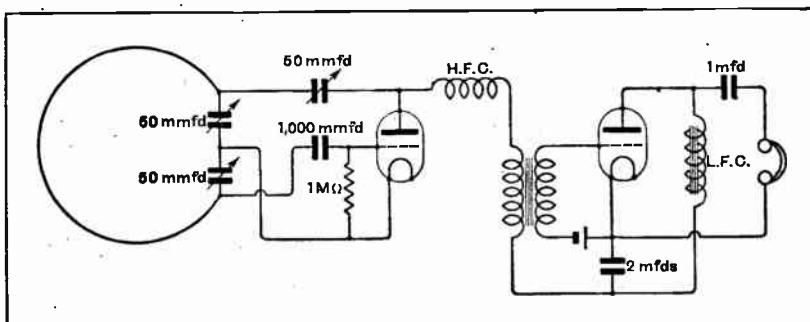


Fig. 2.—Circuit diagram of a two-valve short-wave loop receiver for field-strength measurements and direction finding. The wavelength range is from 4 to 10 metres.

from  $\frac{1}{8}$  in. or  $\frac{1}{4}$  in. aluminium or brass tubing. With  $\frac{1}{4}$  in. tubing and components complying with the above conditions it was found that with a centre-tapped 4-turn coil with internal diameter of 1 in. and 2 in. long, the wavelength range extended from 4.7 to 7 metres, while with another 4-turn coil of equal axial-length but having a diameter of  $1\frac{1}{2}$  in., the available range was from 5 to 12 metres. It is advisable to mount such coils on ebonite or American whitewood to prevent change in shape which, of course, alters the inductance of the coils.

**Frame Aerial Reception.**

For measurement purposes, it is essential to cut down the number of variables involved in the transmission and reception of the waves and, for this purpose, a small loop receiver was designed in order to do away with the necessity for an aerial. This loop is mounted directly on a screened box measuring 20 in.  $\times$  10 in.  $\times$  8 in., which contains all the receiving apparatus. In this way everything except the pick-up loop and the telephone leads is screened, a distinct advantage when measurements are required. For wavelengths below 10 metres the product of area and turns of the receiving loop is comparatively small, and it was decided to construct the loop of single turns of brass tubing. With single-turn coil receivers a centre tapping on the tuning

**Below 10 Metres.—**

coil is objectionable, and, to avoid this, the circuit arrangement shown in Fig. 2 is adopted for the detector.

The tuning adjustment is effected by two variable condensers of maximum capacity, 50 micro-microfarads, each mounted in series on a common spindle, the tapping to the filament being taken from their common connection. Latterly this connection has been omitted, the centre of the double condenser being allowed to take up its own "earth" point. By omitting this connection the capacity across the tuning loop is effectively decreased, and the range of the receiver is thus extended in the direction of shorter wavelengths. A photograph of a complete receiver built on the above lines is shown in Fig. 3. The front lid of the box has been removed to show the internal arrangement of the components. The diagram of connections and the dimensions of the principal components are given in Fig. 2. The details in design emphasised in the description of the previous receiver obviously apply in this case also. In order to make the whole receiver as symmetrical as possible about the loop, and also to shorten the lengths of wires in the detector stage, the apparatus is arranged within the box in three tiers, as indicated in the photograph. The top tier contains the tuning condensers, the reaction condenser, the grid condenser and leak, along with the first valve and a radio frequency choke. The loop is held rigidly to an insulating strip on the top of the box by two terminals to the underside of which is attached the tuning condenser. This tuning condenser, and also the reaction condenser, are mounted on a panel which, when in position, lies about  $1\frac{1}{2}$  in. from the back of the box. This mounting is necessary in order to keep stray capacities at a minimum. Extension handles pass from the condensers through the box and are connected to dials at the back.

**H.F. Chokes.**

It is advisable to be able to change the choke and grid leak, so these were arranged to fit into sockets provided on the top platform. Little systematic investigation has been made into the working of choke coils at very high frequencies, but a design which the authors have found fairly satisfactory consists of a solenoidal coil of No. 47 S.W.G. insulated copper wire wound uniformly on a  $3\text{ in.} \times \frac{1}{2}\text{ in.}$  ebonite former. A range of chokes may be made by varying the number of turns from about 50 to 200. The ends of the wires are soldered to two valve pins screwed into the ends of the ebonite, and, by keeping the distance between these pins the same for all chokes, it is a simple matter to make them easily interchangeable. It is desirable in fixing the positions of the pins to remember that the farther they are apart the less will be the self-capacity of the choke.

A single audio-frequency amplifying stage is mounted on the middle platform of the box, while the necessary filament and high-tension batteries are placed at the bottom of the box. The screening box is used as the lead to the negative end of each filament, as this decreases the number of wires necessary in each compartment. The output terminals for the telephones are placed as a shunt across an audio-frequency choke in

the anode circuit of the second valve. By this means the telephones and, therefore, the observer are maintained at the potential of the screening box (see Fig. 2). This design diminishes certain difficulties due to capacity changes while tuning, and also prevents the high-tension battery being short-circuited when the telephone terminals come accidentally into contact with the box. In order that the screening may be efficient, the box and lid are bolted together when the receiver is in use.

**Wavelength Range of Loop Receiver.**

Using single-turn loops constructed of  $\frac{1}{4}$  in. diameter copper tubing, the following wavelength ranges are covered with a tuning condenser, of which the minimum and maximum capacities are 2 and 25 micro-microfarads

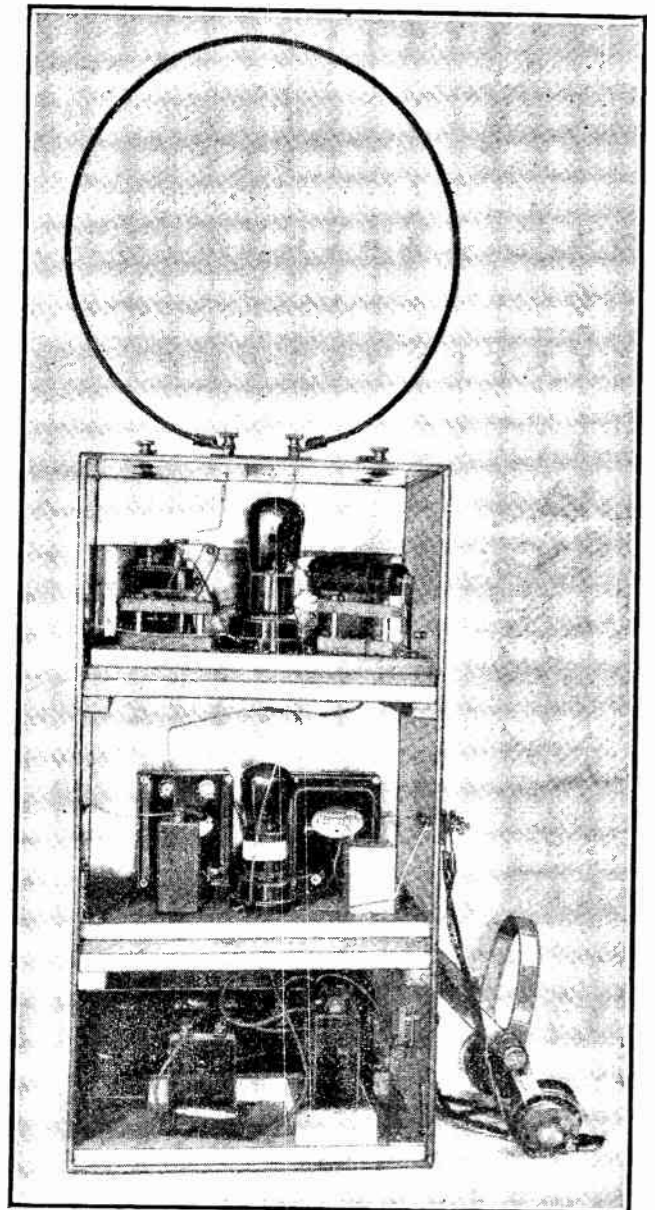


Fig. 3.—The loop receiver using the circuit shown in Fig. 2.

**Below 10 Metres.—**

respectively (i.e., two condensers in series, each having minimum and maximum of 4 and 50 micro-microfarads).

Diameter of loop in inches.	Wavelength range in metres.
5	4.8-6.9
9	5.5-8.8
10	6.2-9.5
12	6.7-10.8

In order to ascertain the possibility of reducing the minimum wavelength by a reduction in the stray capacity of the first stage, some measurements were made of the capacity between the coil terminals and the effect of various components upon this capacity. The measurements were made by a substitution method using a standard variable air condenser and a wavelength of about 17 metres. With both tuning and retroaction condensers set to their minimum positions, the capacity between the coil terminals with the first valve in its socket was 9 and 12 micro-microfarads with the current on and off respectively. To this amount the base of the valve contributed 1 micro-microfarad, while the capacity of the valve itself in between its grid and anode was about 1.5 micro-microfarad, leaving about 7.5 micro-microfarads to be attributed to the wiring connections and their capacity to the screening box. The alteration of the retroaction condenser from its

minimum to maximum position increased the capacity between the coil terminals by 5 micro-microfarads. The substitution of various grid leaks and choke coils in the detector valve circuit made no appreciable alteration to this capacity. It will be seen that the minimum capacity that can be obtained is limited by the capacity of the valve and its connections, and little reduction can be obtained by omitting the valve holder or by using a tuning condenser with a still lower minimum capacity than that at present in use (2 micro-microfarads).

The chief disadvantage of this limitation in the minimum capacity of the main tuning condensers is that the maximum must also be small, as no suitable condenser has yet been designed which incorporates both a small minimum and a relatively large maximum capacity. This limitation in capacity restricts the range of wavelengths which it is possible to cover with any one coil, but the above table indicates that there is no difficulty in making the receiver operate at wavelengths down to about 4 metres. When it is desired to proceed to still shorter wavelengths, it is an advantage to remove the stray capacity due to the screened box. In this way the same receiver, with the inductance coil reduced to a straight wire of No. 16 S.W.G. 2in. long, has been made to operate at 2.9 metres.

## CORRESPONDENCE.

The Editor does not hold himself responsible for the opinions of his correspondents.

Correspondence should be addressed to the Editor, "The Wireless World," Dorset House, Tudor Street, E.C.4, and must be accompanied by the writer's name and address.

**EMPIRE BROADCASTS.**

Sir,—Having read in your columns so many denunciations of the B.B.C.'s short-sighted short-wave policy, one finds it increasingly difficult to produce further arguments in the hope of persuading an early improvement in the situation. Apparently neither the B.B.C. officials nor the engineers responsible for 5SW have any sense of shame or interest in the station, otherwise 5SW would be proclaiming itself to the world at large as the short-wave unit of the richest broadcasting combination in the world, and proclaiming itself in no small voice. Several people already have shattered the excuse that 5SW is experimental. When one thinks of the number of stations that have started since 5SW came on the air, and have been immediate successes, one cannot but feel that the B.B.C. is letting us down rather badly. Anyway, how can a station pretend to be experimental which does not experiment with the most important item, the wavelength? Strangely enough, the engineers are so proud of its puny performance that they never bother to ask for listener's reports.

In my humble opinion the B.B.C. would do well to tell the Marconi Company that they have no use for such a poor effort as 5SW, and ask the Philips Radio people to build a permanent station; it would need no months of experiment! Any fool can see that a truly Empire station must broadcast simultaneously on two wavelengths, neither of which would be that used at present. I would suggest wavelengths of around 32 and 16 metres.

And now, you folks at home, are you in sympathy with the B.B.C.'s plea that they are not justified in spending your money on an Empire broadcaster? Of course you aren't! Then let us have a good lusty demand from you for a station you can be proud of. You are our only hope now. "GROWSER."

R.A.F. Base,

Calafrana, Malta.

September 9th, 1929.

**WIRELESS THEORY.**

Sir,—May I say how I appreciate the articles in *The Wireless World* on "Wireless Theory Simplified," by S. O. Pearson, B.Sc. I do not think that the subject could be treated in a simpler and more attractive manner. May there be many more of a similar nature.

I am one of that small number of readers who find your paper slightly too technical, but who, nevertheless, can find no other wireless periodical to come anywhere near to taking its place.

You will understand, therefore, how valuable a series of articles on the above subject will be to a

NON-THEORETICAL READER.

**B.B.C. TRANSMISSIONS.**

Sir,—I should like, if I may, to submit one or two observations about the quality of B.B.C. transmissions.

For at least one provincial listener, all the special occasions which the B.B.C. are in the habit of heralding with preliminary programme-puffs and pamphlets—the promenade concerts, symphony concerts, operatic performances—serve merely to mark so many *dies non* or rather "blank" nights; and this not because a plebeian ear disqualifies him from appreciating what the best people like, but because the quality of the transmission makes it impossible to listen to it with pleasure.

This state of affairs gives him a sense of grievance at all times. But what moves him to public complaint about it at this moment is his recent very keen enjoyment of "local" transmissions of orchestral music from the Festival Hall at the North-East Coast Exhibition. He has experienced wireless at or approaching its best for a few brief hours. And, naturally enough, he asks himself—and any-one else better able to supply an answer—why he can't be given the genuine thing always.

I believe that neither the engineer nor the musician would

question the practical accuracy of some such classification of B.B.C. transmissions as follows:—

(a) First-rate. Direct or "local" transmissions.

Only those within "local" range of London receive transmission wholly of this quality. Provincial stations, other than Daventry, give only about 25 per cent. direct transmission.

(b) Second-rate. Daventry transmissions.

These suffer deterioration through the use of 70 miles of land-line.

(c) Third- to fifth-rate. Land-line relays.

The land-line may be anything from 100 to 400 miles in length, of varying character, and inadequately corrected. Besides the prime defect of frequency distortion and/or attenuation, these transmissions are vitiated also by background noise. It is impossible, even in the case of any one particular provincial transmitter, to set them down as being all of level merit. Relays by Newcastle, for instance, from the London Queen's Hall, seem, as judged by ear, to be inferior for some reason or other to those from the London studios.

Sixty per cent. of provincial transmissions of music come under this head.

(d) Sixth- to tenth-rate. Wireless relays.

These are re-transmissions by provincial transmitters of Daventry 5XX picked up by wireless. They combine, therefore, the defects of a short land-line, one receiver, and two transmitters, with the addition in varying degrees of atmospheric. Some 15 per cent. of provincial musical transmission is of this sort.

The conclusion to be drawn is that the majority of listeners receive as a rule third- to tenth-rate transmission.

Until a majority at least enjoy for the most part first-rate transmission it would seem premature to accept wireless as an authentic medium either of musical entertainment or of musical education. There is at present a case rather for denouncing it as de-sensitising the collective musical ear.

And can it be possible that the efforts of designers and manufacturers to provide sets giving straight-line reproduction have been so far and remain for the time being so much energy misdirected?

K. McCORMACK.

Newcastle-on-Tyne.

### HIGH SPOTS.

Sir,—The *Humorist* recently had a radio article whose writer says that last year screen-grid valves and pentode coils (*sic*) were the "high-spot" of interest, and asks what it will be this year. I can tell him: it was the drum-controlled loud speakers.

H. E. ADSHEAD.

### IDENTIFYING STATIONS.

Sir,—I have been much amused at the various efforts of broadcasting authorities and others to make the identification of stations an easy matter. All broadcasting stations are given a call-sign consisting of a combination of letters and figures, or letters only. Why not use them? and in this manner: Each station to send its call-sign three times in Morse, slowly and distinctly, in the intervals. Listeners will not need to learn the code as, if sent in a proper manner, it would be an easy matter to copy the dots and dashes on paper and look up the code afterwards and at leisure.

*First-Year Electrical Engineering*, by D. J. Bolton, M.Sc., M.I.E.E.—An elementary text-book of electrical engineering, including Ohm's law, electrical units, primary batteries and accumulators, magnetism, motors and generators, electrostatics, instruments, lighting, telegraphy and telephony, with a few notes on the elements of wireless telegraphy. Pp. 260, with 118 illustrations and diagrams. Published by Edward Arnold and Co., London. Price 5s.

o o o o

*Electrical Wiring and Contracting*.—A practical and authoritative work dealing with all branches of the trade, written by experts for electricians, contractors, and all engaged on installation work, and

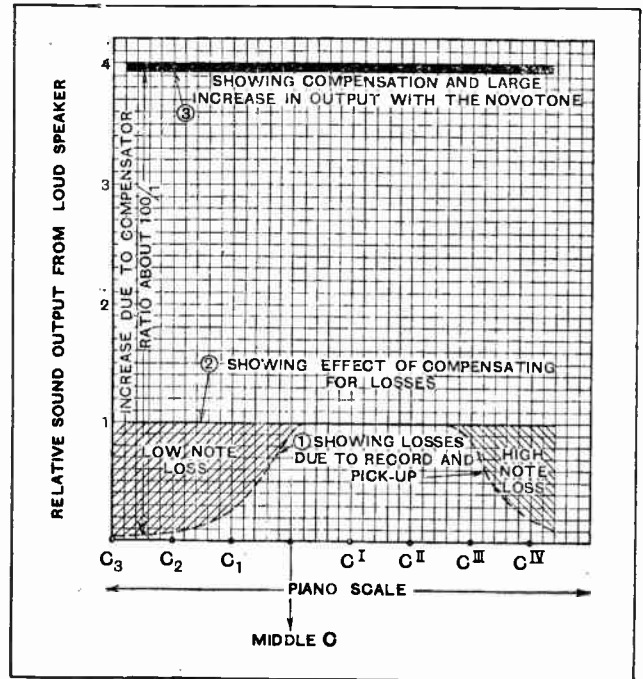
I claim that this simple and very obvious system would obviate all the various phonetic languages—hoots, whistles, ticks, gongs, and so forth—which each station now employs in a vain effort to make itself known.

S. W. CUTLER.

Ealing, W.5.

### THE NOVOTONE.

Sir,—I should like to amplify your remarks on the above device which appeared in *The Wireless World*, page 380, October 2nd, 1929. The apparatus is termed a "filter" and it is also implied that a good pick-up requires no correction. The Novotone is in no sense a filter. It increases the voltage from the pick-up below 250 cycles and above 2,000 cycles. If the groove width below 250 cycles is constant (as it is in practice), it is necessary—even with a perfect pick-up—to compensate for the corresponding reduction in low frequencies. The Novotone gives accurate compensation from 250 cycles to 50 cycles. The requisite compensation above 2,000 cycles depends upon the pick-up, etc., and can be varied by means of a rheostat of 30 ohms or more.



The accompanying diagram shows precisely what happens when the Novotone is connected between the pick-up and the amplifier. With M.C. speakers having pronounced resonances below 100 cycles the Novotone causes a startling effect, which I leave the experimenter to discover for himself.

N. W. McLACHLAN.

### BOOKS RECEIVED.

edited by H. Marryat, M.I.E.E., M.I.Mech.E. To be completed in about thirty weekly parts. *Part I* includes workshop science and the beginning of an article on drawing. Subsequent parts will include electricity and magnetism, A.C. and D.C. generators and motors, practical wiring, testing, heating and cooking, estimating and many other kindred subjects. Published by Sir Isaac Pitman and Sons, Ltd., London. Price 1s. each part (64 pages, with numerous illustrations and diagrams).

*The "Motor Cycle" Diary for 1930*, including, in addition to the usual diary memoranda, speed records, with space for amendments; monthly summary of running expenses; principal hills in Great Britain, with remarks on their special features. Published by Iliffe and Sons Ltd. Price, bound in leather with pencil, 1s. 6d. net or 1s. 7d. post free.

o o o o

*Fenomeni Radiotomografici*, by Prof. Piero Ilardi.—A study of the nature and character of atmospherics, from observations recorded in various meteorological and geophysical observations (in Italian). Pp. 28, with 5 diagrams. Issued by the Servizio Radiotomografico Italiano, Montecatini and Rome.

READERS'

PROBLEMS

ANSWERED

The Service is subject to the rules of the Department, which are printed below; these must be strictly enforced, in the interest of readers themselves.

A selection of queries of general interest is dealt with below, in some cases at greater length than would be possible in a letter.

"The Wireless World" Supplies a Free Service of Technical Information.

Converting a Portable.

I should like to convert a commercial portable 5-valve battery receiver with two aperiodic H.F. stages into an A.C. mains set for operation where a source of current is available; will you tell me if it is likely that any special "snags" are to be guarded against in converting the set, and if it is necessary to do anything beyond making the usual alterations to the low-tension circuits? J. L. P.

We would hesitate to offer any definite advice on this matter, but we cannot help thinking that you would find it extremely difficult to overcome the natural tendency towards instability which would manifest itself on replacing the existing valves by indirectly heated types, having a much better "figure of merit." It seems almost certain that the H.F. amplifier will lack stability, and that motor-boating will be produced unless elaborate decoupling devices are included in the low frequency anode circuits.

o o o o

A "Regional" Crystal Set.

I often use a crystal set for listening to the local station when loud speaker reception is not required, and after hearing the test transmissions from Brookman's Park have come to the conclusion that my present arrangement will be hopelessly lacking in selectivity when the twin stations start operations. I take it that a two-circuit aerial tuner will be the best, and should be greatly obliged if you could suggest any improvement to the conventional arrangement, bearing in mind the fact that I have a number of spare components, including variable condensers of 0.0003 and 0.0005 mfd. capacity, which I should like to use if possible. K. D.

We think you will find it difficult to better the arrangement shown in Fig. 1, which is an improvement over that usually suggested, in that it makes provision for reducing the damping effect of the crystal; this is achieved by joining the detector and phones across a portion only of the secondary inductance coil.

Strictly speaking, the best connection for the crystal tapping can only be determined by trial and error, as its position depends entirely on the character-

istics of the detector. It will therefore be obvious that a simple single-layer winding, or perhaps a section-wound coil would be best for this circuit, but in practice good results are often afforded by the use of an efficient commercial

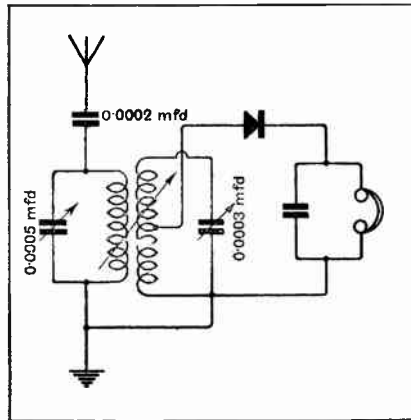


Fig. 1.—Highly selective circuit arrangement for a crystal receiver.

centre-tapped plug-in coil; of course, the crystal connection is made to the mid-point.

RULES.

- (1.) Only one question (which must deal with a single specific point) can be answered. Letters must be concisely worded and headed "Information Department."
- (2.) Queries must be written on one side of the paper, and diagrams drawn on a separate sheet. A self-addressed stamped envelope must be enclosed for postal reply.
- (3.) Designs or circuit diagrams for complete receivers cannot be given; under present-day conditions justice cannot be done to questions of this kind in the course of a letter.
- (4.) Practical wiring plans cannot be supplied or considered.
- (5.) Designs for components such as L.F. chokes, power transformers, etc., cannot be supplied.
- (6.) Queries arising from the construction or operation of receivers must be confined to constructional sets described in "The Wireless World" or to standard manufacturers' receivers.

Readers desiring information on matters beyond the scope of the Information Department are invited to submit suggestions regarding subjects to be treated in future articles or paragraphs.

Results comparable with those yielded by this step-down auto-transformer can be obtained by using an exceptionally large capacity for tuning the secondary circuit, but this is not usually convenient, particularly if it is desired to receive both of the twin stations, which will naturally transmit on wavelengths differing as much as possible.

o o o o

Tapping Litz Wire.

I am building a two-circuit aerial tuner similar to that included in several recent "Wireless World" sets, and have encountered a difficulty in making tapped connections to the secondary winding, which is of Litz wire. It would simplify matters greatly if it were permissible, instead of making connections to all the strands of the cable, to effect a junction to but a few of the conductors; would this course be permissible, or would it be better in the interests of efficiency to cut the wire at each point and to make a soldered connection to each and every strand? O. C. B.

In circuits of the kind under discussion—and, indeed, in most arrangements for which tapped Litz coils are used—it is quite unnecessary to make connection with all the strands. In a tuned open aerial circuit where losses are bound to be fairly heavy, there is no point in taking special precautions, but you should be very careful not to break any strands.

o o o o

"Kit Set" Modifications.

Is there any reason why the "Wireless World Kit Set" should not be modified by the use of anode bend detection? It is realised that this alteration would entail one or two minor modifications; for instance, the detector-grid would be connected directly to the high potential end of the H.F. transformer secondary.

If you approve this alteration, I propose to abandon the use of reaction. P. A.

With the alterations you specify, the set should work quite well, with its detecting circuits altered for anode bend rectification. It must not be forgotten, however, that in its existing form it is essentially designed for grid detection, and we cannot help thinking that it would be rather a pity to alter it.

**Eliminator for the "Foreign Listener's Four."**

*I already have an H.T. eliminator capable of supplying approximately the voltages specified for the "Foreign Listener's Four." Do you think that it would be safe to use it, or would it be better to make up a special unit as described?*

M. T. E.

The circuit of the set in question is such that it is not prone to interaction troubles, and, if your eliminator delivers sufficient current at approximately the right voltage and includes reasonably adequate smoothing arrangements, there is no reason why it should not be used with complete satisfaction.

o o o o

**"Kilo-Mag Four" Pick-up Connections.**

*Will you please give me a circuit diagram showing how a pick-up may be fitted to the "Kilo-Mag Four" receiver? If possible, I should like to make the change-over by means of a single-pole switch mounted through the base of the screening compartment, and operate it through a rod by a knob mounted on the front panel. In addition, I should like to arrange matters so that the H.F. valves are switched off when the waveband switches are in the "off" position.*

A. G. C.

This method of fitting a pick-up is to be recommended, and it is not difficult to devise a suitable method of connection. A recommended arrangement is shown in

Fig. 2, which is drawn on the assumption that the switches at present used for waveband changing are so made that they have a definite "off" position.

You will see from the diagram that the extra switch is so arranged that it changes over the low-potential end of the detector grid circuit from its normal bias connection to the pick-up, which will naturally be connected to a less negative point on the common bias battery. An extra pole is added to the waveband switch  $S_3$  (reference lettering corresponds with that in the original circuit diagram, Fig. 2), and is arranged so that the filament connections of the H.F. valve are broken when its arms are in a position intermediate between the sets of contacts.

o o o o

**Potentiometer or Variable Resistance.**

*By mistake I recently purchased a 1/2-megohm potentiometer instead of a variable resistance of that value; will you tell me if it is possible to alter the internal connections to the terminals, so that the device may be used as a plain variable resistance?*

R. T. C.

Unless a definite "off" position is required for your purpose, it is quite unnecessary to alter the component, and, to use it as a variable resistance, it will only be necessary to connect the external circuit to the terminal in contact with the movable brush contact (generally the centre terminal) and to either one of the other terminals—it is really immaterial which, but it is usual to choose the one

which gives a decrease of resistance with clockwise rotation of the knob.

o o o o

**Built-in Transformer Condensers.**

*For the "Kilo-Mag Four" I am using a transformer with a built-in condenser across the primary windings. Would it be best to remove it, or, alternatively, do you advise me to leave it in position and to omit the by-pass condenser connected between anode and filament of the detector valve?*

C. N. S.

To be on the safe side, we think it would be as well to remove the condenser. Unless steps are taken to by-pass H.F. currents in the detector anode circuit, instability may be encountered, and it is hardly wise to omit the anode by-pass condenser, as you suggest.

o o o o

**Testing in Safety.**

*My "Record III" receiver is nearing completion, and I should like to know what alterations are necessary to enable me to test the receiver with battery feed before connecting my mains unit.*

R. P. C.

This receiver may be fed from a battery supply without any alteration whatsoever. The leads provided for connection to the low voltage A.C. input are connected across a 4-volt low tension accumulator; polarity is immaterial. You should assure yourself that this battery is capable of delivering a current of 3 amperes.

o o o o

**Leave Well Alone.**

*Do you consider that it would be worth while modifying the "New All-Wave Four" by substituting a screen-grid valve for the present neutralised triode H.F. amplifier? If so, will you please give me a few hints as to how to proceed, bearing in mind that, as the set works very well as it is, I do not propose to make any change unless it is possible to do so satisfactorily without radical structural alterations?*

C. R. G.

If you are using an efficient modern three-electrode valve in the H.F. position, it can safely be assumed that a magnification of at least forty times is being attained; unless comparatively elaborate screening arrangements are added, you are hardly likely to better this appreciably by fitting a screen-grid high-frequency valve; unless you are willing to make these alterations, we can hardly advise you to change your existing arrangements.

o o o o

**The "Kilo-Mag Four": A Correction.**

In the practical wiring plan of this receiver, the reference lettering on the two H.F. valve-holder filament terminals should be reversed; it will be obvious that the terminals "earthed" to the metal work should be lettered *r* and *t* to correspond with their connecting wires, which lead to L.T. negative. The valve-holder positive filament terminals, which are connected to the rheostat, should of course be lettered *s* and *u*.

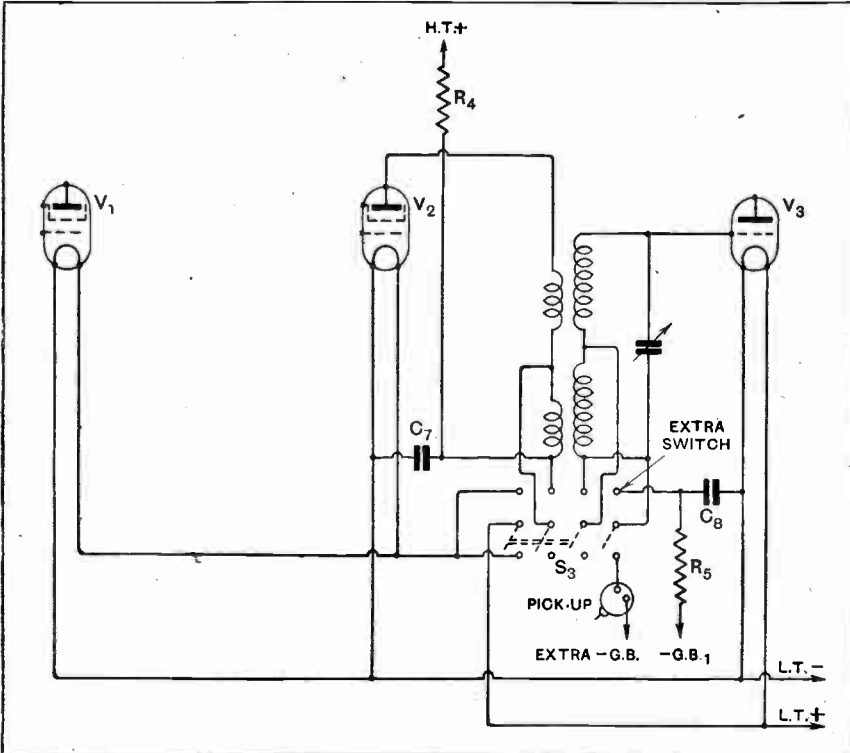


Fig. 2.—Method of connecting a gramophone pick-up to the "Kilo-Mag Four": an extra contact on the wave-change switch  $S_3$  is arranged to break the H.F. valve filament circuits.

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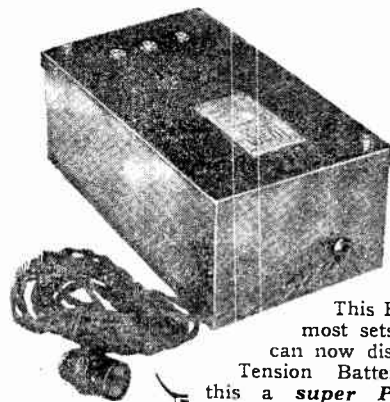
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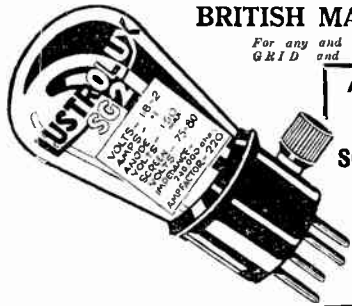
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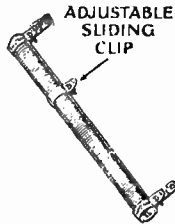
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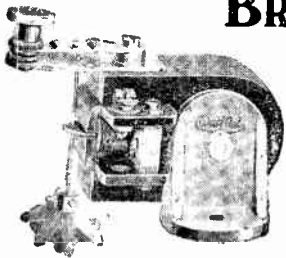
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THE "CHRISTIAN HERALD" is read every week in more than 250,000 homes, representing more or less a million readers, and for years many well-known Advertisers have proved from "keyed" announcements its value as an Advertising Medium. Thus it pays to advertise in the "CHRISTIAN HERALD."

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For the convenience of private advertisers, letters may be addressed to numbers at "The Wireless World" Office. When this is desired, the sum of 6d. to defray the cost of registration and to cover postage on replies must be added to the advertisement charge, which must include the words Box 000, c/o "The Wireless World." Only the number will appear in the advertisement. All replies should be addressed No. 000, c/o "The Wireless World," Dorset House, Tudor Street, London, E.C.4. Readers who reply to Box No. advertisements are warned against sending remittance through the post except in registered envelopes; in all such cases the use of the Deposit System is recommended, and the envelope should be clearly marked "Deposit Department."

### DEPOSIT SYSTEM.

Readers who hesitate to send money to unknown persons may deal in perfect safety by availing themselves of our Deposit System. If the money be deposited with "The Wireless World," both parties are advised of its receipt.

The time allowed for decision is three days, counting from receipt of goods, after which period, if buyer decides not to retain goods, they must be returned to sender. If a sale is effected, buyer instructs us to remit amount to seller, but if not, seller instructs us to return amount to depositor. Carriage is paid by the buyer, but in the event of no sale, and subject to there being no different arrangement between buyer and seller, each pays carriage one way. The seller takes the risk of loss or damage in transit, for which we take no responsibility. For all transactions up to £10, a deposit fee of 1/- is charged; on transactions over £10 and under £50, the fee is 2/6; over £50, 5/-. All deposit matters are dealt with at Dorset House, Tudor Street, London, E.C.4, and cheques and money orders should be made payable to Liffe & Sons Limited.

### THE SALE OF HOME-CONSTRUCTED UNLICENSED APPARATUS.

#### A Service to our Readers.

We have made an arrangement with the Patentees whereby readers who wish to dispose of a home-constructed receiver not licensed under the patents made use of, can license the set by means of the Deposit System referred to above.

The person desiring to sell, in sending us particulars for his advertisement, will in every case make use of a Box No., and should add to the price which he requires the amount of royalty customarily paid by manufacturers.

If the purchaser is satisfied with his purchase, the sum realised will be forwarded to the seller, less the amount due in respect of royalties, which amount will be paid by "The Wireless World" to the owners of the patents concerned, and a certificate will be handed on to the purchaser of the set.

**SPECIAL NOTE.**—Readers who reply to advertisements and receive no answer to their enquiries are requested to regard the silence as an indication that the goods advertised have already been disposed of. Advertisers often receive so many enquiries that it is quite impossible to reply to each one by post.

## ALL WIRELESS WORLD COILS

1930 EVERYMAN FOUR .....	47 6 set
KIT SET, coils with Switches ..	45 - set
NEW KILOMAG. ....	45 - set
RECORD III .....	45 - set
FOREIGN LISTENERS 4 B.B.C. ....	30 - set
5XX 37 6 set	
METAL CABINETS .....	38'6 to 46'6
5" DRUM DIALS with Escutcheons ..	5/6
WAVE TRAP, Litz Wire .....	10 6 each

# B & J. Wireless Co.

2, 3, & 4, Athelstane Mews,  
Stroud Green Road, N.4.

Archway 1695

"THERE IS A WHOLE OF DIFFERENCE"

## APPLEBY'S

THE ORIGINATORS OF RADIO PART EXCHANGE

For Modern High-grade Material Only.

**CHAPEL ST., LONDON, N.W.1**  
OPEN TILL 7 P.M. SAT. 1 P.M.

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### EFFICIENCY WITHOUT FRILLS!

The modern way is the electric way. Perfectly smooth, no hum, economical and efficient—such are "Tannoy" mains units, made for any electric mains. Type 12C. H.T. 120 v. at 15 m/amp. Type 16C.H. 150 v. at 25 m/amp. Combined units from £5-12-6 (complete.) THE SIMPLE WAY TO MODERN RADIO.

**THE TULSEMER MFG. CO.,**  
1-7, Dalton St., West Norwood, S.E.27.  
Telephone: STREATHAM 6731.



### ASHTON PERFECT AERIAL SPREADERS

15/- New Model 15/- Per Set.

## WONDERFUL RECEPTION

ASHTON PERFECT AERIAL SPREADERS  
"THE BEST SET" IS MADE A PERFECT AERIAL IN ALL COUNTRIES.

**Manchester Show.**  
See Stands 8, 49, 65, 82.

## RECEIVERS FOR SALE.

- SCOTT SESSIONS and Co.,** Great Britain's Radio Doctors.—Read advertisement under Miscellaneous. [0284]
- 3-VALVE** All-wave Receiver, latest type, powerful, perfect; £4.-V. Taylor, 57, Studley Rd., Stockwell, London. [0214]
- RECEIVERS for Sale.**—Portable 5-valve, suit case type, complete, as new, perfect; £9/17/6.—Taylor, 57, Studley Rd., Stockwell, London. [0323]
- BURNDIPT** 7-valve Superhet, 1926-27, £15: Burndipt Ethogrand 5-valve, £15; Burndipt Ethophone IV, £7; Marconi amplifier for V2, 35/—James Scott and Co., Radio Engineers, Dunfermline. [0320]
- PORTABLE** Wireless Set; £8.—Greatrex, 34, St. George's Rd., Golders Green, London. [6645]
- PHILIPS** 3v. All Mains, A.C. 240v., £23, sell £18.—B.T.H. Rice Kelling moving coil loud-speaker, A.C. 240v., £40, sell £25.—Saul, 8, Ainsell Rd., S. Lytham, St. Annes. [6493]
- READ and MORRIS, Ltd.,**
- THE** Mains Pioneers, who in 1925 equipped the hospitals with mains sets.
- STILL** Supreme in all Mains Work.
- LOW** Tension A.C. Eliminators Permanently Replacing Batteries; now only £5/15.
- THE** Original Electrolytic Condensers, as used in above, 2,000 m.f.; only 13/—, including postage.
- MOVING** Coil Speakers.
- ALL** Mains Power Units.
- BARGAINS**, second-hand.
- READ and MORRIS, Ltd.,** 31, Eastcastle St. (facing back of Waring's), Oxford St., W. [6466]
- MARCONI**PHONE 82 8-valve Superhet, complete with valves and G.L.B., present list price £64, excellent condition; will accept £30.—A. G. S. McDougle, Ingram House, Bumburgh, Northumberland. [6696]
- PHILIPS** 3-valve A.C. Mains Set, new 5 months ago, Ferranti trickle charger; highest offers.—Dunn, 96, Woodhorn Rd., Ashington. [6771]
- SIX-SIXTY** Receivers, with valves, cabinet; £8.—J. Hawkins, 11, Station Lane, Wombwell, near Barnsley. [6759]
- COSSOR** Melody Maker, 1929, set long and ultra short coils, Dynic eliminator, A.C. 35 ma., trickle charger, 40 amp. hr. accumulator, in crate, Amphion Lion speaker, all in handsome oak cabinet, separate compartments and folding doors; £24.—Paterson, 10, Southampton Drive, Glasgow, W.2. [6758]
- BARGAIN** to Quick Buyer.—4-valve receiver in cabinet, complete with Mullard valves, batteries, accumulator, Amphion cone speaker, all perfect; £10/10 or nearest offer.—Briggs, 44, Main St., Cockermouth, Cumberland. [6757]
- SCOTT TAGGART**, 3 valves, perfect condition, wonderful tone, M.P.A. speaker, complete with batteries, enclosed mahogany pedestal cabinet; £10.—"Wavside," Watling St., Radlett, Herts. [6753]
- 1930** Cossor Melody Maker Kit, cost £8/15, unopened; first £7/15 secures.—Write Chidwick, 49, Holders Hill Av., Hendon, or 'phone after 7.30, evening, Hendon 2072. [6752]
- BOWYER-LOWE** 7-8 valve Superhet., with valves, £7; Igranie frame aerial, 30/-; Ekco No. 2 F A.C. eliminator, £3; Orsam H10 and L10 valves, 2/6 each.—Box 3514, c/o The Wireless World. [6747]
- SALE.**—7-valve Igranie Neutrosone receiver, also 5 frame aerial, sensitive and powerful set, practically new; cost £45, take £20; also H.P. unit and trickle charger for above, cost £15, take £8.—Box 3515, c/o The Wireless World. [6745]
- INQUIRIES** are invited for a 1929 Cossor Melody Maker, complete with A.C. mains equipment, Celestion loud-speaker and all accessories; excellent reception of Continental stations.—Conway, Highview, Summit Close, Wakeman's Hill Av., Kingsbury, N.W.9. [6735]
- 4-VALVE** S.G. All-Wave Receiver, complete with coils and valves, in solid oak pedestal cabinet, also linen diaphragm speaker, best quality components throughout; seen by appointment; £22/10.—Tye, 10, Brooklands Rd., Romford. [6729]
- MOVING** Coil Speaker and Set, all mahogany, pentode output, 200-40v. A.C. eliminator, batteries, etc., cost £30, must sell; £15/5; heard working.—Write, 3, Mawand Rd., Clapton, E.8. [6728]
- OSRAM** Music Magnet 1930 Kit, unopened, buying all-mains receiver; £7/10 secures.—Box 3552, c/o The Wireless World. [6776]
- 5-VALVE** Suitcase Portable, complete; £7.—Ratcliffe, 20, Rosemead Av., Mitcham. [6727]

Mention of "The Wireless World," when writing to advertisers, will ensure prompt attention. A52

Receivers for Sale.—Contd.

4 VALVE Screened Grid Set, including valves, 4 pin coils, output transformer, parts alone cost over £8, perfect reception; £5/10.—Bomford, Post Office Avenue, Southport. [6731]

UNWANTED Present.—1930 Cosmor, all mains, 3, unsealed; £12.—Box 3550, c/o The Wireless World. [6774]

SIMMONDS BROS.—Receivers constructed to your own or any published design; also repairs, reconstructions, and modernisations at moderate charges; best materials and workmanship guaranteed; numerous testimonials; quotations free.—Address, Shireland Rd., Smeethwick. [5882]

EPOCH. EPOCH. EPOCH Moving Coil Speakers Greatly Improve the Results of all Receivers from 2 valves upwards. [6020]

SCIENTIFIC DEVELOPMENT Co., 51, Fishergate, Preston.

WE Offer You the Following Inducements to Purchase Your New Receiver or Other Apparatus from Us.

FIRSTLY.—Unbiased advice. The principal of the firm has twenty years' professional wireless experience, having been at the Government Experimental Stations in 1910. He has been manager for the Sterling Telephone Co., radio expert to the G.E.C., and Chairman of the Technical Committee of the National Association of Radio Manufacturers. His advice has aided our clients many thousands of pounds, for, as everybody knows, there is no hobby on which more money is wasted on useless apparatus by the uninitiated.

SECONDLY.—We take your old apparatus in part exchange for new, as we have means of disposing of much that the ordinary man finds it difficult or impossible to sell; send us a list of your old apparatus, or better still send us the apparatus, and state your new requirements; we will then make our offer for our goods, and if you do not approve, which is unlikely, we will return the parcel, carriage paid.

Thirdly.—You are in Doubt as to the Make of Receiver or Other Apparatus you should Purchase, write to us and we will advise you; we have no leaning towards any particular maker, and will tell you the particular instrument you should buy for your purpose.

SCIENTIFIC DEVELOPMENT Co., 51, Fishergate, Preston. Tel.: 1364. [0226]

ROSSOP 1930 3-valve Kit, unopened; accept £7.—Davies, 322, Narborough Rd., Leicester. [6801]

EMPIRE 2-design S.W. Receiver, ebonite panel, lined aluminium, Lureka C.G. transformer, perfect; £3.—Owen, Quinton Rd., Coventry. [6787]

5 VALVE Portable, complete, nearly new, list 17 guineas, sell £10, bargain; also 5-valve transmittable, complete, £5; spare accumulator with each; 7 Mullard valves, new, half list price.—B. Baker, 2, St. Georges Rd., Bedford Park, W.4. [6742]

EVERYMAN Four, specified components, oak double door cabinet, perfect order every respect, with 2-volt valves, further particulars and demonstration if desired; £10, or nearest offer.—Smith, 25, Housin Rd., Bridge-of-Wear. [6846]

MULLARD S.G.P.3. including long- and short-wave coils, all batteries and cabinet, just new; 10/10.—Box 3559, c/o The Wireless World. [6832]

LSTREE Six Valve Set, made under special instructions by Dawson and Steer, handsome mahogany case, complete with coils, plans, readings and set cuttings of description from "Modern Wireless"; set £30; absolutely new; first reasonable offer accepted.—D. A. Adana, 17, Church St., Twickenham. [6816]

PORTABLE 4-valve Set, in new condition, can be used with the outside aerial, C.A.V. make; £6.—yers, 32, Larnach Rd., Hammersmith, W.6. [6813]

PEGAVOX III, to specification, with valves, oak case, perfect, recently built; £10/10.—White, 54, Station Rd., Hanwell, W.7. [6809]

RUPHONIC 5-valve Portable, Mullard valves, fine tone, new June, mahogany case, cover; £10.—S., 01, Carlton Rd., Walthamstow, E.17. [6804]

PORTABLE Receiver, 3-valve S.G., perfect condition; £11/15.—H. Freeman, 47, Tenbury Rd., King's Heath, Birmingham. [6798]

ROSSOP 1930 3-valve Kit, unopened; cost £8/15, sell for £7/7/6; buying mains set.—Dickens, 16, Wood St., Lye, Stourbridge. [6793]

OWYER-JOWE Pentavox 3, S/9, pentode, complete with valves, brand new; buying portable; for quick sale.—Jadell, 5, Belle Vue Parade, Midsworth, S.W.17. Phone: Battersea 6596. [6790]

C. 200-240 Mains Receivers, 4 valves, complete. £16/15; 3 valves, complete, £11/12/6.—Marchant, Oscar Rd., Broadstairs.

C. Victor Three, complete; £5/10.—Marchant, Oscar Rd., Broadstairs.

HORT-WAVE Adaptor, 15-100 metres, converts any set to short-wave receiver; 5 guineas.—Marchant, Oscar Rd., Broadstairs. [6780]

**The REGENTSTAT**

7/9

FIXED UPPER & LOWER METAL PLATES

OUTER METAL CONTAINER

SPECIAL RESISTANCE ELEMENTS

THE RESILIENT CARTRIDGE

PIG-TAIL CONNECTOR

The special resistance elements and the ingenious construction of housing prevent "packing" and "craekle."

This continuously variable power resistance—range 250-4,000,000 ohms—provides the most satisfactory method of control for radio power work yet known. Its wide range and constant smooth variation of values allows exact control and compensation of voltage or current throughout its entire range.

**The 'REGENTSTAT' does not contain graphite compound and mica, carbon mixture or plastic material.** It is an absolutely new invention, fully patented, ensuring positive contact and constant reliability.

Chief uses: Battery Eliminator Voltage Control, Grid Resistance, Volume Control, Reaction Control, Screening Grid Voltage Control, Grid Bias Control, Resistance Coupling.

Maximum recommended constant dissipation, 10 watts. One hole fixing. British-made throughout.

Write for free copy of our new Art Booklet, which gives full particulars of all Regentone products.

REGENTONE

DEPENDABLE MAINS UNITS, AC and DC

AC MAINS RECEIVERS and MAINS COMPONENTS

For RADIO FROM THE MAINS

REGENT RADIO SUPPLY CO. 21, Bartlett's Bldgs, Holborn Circus, London, E.C.4, Telephone Central 9661

BATTERIES.

WET H.T. Replacements.—Sacs (capped or uncapped) highest grade, No. 1, 10d. per doz.; No. 2, 1/9 per doz.—See below.

ZINCS.—Best quality (wired), No. 1, 8d. per doz.; No. 2, 9d. per doz.; orders valued 5/- carriage paid, otherwise 6d. for postage.—British Battery Co., Clarendon Rd., Watford, Herts. [0258]

WET H.T. Batteries.—Parts per dozen, jars, No. 1, 2 1/4 x 1 1/2 square, 1/3; No. 2, 1/6; zincs, No. 1, 10d.; No. 2, 11d.; sacs, No. 1, 1/2 dozen; No. 2, 1/9; terminals, 8d., 10d.; dozen cells (18 volts), complete with bands and electrolyte, No. 1, 4/1; No. 2, 5/-; post 9d.; high efficiency, long life, self charging, upkeep small; send 6d. for sample unit; illustrated booklet free, carriage free orders 10/-; write for free list wireless bargains; trade supplied.—W. Taylor, 57, Studley Rd., Stockwell, London. [0039]

G.D.E.S. Accumulator Hire and Maintenance Service (5 mile radius).—98, Cherry Orchard Rd., Graydon. [6374]

PENTODE Users.—Write for details of new size self-charging wet battery; 20,000 millimhos, 6d. per volt; illustrated catalogue giving data, post free.—U. Taylor, 57, Studley Rd., Stockwell, London. [0273]

L.T. Accumulator Service and Charging, including free collection and delivery, covering: Poplar, Bow, Stratford, Plimston, East Ham, Barking, West Ham, Forest Gate, Ilford, Chadwell Heath, Romford, Dagenham, Becontree, Leyton, Walthamstow, Wanstead, and Woodford; also H.T. service from 1/- per week, covering above districts, and any part Greater London.—Write for particulars, Pearson Bros., 32, Cawdor St., Poplar, London. Phone: East 6155. [6471]

FOR Sale, 3 Exide high tension batteries, each 60 volts, in mahogany container; best offer accepted.—R. A. S., Challow, Radlett. [6737]

EPOCH. EPOCH. EPOCH.—Watch Epoch grow! [6021]

CHARGERS AND ELIMINATORS.

TANTALUM Electrode Strips for H.T. Rectifiers, suitable for A.C. mains eliminators; 2d. each, on set of 8, 1/-—1/7, Dalton St., West Norwood, S.E.27. [0308]

VORTEXION Transformers, chokes, etc., would to any specification; write or phone for quotation; best quality components only.—Vortexion, 72, Merton Rd., Wimbledon, S.W.19. Tel.: Wimbledon 2814. [0319]

PHILIPSON'S Safety High Tension Battery Eliminators.

PHILIPSON'S Safety Eliminators Give Consistent Results.

PHILIPSON'S Safety Eliminators are Guaranteed for 12 months.

PHILIPSON'S Safety Eliminators are Sold on 7 Days' Approval.

PHILIPSON'S Safety Eliminators are Housed in Art Embossed Metal Boxes, fitted with 12ft. of flex and a Jabelite plug, and are constructed from the very best material throughout.

PHILIPSON'S Safety Eliminators are the Cheapest to Install, and the cheapest to run; prices: Model A.C.5, £4/17/6; A.C.7, £3/17/6; complete with full wave rectifiers; model D.C.4, 3/7/6; 11.C.5, 4/5/-.

PHILIPSON'S Safety Eliminators are Described and Illustrated in our Booklet "Radio Power." Have you had your copy?—Write to-day to PHILIPSON'S and Co., Ltd., Radio Engineers, Astley Bridge, Bolton. Phone: 2038. Phone: Grams, Safety, Bolton. Est. over 50 years. [0318]

TRANSFORMERS and Chokes for Battery Eliminators, and for all wireless purposes, receiving or transmitting; enquiries invited.—Chester Bros., 244, Dalston Lane, London, E.8. [6138]

ATLAS Eliminators, D.C. £1/17/6, A.C. £3/17/6; Nesper trickle chargers, 29/6. Phone Gerrard 6268 for demonstration.—Greatrex and Co., 184, Regent St., London. [6451]

TANTALUM and Liumion for A.C. Rectifiers; make up your own inexpensive chargers; blue prints for H.T. and L.T., 1/- each; Liumion electrodes fitted with terminals, 2.3 amps. and 5-8 amps.—Blackwell's Metallurgical Works, Ltd., Speke Rd. Works, Garston, Liverpool. Phone: Garston 980 (2lines). [6282]

30/.—Fel-Petrie A.C. eliminator kit, 120 volts, 15 millimhos, contains mains transformer, choke, resistance for 60 volts tapping, 3 condensers (500 volt test), valve holder, and valve; 30/- complete, carriage paid; guaranteed; state voltage.—Fel-Petrie Radio, 56, Garden St., Sheffield. [6505]

MULLARD H.T. Unit, 240 volts, 50 cycles, with D.U.2 valve, perfect condition; £4.—Blaxall, Brantwood, Edgware. [6773]

RELIABLE Low Priced Eliminator Kits.—No. 1, output 150v. 12 m.a., 30/-; No. 2, output 150v. 30 m.a., 45/-; No. 3, output 200v. 30 m.a., and 4v. 3 amp. winding for indirectly heated valves; all above include rectifying valves and are carriage free.—Eliminators, 138, High St., E.1. [6820]

PHILIPS All Mains Three, cost £23, slightly soiled; take £16.—Box 3560, c/o The Wireless World. [6819]

# Brownie

26



the **'DOMINION'** Slow Motion Dial

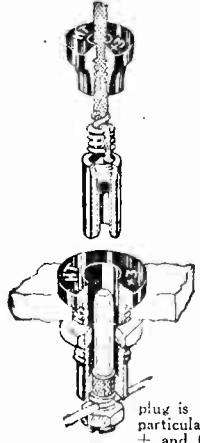
A Vernier Dial at 2!! Bring your set up to date by fitting this slow motion dial. The mechanism is of special non-backlash construction which makes very fine tuning easy. Finished in smooth black or beautifully grained mahogany bakelite.

# Brownie

wireless

HELSON ST. WORKS, LONDON, N.W.1.

## YOU CANNOT GO WRONG



With the present day practice of widely utilising the Mains Supply for Moving-Coil Speakers, Chargers, Receivers, etc., it is essential to have a terminal with which you CANNOT GO WRONG.

### CLIX ALL-IN-PLUG & SOCKET TERMINAL

is the only Panel Terminal entirely insulated when connected or disconnected, and entirely supersedes the old type of panel terminal. Every plug is engraved for its particular use; also H.T. and G.B. — plug-in sections vary in size and safeguard your valves.

SAFEST—BEST CHEAPEST.

Price **8** Complete Panel Flex Portion 4d. Flex Portion 4d.

## LECTRO LINX, LTD.

251, Vauxhall Bridge Road, S.W.1.

**Chargers and Eliminators.—Contd.**

**UNIFLEX H.T. Eliminator Kit**, giving 15 milliamps. 120 volts; 30/- the kit of parts, already mounted on base board, with complete instructions for simple connecting.

**THIS** New Improved Uniflex Model is the Finest Value in England, and includes shielded mains transformer, with terminals, heavy choke, 3 Hydria condensers, tested 500 volts D.C. Loewe vacuum resistance and clip, valve holder, panel already drilled with three sockets fitted for negative, 60 volts, and 120 volts; all the components mounted on a wooden base board and neatly boxed, with full instructions and picture diagram, ready for assembling in a few minutes.

**HOW to Order.**—Just send a postcard for one complete 30/- kit, carriage paid (if 15/- Mullard D.U.10 valve is to be included, ask for 45/- kit); all kits sent c.o.d. (pay the postman); thousands of these kits now in use all over the world; hundreds of testimonials.

**FULL Particulars and Diagram Free**; dealers write for terms.—Liverpool Radio Supplies, Uniflex Works, 64, Myrtle St., Liverpool. [6724]

**180 Volt H.T. Eliminator**, with U.5 valve, Parmeko transformer and double choke, and two 6 microfarad hydrias.—Offers to Green, Radio Research Station, Slough. [6762]

**RADIELLE** Eliminator, cost £10.17/6, practically new, guaranteed, 2 variable tappings, 1 fixed, and 1 special screened grid for 80 volts, A.C. mains, 220 volts; bargain, £5/10.—Bomford, Post Office Avenue, Southport. [6730]

**EPOCH.**

**EPOCH.**

**EPOCH.**—Something new in trickle chargers.

**EPOCH.**

**EPOCH.**—See the marvellous new range of trickle chargers. [6458]

**FOR Your Permanent Satisfaction Use C.E.C.O. Eliminators.**

**CUT Out Battery Troubles.**

**END All Set Noises.**

**COME to Us for Safety.**

**ORDERS in Strict Rotation.**

**C.E.C.O. Eliminators Incorporate**

**WESTINGHOUSE Metal Rectifiers.**—Write C.E.C.O., Broadway House, South St., Romford, Essex. Tel.: 80.

**20-MILLIAMPS Model**; 75/-. [6721]

**MARCONIPHONE S.G.P.** All Mains Three (new); £15.—24, Glenhouse Rd., Eltham, S.E.9. [6794]

**TOWNSEND'S Mains Transformers for Westinghouse Rectifiers**; A3 11/9, H.T.3 or H.T.4 11/9, H.T.1 14/6.

**TOWNSEND'S All Mains Transformers**; 135v. 60 m.a. and 4v. 4 amps. 19/-, 200v. 100 m.a. and 4v. 4 amps. 21/-.

**TOWNSEND for Transformers to Specification at Cut Prices**; enquiries invited.—Townsend, Greenwood Terrace, Bramley, Leeds. [6820]

**MARCONIPHONE All Power Unit**, B928, model A.C.1B, 100-125 volts, 40 cycles and over, perfect condition; offers around £3/10; deposit system.—Jones, Cedars, Briton Ferry, Glam. [6815]

**SAVAGE'S Specialise in Wireless Power from the Mains**, reliable apparatus at reasonable prices.

**SAVAGE'S Transformer Laminations and Bakelite Bobbins**; intending home constructors should write for list.

**SAVAGE'S Reliable Smoothing Condensers**—1,000 volts D.C. test, 2 mid. 3/-, 4 mid. 5/3; 500 volts D.C. test, 1 mid. 1/6, 2 mid. 2/3, 4 mid. 3/9.

**SAVAGE'S Super Smoothing and Output Chokes**—Many types available, write for list.

**SAVAGE'S Mains Transformer for Westinghouse Rectifiers**—H.T.4, 18/6; A3, 17/-; A4, 20/-.

**SAVAGE'S Mains Transformer for Westinghouse H.T.4 Unit**, with additional winding, 4 volts 3 amps.; 23/-.

**SAVAGE'S Mains Transformer**—V.T.31, 200-0-200 volts 60 m.amps., 2+2 volts 2 amps., 2+2 volts 3 amps.; 28/-.

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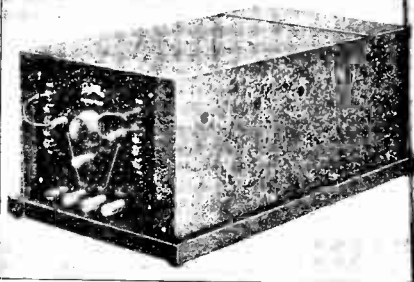
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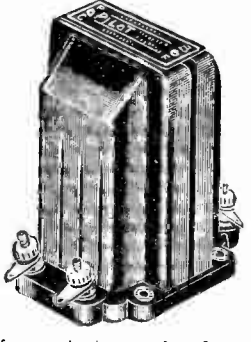
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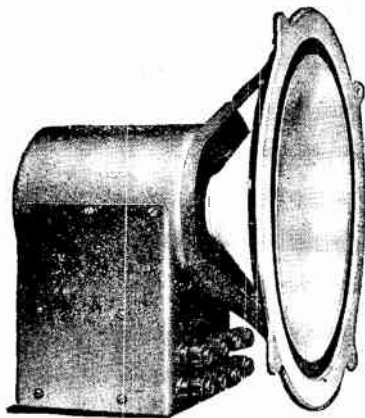
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**EPOCH.**

**EPOCH.**—See the new range of Epoch A.C. mains transformers. [6459]

**EPOCH.**

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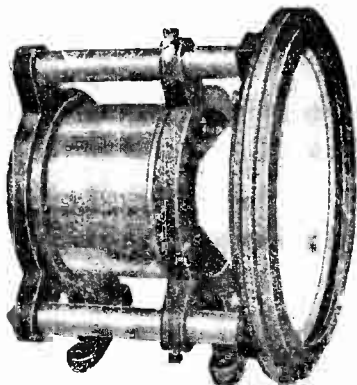
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OAK BASE—Jacobean Finish 57/6  
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Also suitable for the New "KILOMAG 4" and "W.W. RECORD III".  
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**EPOCH**—No more suspension resonance!

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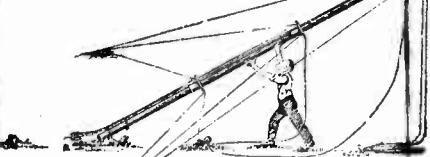
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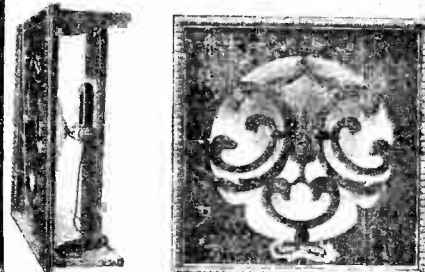
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GOODMAN'S Cone Chassis Assemblies, the cones fitted to which are unique, by reason of Goodman's exclusive doping processes, can be fitted with any cone unit in 2 minutes; new model, 12/6; enthusiastic users write:

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GRASSMAN-LYONS Universal A.C.6S, for any A.O. mains from 110 volt to 250 volts, 40-100 cycles; 8/15.

All These Grassman Dynamic Speakers are Held in Ample Stock; no waiting; send for our 16-page illustrated descriptive book on moving coil loud-speakers. Claude Lyons, Ltd., Radio House, 76, Old Hall St., Liverpool. [6738a]

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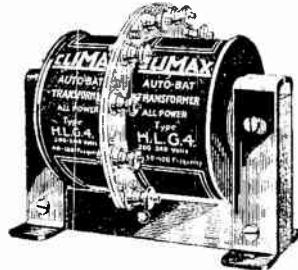
AMPLION Lion Chassis, L14, as new; £4, or nearest.—Swindin, 50, First Avenue, East Dene, Rotherham. [6805]

URPLUS Components and Lion Power Speaker; £4/10.—Write F. Caddick, 15, Stanley Park Rd., Allington, Surrey. [6797]

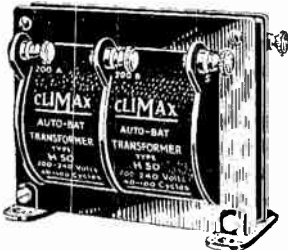
Do You Know that the A.O. Grassman Moving Coil Loud-speakers Contain a Special 2000 mfd. Condenser? This entirely eliminates the last traces of A.C. hum; so far as we are aware no other A.O. dynamic speaker is fitting this all-essential part as standard; the O-Grassman sells for only £8/5 (220-30 volts, 40-60 cycles mains only); special model, model A.O.S, for all other voltages and periodicities.—Claude Lyons, Ltd., Old Hall St., Liverpool. [6738]

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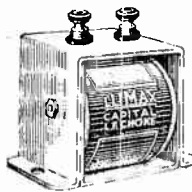
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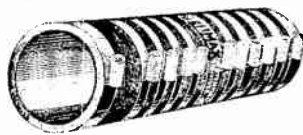
Climax Auto-bat Transformer Type H.L.G.1— for H.T., L.T. and G.B. supply, when using metal rectifiers and indirectly heated mains valves. A first class product with first class performance at a popular price - - - 32/6



Climax Auto-bat Transformer Type H.50— for H.T. supply units using metal rectifier. Output up to 180 volts, and up to 50 milliamperes. Remarkable value. Price 17/6



The Climax Capital Choke forms an extremely efficient smoothing choke for eliminating the ripple in H.T. supply for A.C. or D.C. mains. Winding resistance 500 ohms. Current carrying capacity 50 milliamperes. Inductance 12-20 henries. Price - - - 8/-



Climax Potential Divider for voltage tappings in mains receivers and units. Ten Tappings. Wire wound. Bakelite bobbin. The most popular mains component yet designed. - - - Price 5/-

CLIMAX A YEAR AHEAD

Ask your Dealer for our new leaflet "The Mains Constructor."

CLIMAX RADIO ELECTRIC, LIMITED

Haverstock Works, Parkhill Road, Hampstead, London, N.W.3.

Telephone: Primrose Hill 1171-2.

Loud-speakers.—Contd.

BAKER

SELHURST Radio Moving Coil Loud-speakers were acclaimed by all those who visited the Olympia as the most realistic reproducers in the exhibition; the amplifiers used for the demonstrations consisted of 2 valves only, sure proof of exceptional efficiency; order now on 14 days' approval, you will be immediately convinced; a new 36-page booklet, "Sound Advice," is yours for the asking; a postcard will do; call at our works at Croydon, we are always open.

SELHURST

THE Judgment of Olympia.—There is no doubt that our 1930 super power moving coil speaker proved its superiority in every way by actual demonstration, results definitely proved by actual listening on the spot; it has no rival for unmatched power and purity of tone without the need for an elaborate amplifier; our new 36-page booklet will interest you; write now for your copy.

RADIO

ORDERS are pouring in from all Parts of the Country, and from our agents abroad, for the new 1930 super power speaker; the reason is simple—Bakers concentrate on the things that really matter, i.e., high flux density, large number of ampere turns, correct design, matched moving coil, etc. etc.; we ask all music lovers to obtain this speaker on 14 days' approval for comparative test against any other make, regardless of price, the result will be a further addition to our legion of satisfied users.

MOVING

GET a Bakers Moving Coil Loud-speaker and you will be amazed at its remarkable efficiency combined with perfect quality of reproduction; whether used for the cinema, the restaurant, public address equipment or the home Bakers' moving coil speakers are supreme for realistic reproduction; remember Bakers were the first firm in this country to manufacture high grade moving coil speakers of the floating cone type; write now for the new free booklet, "Sound Advice," it will help you to decide.

COIL

LOW to High Notes are reproduced with a tone quality of an entirely new order, and with a range covering the entire musical scale; directly you hear a Bakers moving coil loud-speaker you are impressed by the brilliance of reproduction and natural tone; whether reproducing speech or music Bakers speakers are supreme; call at our works at Croydon, we are always open

SPEAKER

SEND to Bakers, the pioneer British manufacturers of high grade moving coil speakers, and you will not be disappointed.

BAKERS SELHURST RADIO, 89, Selhurst Rd., South Norwood, S.E.25. Tel.: Croydon 1618.

CALL at our Works at Croydon, they are always open.—42, Cherry Orchard Rd., East Croydon (15 minutes non-stop from Victoria or London Bridge). [0231]

**AMAZING  
STANDARD  
WET CARTRIDGE SACS**

**PROVE  
their worth!**

Have you learnt how a Standard Permanent Wet H.T. Battery can save you pounds? It gives a full-bodied flow of current that lasts for an amazing period—12 months or more, because this wonder battery is self-regenerative. THEN—YOU CAN RECHARGE IT simply, easily and at low cost at home with the new Cartridge Sacs (Sac, Zinc and Insulation in one). Just slip cartridge into jar, add fluid, press home cork—that's all!

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**CABINETS.** In Oak or Mahogany, supplied to hold batteries. Well designed and finished to take any number of cells and also forms stand for set. Oak from £2.9.6. Mahogany from £3.0.0.

Purchase it ready for use, just add chemical. Lasts for 12 months (approx.). Recharge at home.

**SPECIAL OFFER.** No. 3 Cartridge Model Battery, 96 volts (16 milliamps capacity). Comprises two trays of 32 cells each, with lid and necessary electrolyte chemical. Cash £2.13.10, or 9.5 down and 5 monthly payments of 9/5.

**The Standard Wet Battery Company**  
(Dept. W.W.), 84/188, SHAFTESBURY AVENUE, LONDON, W.C.2.

**Loud speakers.—Contd.**

**GRASSMAN.** Grassman. Grassman.

**T**HE Name to Know in Relation to Moving Coil Loud-speakers; come and hear these remarkable loud-speakers at our Stand, No. 95, New Hall, Manchester Radio Exhibition, City Hall, Deansgate, Manchester, October 16 to 26th inclusive.—Claude Lyons, Ltd., 76, Old Hall St., Liverpool. [6739]

**Y**OUR Old Loud-speaker Taken in Part Payment for the Latest Type; see our advert. under column Receivers for Sale.—Scientific Development Co., 51, Fishergate, Preston. [0227]

**EPOCH.**

**EPOCH.**

**EPOCH.**

**EPOCH** by Deferred Payments.

**EPOCH.**

**EPOCH.**—Any responsible householder can obtain any type Epoch moving coil speaker by easy terms; no references, no interest.—Particulars from Mr. Lawson, 110, Cannon St., E.C.4. [5518]

**W**HY is the Webson B.S.7 Moving Coil Loud-speaker used as a standard in the principal laboratories in the wireless trade?

**W**HY is the Webson B.S.7 Moving Coil Loud-speaker used by manufacturers of high grade radio gramophone sets?

**B**ECAUSE the Webson B.S.7 is designed and made for the use of musical critics to whom only the finest possible reproduction is good enough.

**H**AVE you heard a Webson Moving Coil Speaker? If not, to do so will be a revelation.

**S**END for Personal Broadcasts, post free, from Star Engineering, Didsbury, Manchester. Phone: Didsbury 1785. [6698]

**TRANSMITTERS.**

**84** Metre Crystal; 17/—; controls 10 watts without reaction.—Smith, Bryn Rodyn, Colwyn Bay. [6766]

**VALVES.**

**A**MPLIFIER Valve.—If you require power you cannot do better than one of these:—

**F**ILAMENT Volts 6. plate volts 400 (maximum). grid bias 84 volts (approx.). impedance 800 ohms. amplification factor 3.8. mutual conductance 4.35 m.a./volts; price £5/10; see article "The Wireless World," 24th July, 1929. then send to North London Valve Co., Ltd., 22½, Cazenove Rd., Stoke Newington, London, N.16. [6764]

**C**OSSOR s.g. Valve (Original Horizontal Type), with screen, coils and holders, suitable for H.F. unit; 21/—W. B., 114, Hambalt Rd., Clapham, London, S.W.4. [6769]

**O**NE Osrarn U5 Valve, unused; one Osrarn 6-volt S625 valve, unused; one ditto, little used; will sell singly or lot; offers.—Box 3568, c/o The Wireless World. [6844]

**COMPONENTS, ETC., FOR SALE.**

**B**ELLING-LEE Panel Fittings are designed to give an expert finish to any home-constructed set; catalogue post free.—Belling and Lee, Ltd., Queensway Works, Ponders End, Middlesex. [0018]

**M**ETERS. Meters, Milliamperes, and ammeters, re-calibrated and shunts provided, voltmeters fitted with resistances for higher ranges, send meters for estimates.—Chester Bros., 244, Dalston Lane, London, E.8. [5240]

**S**LIGHTLY Used Pick-up, Celestion, 50/-; Philips, 30/-; R.I., 50/-; Igranic, 20/-; G.E.C., 20/-; R.I. tone arm, 20/-; Brown microphone amplifier for crystal set, 30/-; Magnavox moving coil speaker, £5.—James Scott and Co., Radio Engineers, Dunfermline. [0321]

**600-OHMS** Decoupling Resistances; see advt. under Coils. — Groves Brothers (Manufacturers). [6306]

**W**ESTON Model 301, milliammeters, ammeters, and voltmeters, ranges from 15 milliamps, 21/- each; portable 3-range instruments, in oak case, 5in., send 0.5 milliamps and 12-240 volts, 45/-; hot-wire ammeters, 0.1 amp., 4/-; 0.05 amp., 3/-; instrument repairs and alterations of every description; any item 7 days approval against cash.—The Victoria Electrical Co., 47, High St., Battersea, S.W.11. Established 1910. [6175]

**P**OTENTIAL Dividers, 10,000, 15,000, 20,000, 25,000, and 30,000 ohms, 5 variable tappings; 2/- each.—Below.

**P**OTENTIAL Dividers, heavy duty, wire wound, 15,000 ohms, 7 tappings; 6/6.—Below.

**C**ONDENSERS, 2 mid., 2/6; 4 mid., 4/6; guaranteed; tested 500 volts.—Below.

**C**HOKES (I.F.E.).—Choke coils, excellent for smoothing up to 20 milliamps, 2/-; special heavy duty chokes for 100 and 200 milliamps at 8/6 and 18/- respectively; any article on approval against cash.—Huggins, Radio Engineer, Clacton-on-Sea. [5030]

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We SPECIALISE in the supply of a Good Quality Radio Sets, Components and Accessories on Easy Terms. We can give you efficient service and our terms are low. We can recommend the following:—

**1930 3-VALVE A.C. COSSOR KIT**, 20/- with order and 11 payments of 28/-.

**1930 2-VALVE A.C. COSSOR KIT**, 15/- with order and 11 payments of 19/6.

**NEW OSRAM MUSIC MAGNET**, a very fine receiver, including Cabinet and Valves, 10/- with order and 11 payments of 19/6.

**NEW MULLARD ORGOLO KIT**, 7/6 with order and 11 payments of 11/9. Valves extra.

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**BROWN "V" UNIT AND CHASSIS**, fitted into our own high-grade Cabinet equal to most expensive speaker, except moving coil, 5/- with order and 11 payments of 5/3.

No postage or packing charges. Send us your list of requirements and a quotation will be sent by return.

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Phone: NATIONAL 1977.

**NEW  
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and Broadcasting  
MICROPHONE**

The Ideal Instrument for addressing an Audience through Loudspeaker (via Wireless Set or Valve Amplifier), and for relaying Speech or Musical Entertainment to any distance.

Powerful Loudspeaker Reproduction with perfect Purity

Highly sensitive Microphone, guarantees definitely free from distortion or microphone noise, absolutely silent background; far superior to ordinary Microphone Transmitters; for use with Valve Amplifier or Valve Set (through leads of Gramophone Pick-up if desired) at Open-air Meetings, in Cinema, Theatre, or Concert Hall. Operates from 2 Volt tappings of I.T. Accumulator, through Microphone Transformer. Current consumption one-tenth Ampere. Provided with detachable sound collector and 9 ft. connecting cord, and fixed by rubber-cord suspension in nickel-plated frame, on pedestal, 11 in. high, for mounting on Speaker's Platform, in Pulpit, on top of Camera Stand; or for suspension from ceiling, as illustrated.

(Microphone without Pedestal: 15/6)

The above Microphone is rendered Directional by attaching the Sound Collector.

**MICROPHONE TRANSFORMER,**

special design to obtain best possible result from sensitive Microphones when connected to high-resistance phones, Loudspeaker Valve Set, or Valve Amplifier; best Transformer made for clear Speech with volume, modulation, speech, and music transmission, Public Address, etc.; Print. & Sec. terminals fitted; full terms free. Good-by return post.

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Components, Etc., for Sale.—Contd.

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**DECOUPLING** Resistances are Necessary to get the full amplification from screened grid valves; see our adverts under Coils.—Groves Brothers.

**DECOUPLING** Resistances are Necessary in all screened grid receivers.—See Groves Brothers' adverts under Coils.

**DECOUPLING** Resistances in the New Kilo-Mag Four and Foreign Listeners Four were manufactured by Groves Brothers.

**DECOUPLING** Resistances.—Improved Constantan wire wound are 1/6. post free, from Groves Brothers. [6577]

**BAKER'S** Sellhurst 6v. 1/2-amp. Moving Coil Loud-speaker, unassembled; Ferranti O.P.40 transformer; McMichael Superionic 5-valve unit, complete Excide batteries, uncharged, W.Z.G.4 D.M.G., D.H.G., C.Z.G.4, C.Z.G.3; 2 Osram S625 valves; all above articles brand new, must be sold; what offers?—Box 3406, c/o The Wireless World. [6592]

**BLUE** Spot Phonograph Pick-up, stand model, with volume control. 30/-; 2 P.M.4. 1 P.M.3A. 4 coils. 6/- each.—Box 3494, c/o The Wireless World. [6753]

**COSSOR** S.G.210, R.C.410, Mullard P.M.3. 2 P.M.4, Marconi D.E.H.410, 3 S.M. dials, Keystone S.G. choke, Climax choke, Permacore and H.L. transformers, must sell.—Box 3483, c/o The Wireless World. [6723]

**NEW** A.C./S. 17/6; P.M.24, 13/6; also 1'625, S.L. 610H, Cosmor 610 H.L.F., at half price; Goodman balanced armature unit, 10/-; Honeybeard mains transformer, 200-240 A.C., 9/6.—Wrench, "Camelot," Ladbroke Rd., Ewell, Epsom. [6763]

**D.C.** Mains Motor Charger, input 200v., output 0-9 volts 30 watts. £2; large collapsible 3ft. frame aerial, tappings, 50/-.—Box 3513, c/o The Wireless World. [6746]

**S. G. BROWN'S** 1,000 ohm super sensitive P.Q. power speaker unit, in perfect condition, £5/10; 5ft. Gin. exponential horn and folding tripod stand, to suit above, £1/10, splendid combination for dance hall or demonstration; pair matched L.S.5 valves, almost new, 12/6 each; Excide, portable set, accumulator, 20 amp. actual, 12/6; Lissen super pick-up, new, 8/6; 3-50 Henry L.F. chokes, stand 100 m.a. at 240 volts, 7/6 each, all split new and perfect; above goods sent a.o.d. if desired; further particulars send stamp.—Raser, 5, Attadale Rd., Inverness. [6736]

**YOUR** Old Components Taken in Part Payment for Latest Type; see our advert. in column "Receivers for Sale"—Scientific Development Co., 51, Ashcroft, Preston. [0228]

**EPOCH**.

**EPOCH** for Best Results.

**EPOCH** for Best Results.

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**EPOCH** Moving Coil Speakers.

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**EPOCH** Trickle Chargers.

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**EPOCH**—New City Address, 3, Farringdon Av., Ladbroke Circus, E.C.4. 'Phone: Central 1971 (2 nes). Private Branch Exchange. [6027]

**GENUINE** Western Electric 2-valve Amplifiers, all complete, ready for working, less valves; each amplifier contains 3 transformers worth £3 each, one of which is tapped with volume control switch on incl; now is your chance; £1 each, carriage paid.—Hughes and Sons, 149, Chepstow Rd., Newport, Mon. [6827]

**929** Components, slightly used, all as new.—A.F.5. 15/-; R.L. Varley R.C.C. unit, 8/6; Ormond 0005 log, 4/-; ditto S.L.F. 3/-; Pilot dials, 2/-; Ormo 4-1 L.F., 4/-; Cosmor S.G.220, 10/6; D.E.H.610, 1/-; Midswan 610 L.F., 5/-; P625A, 7/6; Blue Spot R.K., 12/6; 6v. R.K. unit, 70/-; Polar 0.0001, 2/6; ver Ready 6v. 40-amp. starter battery, 27/6; also coil condensers, leaks, resistances, Cosmor coils and live holders at half price; approval on anything.—Avis, 322, Narborough Rd., Leicester. [6800]

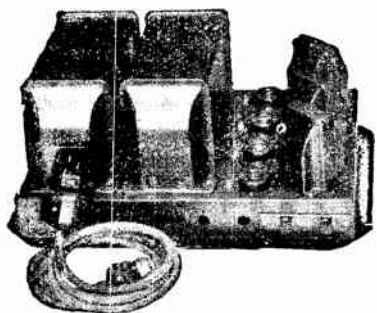
**FERRANTI** O.P.3 (C), 17/-; A.F.4, 10/6, nearly new; few other components cheap also few Mullard valves, now half list price.—B. Baker, 2, St. Georges Rd., Bedford Park, W.4. [6743]

**WANTED**, 2 Cylodon 0.0005 condensers, cheap; sell set 4 Lissen S.G.3 coils, £1.—Stevenson, 18, Lampion Crescent, Sydenham. [6806]

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**"PAM" A.C. AMPLIFIERS.**

**"PAM" A.C.-OPERATED POWER AMPLIFIERS** have at the back of them a manufacturing organisation of 46 years' experience, during which the last 30 years have been especially devoted to the design and manufacture of reproducing equipment.

**"PAM"-16** is a powerful Amplifier very suitable for small Dance Halls and Cinemas, or for use in the Home by those who desire rich ample volume combined with that utter fidelity of reproduction for which **"PAM" AMPLIFIERS** are so justly famous the world over.

**GUARANTEED SPEC'N.—"PAM"-16.**

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Gain, at 1,000 Cycles	- - - - -	57 D.B.
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**EXPERIMENTERS**, so send for guide, which will be sent post free from J. H. Taylor and Co., 15, Radio House, Macaulay Street, Huddersfield, to whom competition efforts should be submitted, indicating also if name and address publishable if successful. Prize-winner this week from Chatham. (Only 23 alternative words required. Radio House, Huddersfield, remaining, one word for each initial following.) [6783]

**A** NUMBER of New Selected Osram Valves, L.S.5, L.S.5A, L.S.5B, 15/-; D.E.5. 7/-; Lotus 2-way coil holders, 2/6; Parex S. G. valve holder, 1/6; R.K. and other loud-speakers, new and second-hand; transformers and chokes, section wound.—Research, Box 3567, c/o The Wireless World, or Prospect 5051. [6839]

**BROWN V** Unit, 15/-; 3 100,000 W.W. Mullards, 2/6 each; 2 0.0005 T.B. S.L.F., 7/- each; 2 Marconi L. and S. O.T. astatic aerial coils, 2/6 each; L. and S. Toroid, 5/- each; Colvren, Reinartz, and bus; 3/-; Ormond friction, 0.0003, 5/-; R.I. transformer, 5/-; 3 R.I. dual rheostats, 5/- lot; Lissen L.F. choke, 2/6; few 0.001 Hubilier mica, 1/-; add postage.—184, Burnley Rd., Blackburn. [6840]

**METAL** Cabinets, fitted with oak base and top, hand-somely finished; new Kilo-Mag and Record, 45/- each; Kit cabinets, 35/-; metal part only 32/6 and 24/- respectively; see Coils section.—Stott, 63, Syke Rd., Rochdale. [6843a]

**MOVING** Coil Speaker, 6-volt, Pentode coil, cost £6, £3; Westinghouse 1 amp. charger, suitable above, 35/-; A.C.S., guaranteed, unused, 17/6; P.M.24, new, perfect, 15/6.—Box 3562, c/o The Wireless World. [6834]

**ORGOLAS**, Etc.! Cylodon shop soiled 0.0005 twin condensers, list 39/6, sacrificing 7/6; beautiful jobs, unused.—Mabech, Braemar, Ballymena, Ulster. [6826]

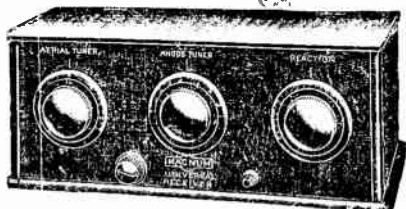
**58/6**—120-volt I.T. accumulators, compact, portable, guaranteed 12 months; agents wanted.—Pearson, 29, Midland Rd., Winton, Bourne-mouth. [6825]

**AUSTIN** Power Transformers and Chokes Com-and Success in any Eliminator; fully guaranteed; I.T.3 and I.T.4, 16/-; I.T.1, 17/-; A.3, 12/-; A.4, 15/-; multiple outputs supplied.—Austin Mills, St. Albans Av., Heaton Chapel, Stockport. [6823]

**1930** Everyman Four.—All parts in stock; send for prices, or send us list of your requirements and let us quote; hire purchase terms arranged.—Webb's, 164, Charing Cross Rd., London, W.C.2. [6822]

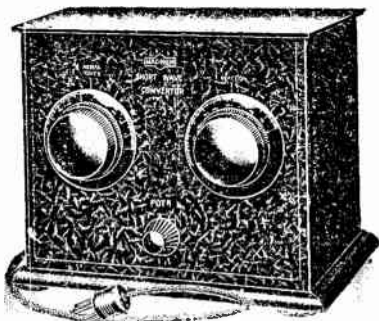
**PHILIPS** Rec., type 2502, £9/10; I.T. unit, type 2002, £4; set spare valves, unused, 30/-; Hegim unit, 10/-; two 4-40 accs., £1; heard by appointment.—Ryan, 68, Tunis Rd., W.12. [6817]

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This Converter is adaptable to any valve set by simply removing the detector valve from set and inserting it in the valveholder of converter, the plug of converter taking the place of the detector valve. In crystalline metal cabinet, with 2 Coils 20/40 and 40/80 metres. Plug and Adaptor £4.10.0d. inclusive.

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**50/-**

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**F**REE, Fellows horn speaker if following taken in one lot: Marconi phone Ideal transformer, 12/6; Brandes improved transformer, 7/6; Marconi phone L.W. variometer, 5/-; H.I. tapped inductance with reaction, needs adjustment, 5/-; transportable oak cabinet, 3 panelled doors, 15/-; Ormond 0.00025 brass slow motion, 6/-; D.C. H.T. eliminator, 6 tappings, 12/6.—Cole, Wickington, New Ltd., Okchampton. 16811

**D**E.5B (two) 6-volt Cossor R.C. H.F. dect., 3/9 each; Stentor, 4/6, practically unused; accumulators. Fuller 2-volt 60 actual (two), 5/9 each; C.A.V. 36 actual, 5/-; Exide 6-volt 40 actual, with crate, 15/6, or 5/3 2-volt.—Hillside, Clifton Rd., Coulsdon. [6803]

**P**.M.254, new, 10/-; Cossor 410 H.F., 5/6; Mullard Permacore, 12/6; as new.—D., 5, Becmad Av., Stratham, S.W.16. [6789]

**A**IRSPACED H.F. Choke, lowest self capacity, even smoking; 2/-, post free.—Culton-Stewart, 28, St. Enoch Sq., Glasgow. [6792]

**L**ARGE Sterling L.S. Base, 17/-; 4A roll film folding Kodak, f/8 lens, 18/6; or exchange 120 volts H.T. accumulator, good pick-up or tone arm.—17, Ludlow St., Caerphilly, Cardiff. [6785]

**20** Hart 10v. Paxits, 5,000 milliamp, 5/- each, new; 1 Ferranti valve tester, £4/10; 1 Osram lit, unopened, £7/10; R.K. 6v. speaker, £3/15; Philips A.C. unpacked, model 3009, £5; lots of other bargains; send list of requirements.—Owner, 9, Carlton Rd., Barnley. [6784]

**F**ERRANTI Milliammeter, flush type, 0-50, £1/0/6; carbondum detector unit, 6/-, both unused; 2 C.A.V. H.T. accumulators, new in June, 45/- pair.—Hawkins, 17, Stillness Rd., S.E.23. [6777]

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**A P P L E B Y S**

**B**IG Output Means Fresh Goods: fresh goods are better; you can rely on fresh materials from Appleby's, retail radio distributors with a wide market.

**B**RIEFLY—here is our service, simple, straightforward, fair. A not-too-dull brochure, more fully descriptive, will be sent to you, immediately, on request.

**W**E Supply Practically all the Leading Lines of Radio Apparatus at current list prices, and make no carriage charges, except on accumulators and batteries and exceptionally bulky articles.

**I**F You Wish we will take in part exchange any branded receiver, component or loud-speaker for which you have no further use, providing such is reasonably modern and in workable condition.

**T**O Make Fair Offers we must see the material; on receipt of a parcel, which must contain a list of contents and name of sender, we will send our offer, which is as an allowance from an order for new requirements totalling not less than twice the allowance—but it is fair. In the unlikely event of no agreement being reached, we will return your material carriage paid; you need have little fear for our returns in this respect have always been below one per cent. We cannot execute part exchange orders of less than 10/- net cash value that is, after part exchange allowance has been deducted.

**T**HE Above Terms Exist that fair offers may be an economical possibility, and a sound standard maintained; particular points of questions are elucidated in a little folder, "The Ins and Outs of the Outs and Ins"; a copy post free on request.

**A**PPLBY'S, specialists in distribution by mail and the originators of radio part exchange, No. Forty-four in Chapel St., Marylebone, London, N.W.1 (station opposite, Edgware Rd., Metropolitan Railway). [6516]

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Range Multipliers 6/6 each

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"It bears out what I have always told you, that for lasting service and good results the Helleesen Battery simply hasn't an equal."

**PRICES**

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- "Wiray" 9 volt Grid Bias Type 2/-
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- "Kolin" 60 volt H.T. Type. 19/-
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Your Dealer Sells Them.



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YOUR Old Apparatus Taken in Part Payment for Latest Type; see our advert. in column Receivers for Sale.—Scientific Development Co., 51, Fishergate, Preston. [0229]

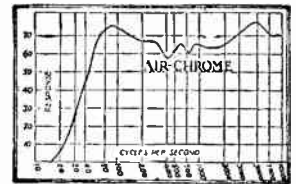
**PATENT AGENTS.**

PATENTS and Trade Marks, British and foreign.—Gee and Co. (H. T. P. Gee, Member R.S.G.B. and A.M.I.R.E.), 51-52, Chancery Lane, London, W.C.2. Phone: Holborn 1525. [0001]

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SCOTT SESSIONS and Co. Great Britain's radio doctors; read advertisement under Miscellaneous column. [0263]



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Patent No. 295,625.

... incorporates the Double-diaphragm Principle... uniform frequency response from 60 to 10,000 cycles... reproduces the high and the low notes faithfully.

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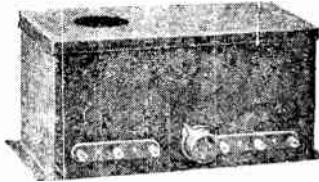
The only speaker with a published frequency response curve

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P & T

The Unit for the Screened-grid Valve!

THE TONEX UNIBOX



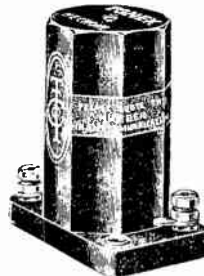
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UNIBOX is to the screened-grid circuit what TONATUNA is to the detector L.F. circuit. It is an absolutely complete shielded coil unit for a screened-grid valve receiver and is the very thing that has been wanted for a long time. All the coils are enclosed in a metal case attractively finished in crystalline enamel. The screened-grid valve itself fits into the case—and in addition an extra shield can be fitted for isolating the aerial tuning condenser from the rest of the circuit. The coils cover long and short wave broadcasting bands and a self-contained change-over switch is provided. The UNIBOX contains all the essential parts of the screened-grid circuit, the addition of tuning condensers and a few other components being all that are required to build a complete receiver.

TONEX HAVE PRODUCED IT

THE TONEX H.F. CHOKE

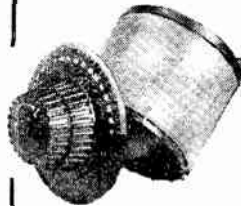
A choke that defies competition. Sectional windings enclosed in a handsome moulded Bakelite case. Handy terminals with screw-driver slots are fitted, and soldering tags are provided also. Fixing holes are metal bushed.



3 TYPES—  
10-90 metres - - 3/6.  
30-3,000 metres - - 4/6.  
Centre Tapped - - 5/6.

THE TONEX TONATUNA

The well-known tuning coil that has achieved remarkable popularity. No coils to change and a simple turn of the centre knob switches over from short waves to long waves. Aerial coil is centre tapped for increased selectivity. Range 2.0 to 520 metres and 1,100 to 2,000 metres.



Price 21/-

If your dealer does not stock, write direct giving his name and address—

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Repairs.—Contd.

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P.M.24 Valves, push-pull work, full emission; cheap; exchanges considered.—Box 3564, c/o The Wireless World. [6836]

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AERIAL Imperial Gives Astonishing Results, and is easy to handle as blind cord, so say users of this distance annihilator, 42 strands; 75ft. 3/6, 100ft. 5/-, post paid.—John Oakley, 38, Stonegate Rd., Leicester. [6735]

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A.N.P. Coil and Base, Ferranti A.F.3, Marconi Idea 6/1, R.I. double ratio output transformer 1/1, 25/1 Blue Spot 66K, Weston relay; Valves, 2 P.M.1 L.F., P.M.1 H.F., 2 D.E.5B, D.E.5A, D.E.5, 2 R5V, 3 Cosmor P.1, P.2, W.F.216A, all in good order; exchange for A.F.50 or A.F.40, O.P.9c, and good frame aerials for Broadcast and Daventry, or sell.—Hulley, 255, Onslow Drive, Glasgow, E.1. [6812]

FINANCIAL PARTNERSHIPS.

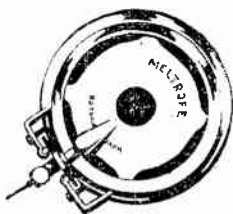
RETIRED Officer (Signals), desires working partnership with small progressive wireless firm, London area, or coast town, advertiser has knowledge of all branches, and has a private clientele that can be considerably increased.—Full particulars, and amount required, which will be treated confidentially, Box 3495, c/o The Wireless World. [6734]

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—and stocked by all good dealers!

COMPLETE ELIMINATOR TRANSFORMER

PRIMARY			
DIAGRAM REFERENCE	VOLT	AMP.	
A - B	110-120	-	
B - C	110-120	-	
A - C	220-240	-	

SECONDARY			
WINDING	VOLT	AMP.	RES.
1 - 2	250	0.07	
2 - 3	250	0.07	
1 - 3	500	0.07	
4 - 5	1.5	1.5	
5 - 6	1.5	1.5	
4 - 6	3.0	1.5	
7 - 8	1.5	1.5	
8 - 9	1.5	1.5	
7 - 9	3.0	1.5	

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Well designed, and current for 5 valves. 20% CARR PAID

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KILO-MAG & RECORD THREE METAL CABINETS.

35/- each or with woodwork 46/6 each  
Kit-Set 27/6 and 38/6 each respectively.  
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Graves 'Vulcan' 2-Valve Wireless Set is the World's greatest achievement in Wireless Value & Efficiency

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Even if you are only a beginner, this magnificent installation will enable you to start where others leave off; or if you are an experienced wireless operator, this superb set will give you a thrill of interest which you have never had before, and a sense of power and command over the mysterious forces of the ether which will positively astonish and fascinate you.

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Our inclusive Bargain Price is for deferred payments. Send 10/6 now, and complete purchase in 14 Monthly Payments of 10/6 if satisfied after trying Outfit in your home. Money back if disappointed.

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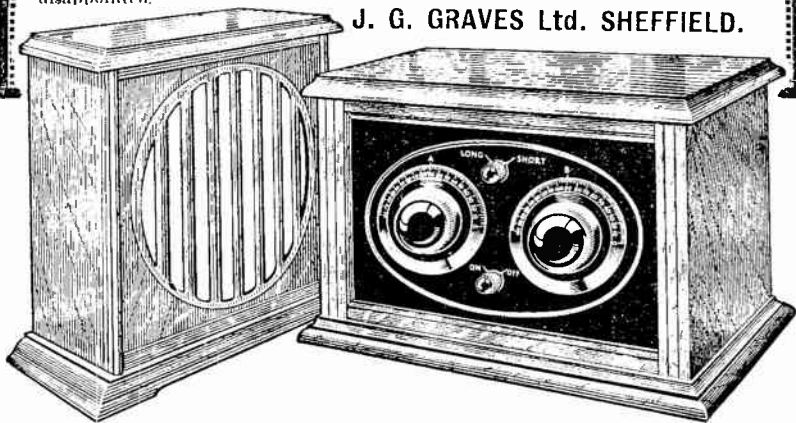
**THE GRAVES SCREENED GRID 3-VALVE SET**

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**TERMS: 15/- with Order, and 15/- Monthly.**

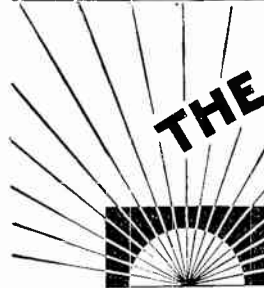
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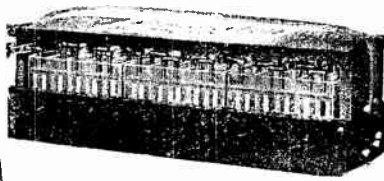
Ask your dealer for Belling-Lee Handbook 'Radio Connections.'

Advertisement of Belling & Lee Ltd., Queensway Works, Ponders End, Middlesex.

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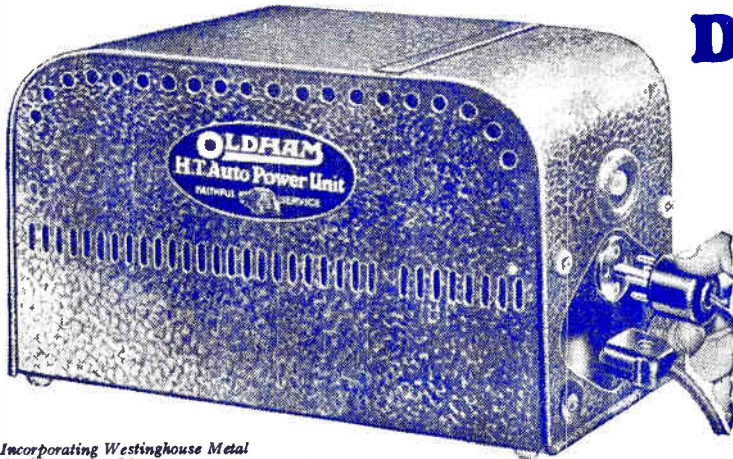
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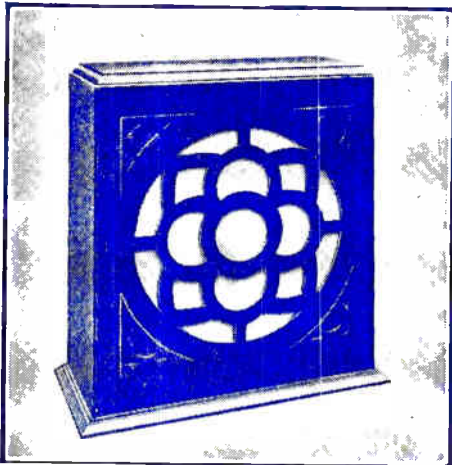
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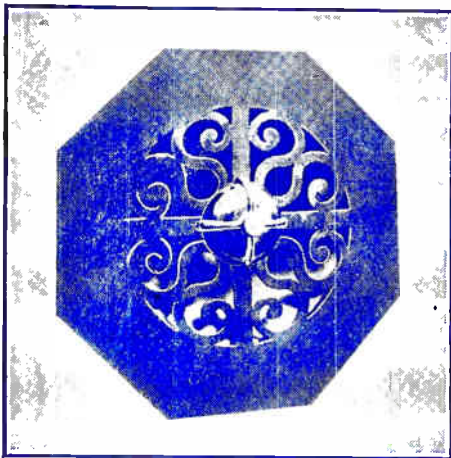
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# The Wireless World

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AND RADIO REVIEW

*The Paper for Every Wireless Amateur*

Wednesday, October 30th, 1929.



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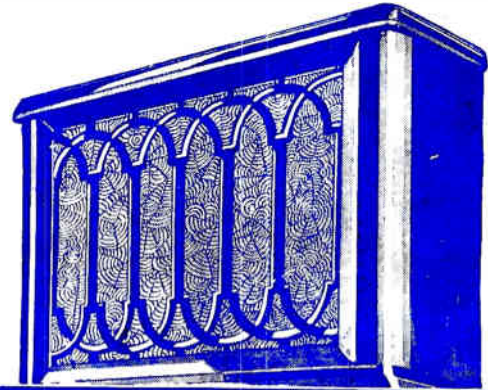
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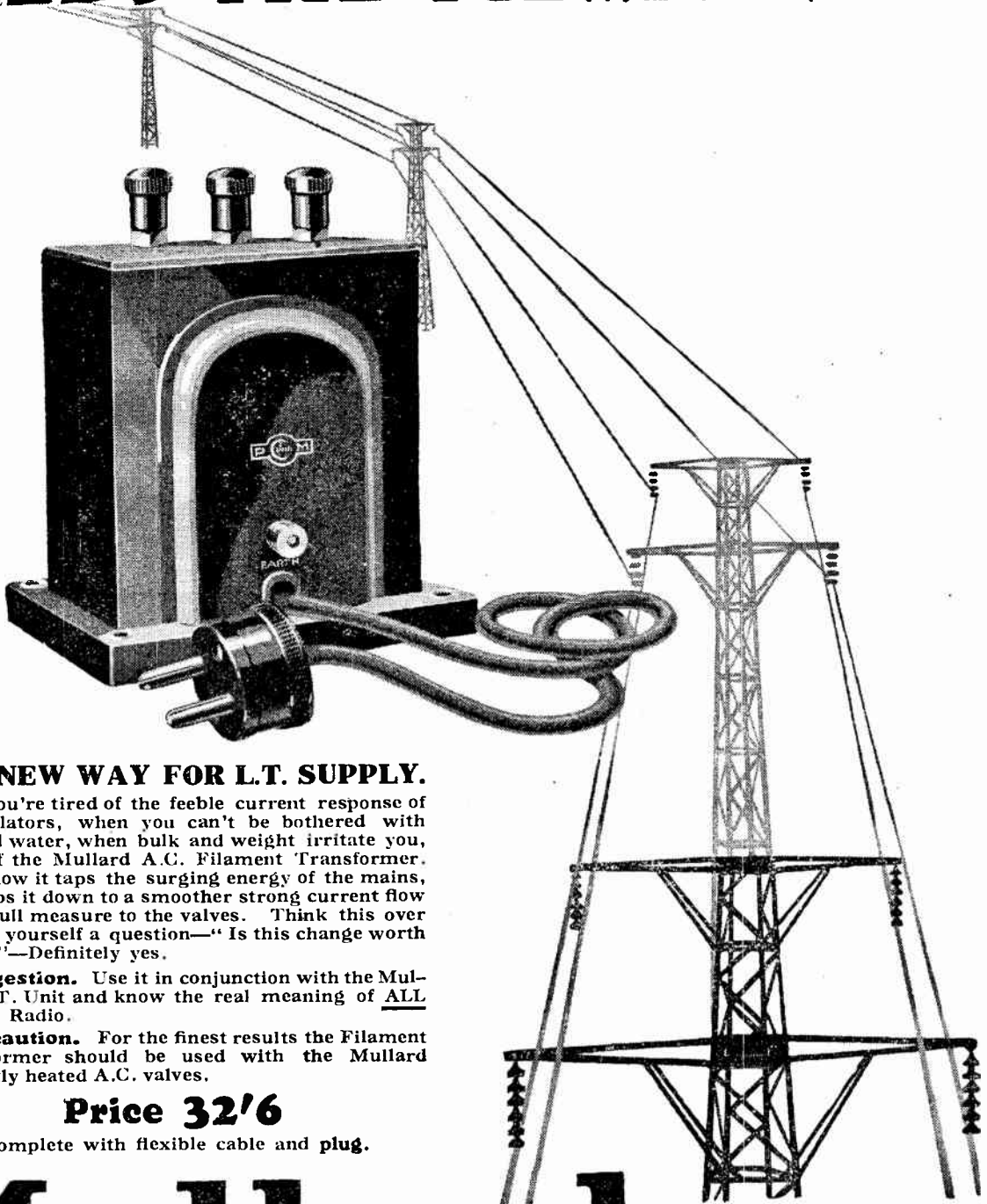
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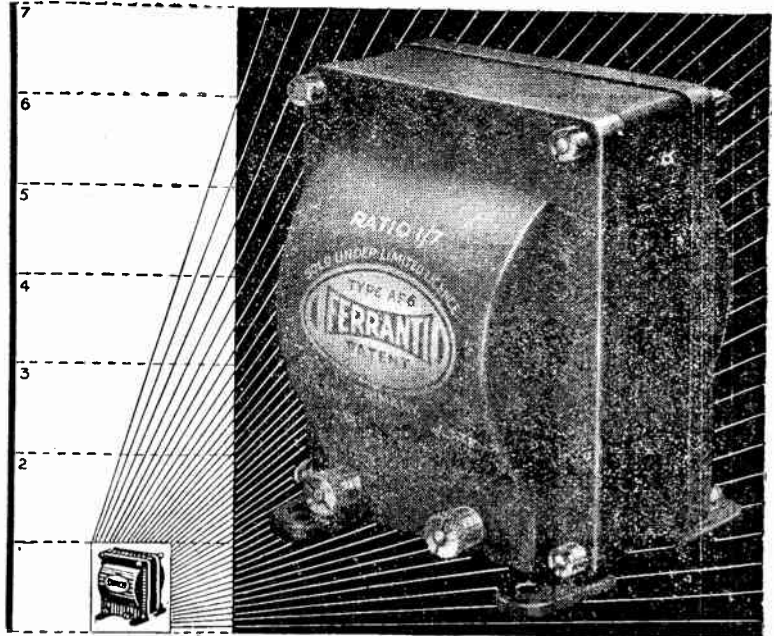
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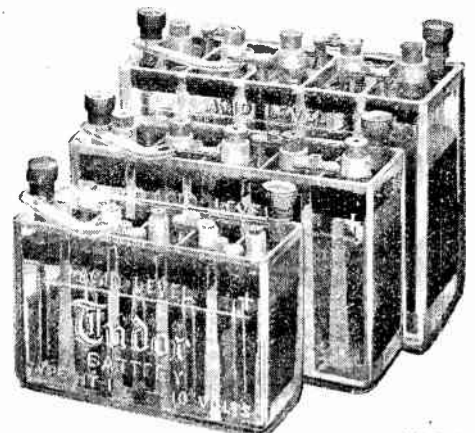
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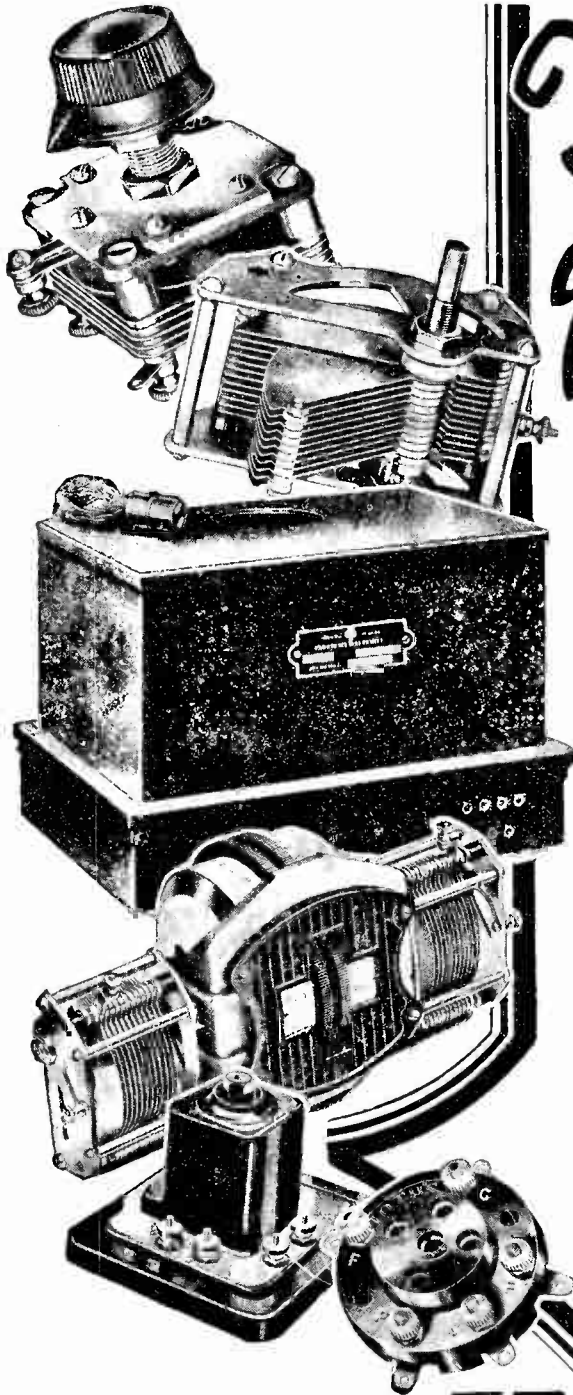
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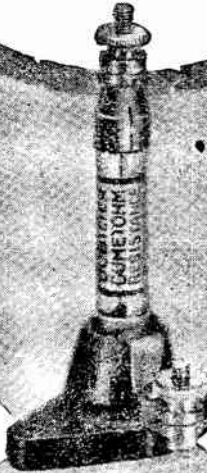
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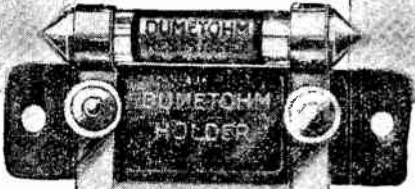
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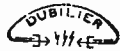
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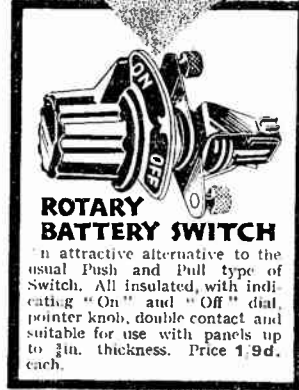
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"A Bit about a Battery." There's a copy for you at your dealer's

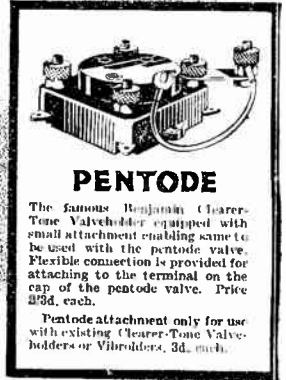
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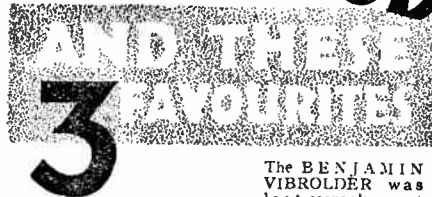
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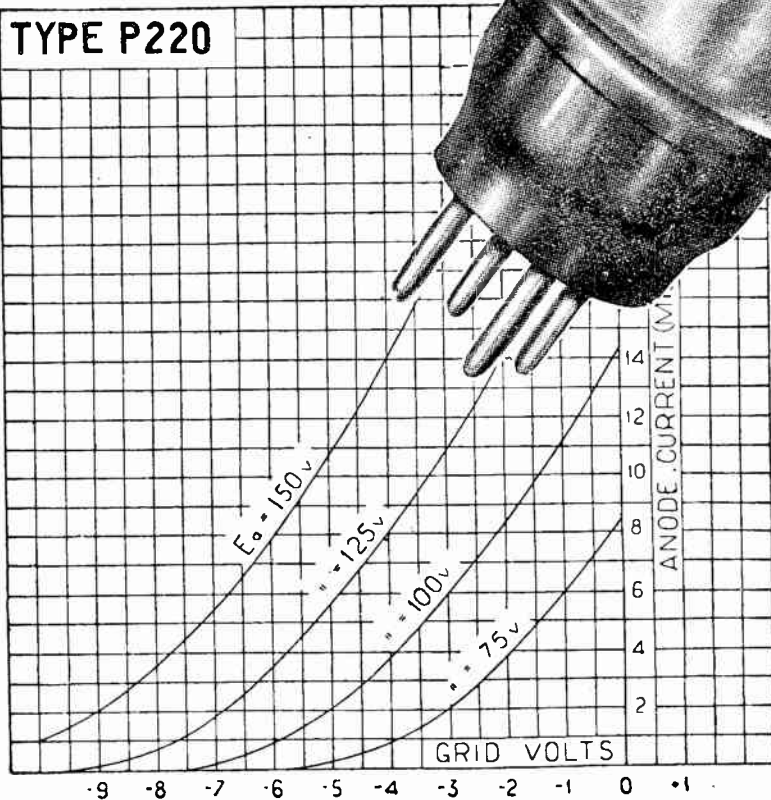
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the New  
Vitalising Element



PATENTED

The wonderful new Vitalising Element ensures continuous and satisfactory service. No other battery can give you the same service. It's the new Vitalising Element unique to Grosvenor that does it. Fitted by all the Leading Set Makers after the most exhaustive comparative tests, and PROVED to be the best.

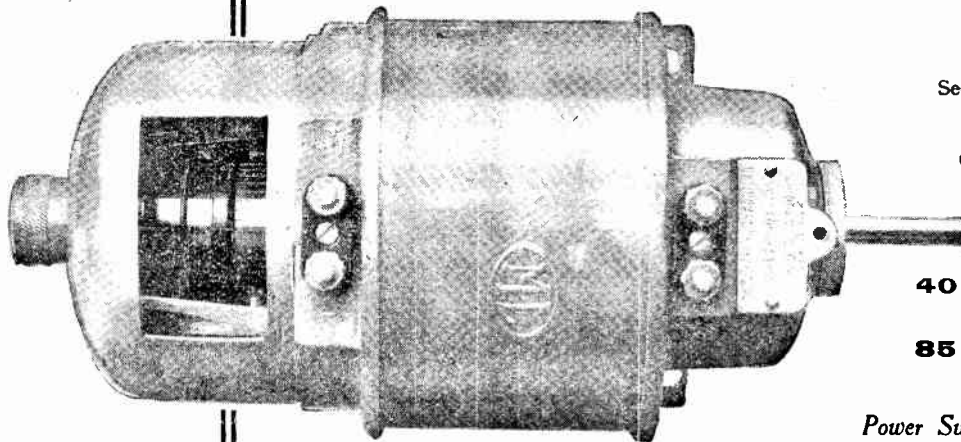
66 v. from 7/6      99 v. from 11/6

THE GROSVENOR BATTERY Co., Ltd.,  
2/3, White Street, Moorgate, LONDON, E.C.2.

## GROSVENOR BRITISH MADE BATTERIES



An entirely new M-L production for  
the ALL ELECTRIC RECEIVER,  
the D.C. to A.C. Converter.



See *The Wireless World*,

Page 375.

October 2nd, 1929.

**40 WATT Model**

**£13-0-0**

**85 WATT Model**

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*Power Supply Units our Speciality.*

IF YOU ARE ON D.C. MAINS employ the above machine for running your ALL ELECTRIC RECEIVER. The only safe way to operate receivers from D.C. Mains. Suitable for well-known makes of Receivers.

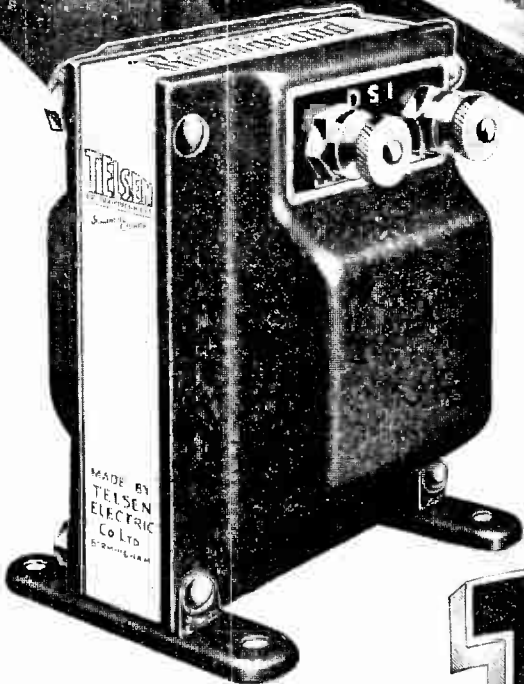
**M-L MAGNETO SYND. Ltd., Radio Dept.,  
COVENTRY.**

Telephone: 5001.

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# GET MELODY OUT OF

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## AND UNDISTORTED REPRODUCTION

Get fidelity into your 'Radio,' pure, clear, full-toned reproduction so amazingly near to the original performance that it is a revelation. No component is apt to make or mar your reception more than the transformers. In future, see that your set includes the best.

They are Entirely British.

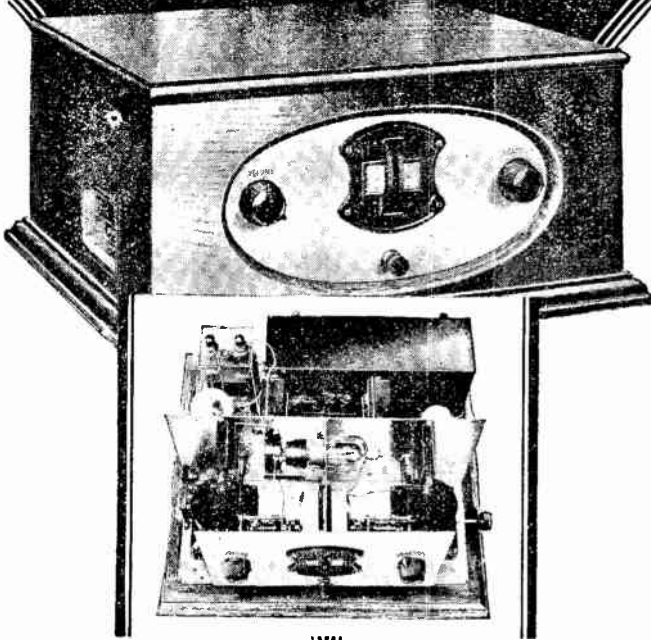
**RADIOGRAND      ACE**  
**12'6      8/6**

Both in ratios 3-1 & 5-1

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# TELSEN TRANSFORMERS

# Build the LOTUS S.G.P. Set at home!



The new Lotus 3-valve S.G.P. receiver is the season's greatest success. British and European stations come in with outstanding clarity and power. It is selective to a degree hitherto unattained. Build this wonderful set yourself at home. You can buy the complete outfit ready to assemble from any retailer for £7 / 12 / 6. Ask for the Lotus S.G.P. Kit — full instructions are with it and the main components are already mounted.

*From all radio dealers*

# LOTUS

## S.G.P. 3 - valve Kit Set

Send to-day for full descriptions, diagrams and instructions for assembling.

*Made by the makers of the famous Lotus components in one of the most modern radio factories in Great Britain.*

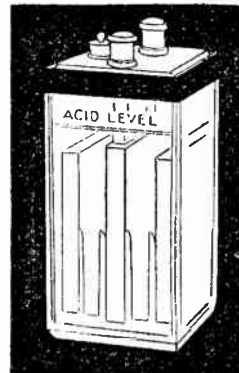
**Garnett, Whiteley & Co. Ltd.,**  
Lotus Works, Liverpool.

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# WHY PAY MORE ?

When you can buy Ediswan Accumulators at these prices!

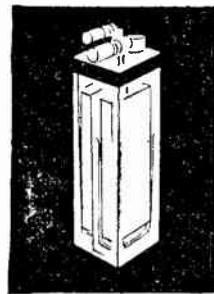
**EDISWAN  
LOTEN**



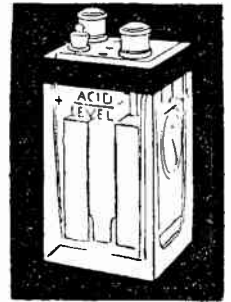
Major Loten.  
70 Amp. hrs 11/-



Little Loten.  
20 Amp. hrs. 4/3



Midget Loten.  
12 Amp. hrs. 2/9



Minor Loten.  
45 Amp hrs 8/-

Your accumulator worries are ended if you instal an Ediswan Loten — your charging bills are reduced, too, because the new mass type plates ensure maximum life per charge. From the lead used in the plates to the glass of the container. Loten accumulators are 100% British.

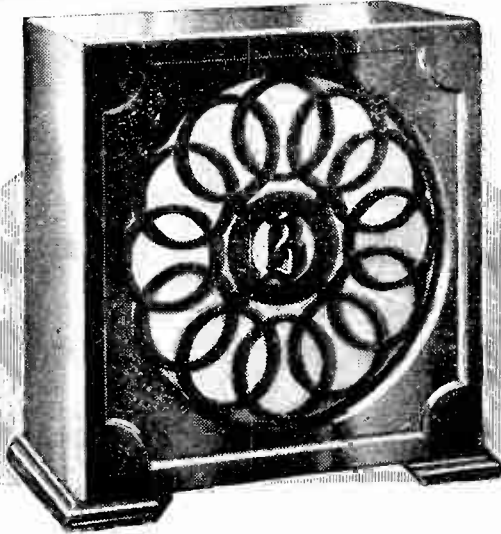
If it's  
**EDISWAN**  
..... it's better

Ask your radio dealer.

**THE EDISON SWAN ELECTRIC CO., LTD.**  
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SHOWROOMS IN ALL THE PRINCIPAL TOWNS. B.46a

BRITISH

THROUGHOUT



**We Stake Our  
REPUTATION  
on the TRUTH of  
these STATEMENTS**

**THE** new Brown "Vee" Reed principle combined with the new Brown Duplex diaphragm gives results far in advance of any other kind of loud speaker.

Only in the new Brown Duplex Loud Speaker are these revolutionary principles to be found. They are the patent of Mr. S. G. Brown who is known throughout the world as the maker of the first wireless loud speaker.

For this reason, no matter how much you have paid for a loud speaker, you have not heard results that can even be compared to the reproduction of these new Brown instruments.

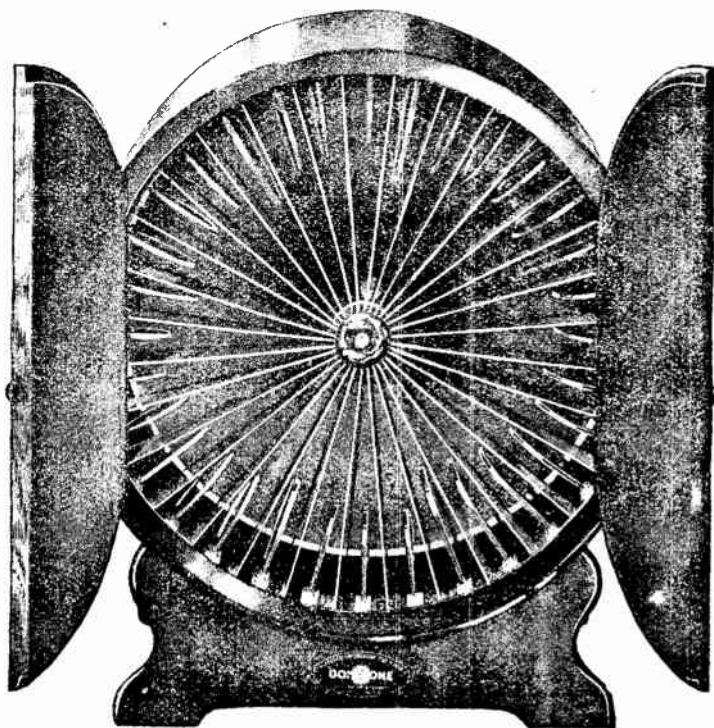
But a hundred descriptive words are not worth as much to you as one minute's listening. Before you buy a loud speaker, get your Dealer to demonstrate the new Brown Duplex models. You will be more than impressed and will place your order at once.

In 3 models: V10, £5 10 0. V12, £7 10 0. V15, £12 10 0. All obtainable on easy monthly payments.

*The* **NEW**  
**Brown**

**DUPLEX LOUD SPEAKERS**

# DONOTONE



From 5 Gns.

THE **BEST** LOUD SPEAKER.

The new model with the wonderful tuned gongs gives the most amazing purity and volume.

**COME AND HEAR IT!**

*Demonstrations Daily.*

7 Days' Approval against cash.

The  
**DONOTONE** (Regd.) **LOUD SPEAKER**  
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TELEPHONE: HOLBORN 0523.

**Buy  
a good  
Battery  
for your  
Portable  
set!**



**EVER READY**

*Britain's Best Batteries*

**SPECIAL UNITS**  
for  
**PORTABLE SETS.**

<b>PORTABLE 1</b> 63 volts Size 6" x 5" x 3"	<b>8/6</b>
<b>PORTABLE 2</b> 99 volts Size 9" x 5" x 3"	<b>13/6</b>
<b>PORTABLE 3</b> 108 volts Size 10" x 5" x 3"	<b>15/-</b>
<b>FOR NATIONAL PORTABLE</b>	
<b>W966, 126 volts, 25/-</b>	

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# *This is the way to Make it "All-Electric"*



## **No more batteries Much more volume**

Is your set in line with the very latest in radio development or do you still fuss and bother with batteries?

Bring your present set up-to-date with the minimum expense by buying a Philips All-Electric H.T. Unit and Trickle Charger. The addition of these two components makes your old set the very newest of the new.

*Write for illustrated leaflet.*

### PRICES

H.T. Supply Unit  
Type 3009 for A.C.  
Mains - £5 : 15 : 0

H.T. Supply Unit  
Type 3002 for A.C.  
Mains - £5 : 10 : 0

H.T. Supply Unit  
Type 3005 for D.C.  
Mains - £3 : 17 : 6

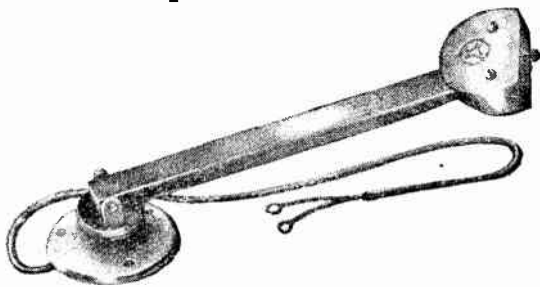
Trickle Charger  
Type 1017 for A.C.  
Mains - £2 : 15 : 0

# PHILIPS

PHILIPS RADIO, PHILIPS HOUSE, 145, CHARING CROSS ROAD, LONDON, W.C.2

# Input and OUTPUT:

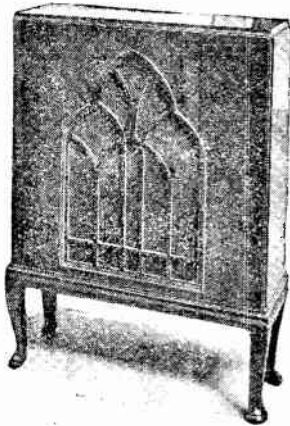
The R.G.D. Magnetic Pick Up is designed



To avoid all record wear, give perfect tracking, and is specially developed for Moving Coil Speaker reproduction. Without these features, it is impossible to get good input and reproduction.

In Oxidised Silver £3 : 3 : 0 In Bronze £3 : 0 : 0

## The Speaker:



To give of its best, must be specially designed from an acoustic principle, apart from the unit installed therein. With the R.G.D. Moving Coil Loud Speaker we can say that these points have been thoroughly dealt with. The case is of solid oak, and the instrument is of an exceptionally high-class nature. For D.C. mains the cost is £20-0-0. And it can be supplied with the equipment for A.C. mains if desired. Literature on application.

**THE RADIO GRAMOPHONE DEVELOPMENT COMPANY**

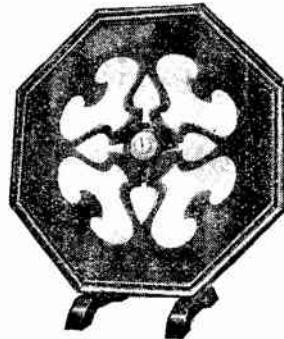
St. Peters Place, Birmingham

# TAKE YOUR CHOICE!

M.P.A. RESEARCH DEPARTMENT OFFERS YOU THESE 3 NEW M.P.A. SPEAKERS, SCIENTIFIC MASTERPIECES! EACH ONE A TRIUMPH OF GOOD LOOKS, TONAL PERFECTION AND VALUE! HEAR AND COMPARE



### THE NEW M.P.A. POPULAR PLAQUE



A BETTER INSTRUMENT THAN EVER BEFORE—and AT A LOWER PRICE! Fitted with the wonderful new Mark VI unit; with new robust protecting grille a back; mounted on wooden base. Remarkably sensitive, clear and loud! Even response over wide range of frequencies, attractive mahogany or oak finish. **25/-** And look at the price!

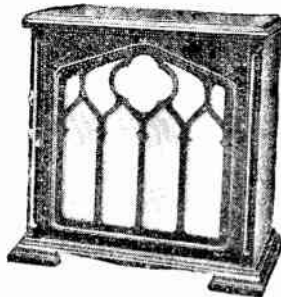
★ Don't forget also to hear the new Mark VI Speaker Unit. It is 6" x 12 1/2", chassis with 14" wood baffle and 9" cone casts 10/-; full mounting instructions are given.

### THE NEW M.P.A. POPULAR CABINET

ANOTHER EXAMPLE OF M.P.A. VALUE! An attractive speaker with a first rate performance. Yet low in cost! Like the Popular Plaque, it has the unique Mark VI movement. Extremely sensitive. Splendid reproduction. Exceptionally wide range. Handsome polished oak cabinet. Box resonance eliminated. Hear **45/-** it and you'll buy it! Price Mahogany Cabinet 47/6



### THE NEW M.P.A. MOVING COIL SPEAKER



SEE AND HEAR THIS AMAZING NEW SPEAKER! Whatever price you are prepared to pay, you will not get anything better! Here indeed is "Hearing that is almost seeing!" Built on entirely new principles. Permanent magnet. No separate energising current required. Patent baffling system eliminates box resonances. Glorious tone! Dignified design in polished oak. A delight for the eye and the ear! Complete **15 GNS.**

Unit only on base, 12 Gns.



Hearing that is Almost Seeing

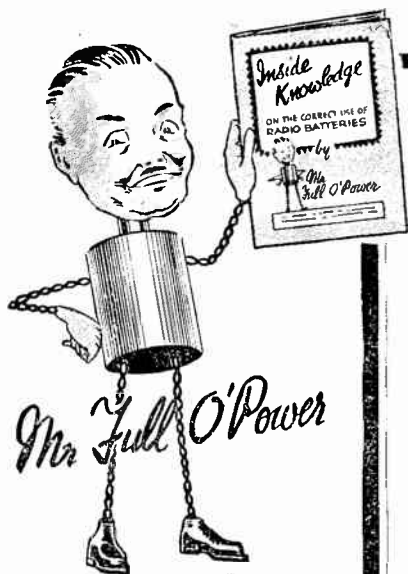
M.P.A. products above £5 can be purchased on easy deferred terms. Ask your dealer to-day.

M.P.A. Wireless, Ltd., Dept. 2, Radio Works, High Road, Chiswick, W.4.

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# THERE IS A SIEMENS RADIO BATTERY FOR EVERY WIRELESS SET.



**S**UMMED up in a few words, the secret of success with a High-Tension Battery is to choose the correct type of battery for the load it is expected to bear.

Useful information on this point is given in a special table which appears in "Inside Knowledge," a booklet by Mr. Full O'Power, which also contains many other hints and tips which every owner of a wireless set will find both interesting and instructive.

One point in particular should be borne in mind—always use a *power* battery whenever a *power* valve is used. The cost of a power battery is *less than double that of an ordinary battery*, whilst its working life is approximately *three times as great*.

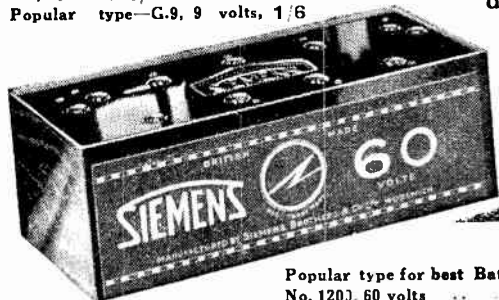
## "INSIDE KNOWLEDGE" (On the correct use of Radio Batteries)

is obtainable from Radio Dealers and is free for the asking. If any difficulty is experienced please write direct to

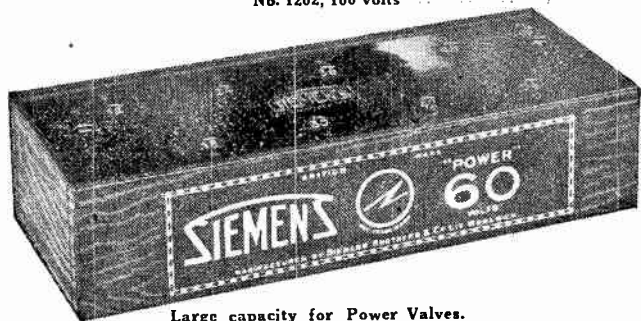
SIEMENS BROTHERS  
& CO. LTD.,  
WOOLWICH, S.E.18.



**Grid Bias**  
Specially designed for exceptionally long service. Standard type. G.1, 4½ volts, 1/3 G.2, 9 volts, 2/- Popular type—G.9, 9 volts, 1/6



**Popular type for best Battery value.**  
No. 1200, 60 volts .. 8/-  
No. 1202, 100 volts .. 13/-



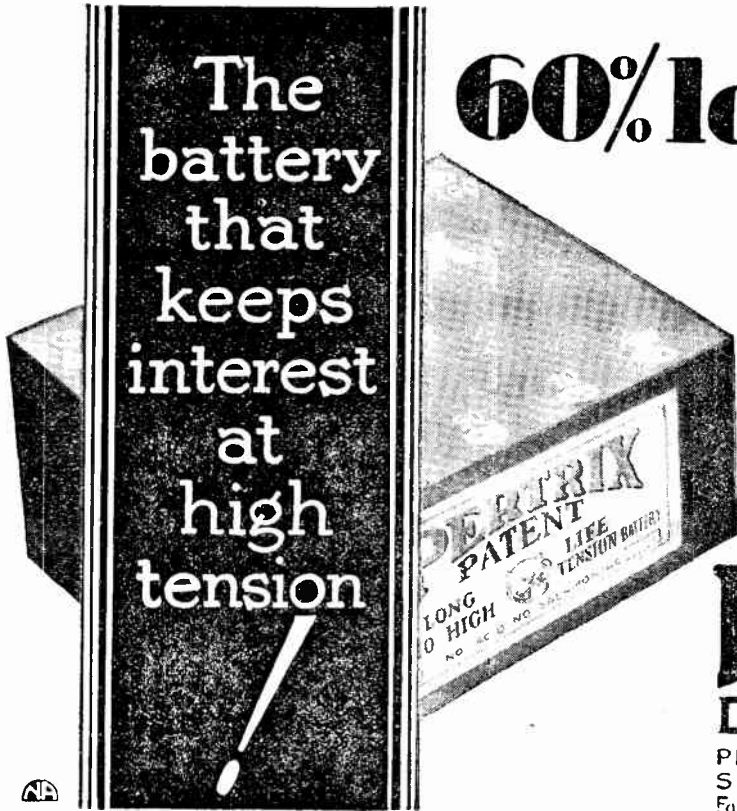
**Large capacity for Power Valves.**  
No. 1204, "Power 60" volts, 13/6  
No. 1206, "Power 100" volts, 22/6



**Super Radio Battery for Multi Valve Sets.**  
No. 1035, 50 volts .. 25/-

The battery that keeps interest at high tension

60% longer life!



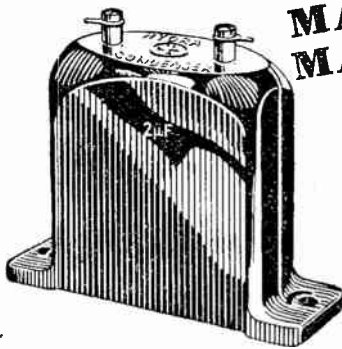
A most important consideration, is it not? A battery that lasts longer, that loses nothing of its power when out of circuit, that develops no "crackle."

Actually, a new era in H.T. Batteries began with the advent of "Pertrix." Try one, and never again will you be content with any other.

# PERTRIX DRY BATTERIES

PERTRIX LIMITED, BRITANNIA HOUSE, SHAFTESBURY AVENUE, LONDON. W C 2. Factory — BRITANNIA WORKS, REDDITCH. WORCS.

# HYDRA CONDENSERS



MAKE MAINS RADIO SAFE!

Hydra Condensers are made to stand up to high pressures—to the sort of voltages you get in mains units. That is why Hydra make mains units safe.

Look for Hydra in the circuit before you buy an eliminator—then you know you are buying an eliminator that will give you current that is smooth, voltage that is accurate, and output that is constant and safe.

Leading makers of eliminators are standardising Hydra — because they know that Hydra reliability is their surest safeguard. Hydra in a mains unit means SAFETY FIRST for you and your set!

# HYDRA CONDENSERS?"

ASK AND INSIST— "HAS IT GOT

Write for names of manufacturers who standardise HYDRA in their Mains Units.

LOUIS HOLZMAN, 37, Newman St., London, W.1

TELEPHONE

MUSEUM 2641

Mention of "The Wireless World," when writing to advertisers, will ensure prompt attention.

Weston sets the world's standard



Model 506, Pin Jack Voltmeter complete with high range standard testing cables.

Price £2. 10. 0.

To obtain the very best results from your receiver, you must be quite sure that the High Tension, Low Tension and Grid Bias voltages are regulated correctly.

For exact measurements of these variable voltages be sure you use a Weston Pin Jack Voltmeter.

It is sold by all Radio Dealers as the finest instrument for accuracy and reliability.

Write for the Weston Free Booklet, "Radio Control," which explains the necessity for accurate electrical control of your Radio receiver, and gives much helpful advice. Address your applications to:—

# WESTON

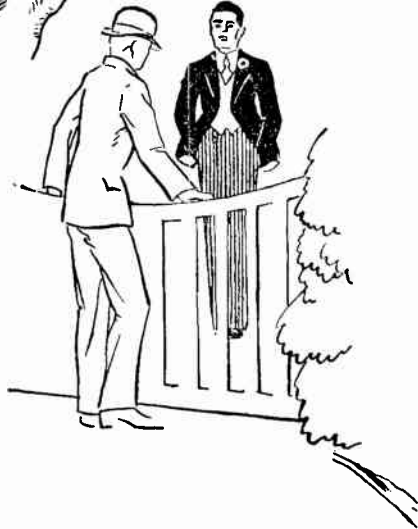
ELECTRICAL INSTRUMENT CO., LTD.,

15, Great Saffron Hill, London, E.C.1

A.2



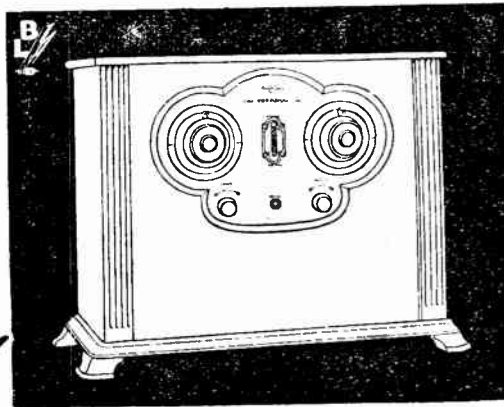
**COME  
OVER  
HERE!**



The man next door said the programmes weren't up to standard. Father said it must be the set. So the man came over to listen to the Vox Populi Three. Now he says he realises all he's been missing.

If one of your friends has a screened Vox Populi Three, hear it at the first opportunity and see if you don't have a similar experience. Or any good wireless dealer will oblige. Listen to singer or player—what purity of reception. No trouble about batteries either—this Bowyer-Lowe set runs off the electric light. And you can buy a Screened Vox Populi Three for your own home on easy monthly payments.

- List No. 370 Mains Driven D.C.  
£28 0. 0.
  - List No. 369 Mains Driven A.C.  
£33 10. 0.
  - List No. 339 Battery Model  
£20 0. 0.
- Prices include valves and royalties.



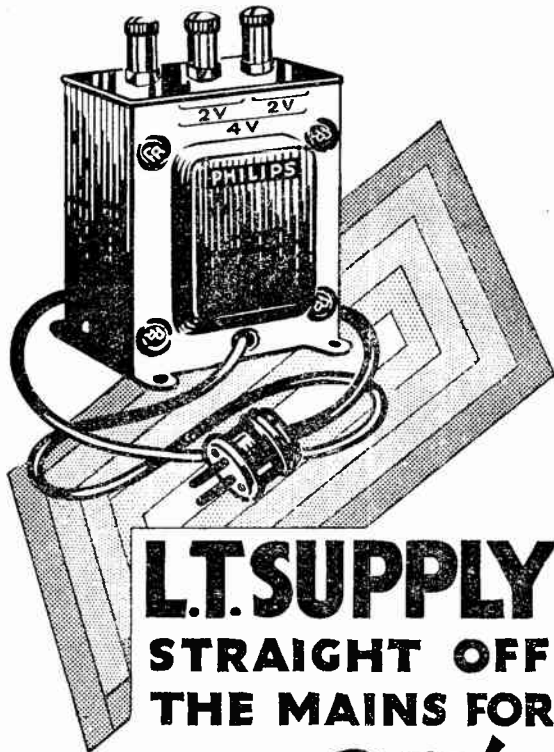
THE  
**BOWYER-LOWE**  
CO., LTD.

In Association with  Recordphones Ltd.

Ask your Wireless Dealer about the comprehensive range of Bowyer-Lowe Sets and Components, or write for Illustrated literature.

LONDON SHOWROOMS:  
**ASTOR HOUSE, ALDWYCH, W.C.2.**  
HEAD OFFICE AND WORKS:  
**RADIO WORKS, LETCHWORTH, HERTS.**





**L.T.SUPPLY  
STRAIGHT OFF  
THE MAINS FOR**

**29'6**

Fit a Philips All-Electric Filament Transformer and do away with your accumulators. Save trouble and expense and get the best results.

No accumulators to run down or fail in the middle of a programme.

No weekly bother of changing accumulators.

No bill for recharging.

Type 4009.

Price 29/6

**PHILIPS**

**A.C.FILAMENT TRANSFORMERS**

PHILIPS RADIO, Philips House,  
145, Charing Cross Road, London, W.C.2.

Arks. T. I.

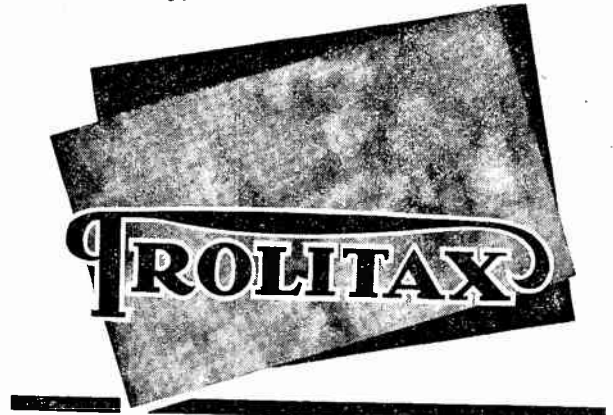
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Your wireless panel can be a thing of beauty as well as efficient. Every wireless dealer stocks Trolitax in a variety of finishes, embossed and wood grained, and can supply panels cut to any required size. Not only is Trolitax a perfect insulating material; it is easily workable, is impervious to damp, does not soften under heat and therefore does not allow screws or terminals to become loose when soldered. Trolitax is the ideal panel—it retains its lustrous finish under all conditions. A Trolitax panel improves any set. Consult your dealer.

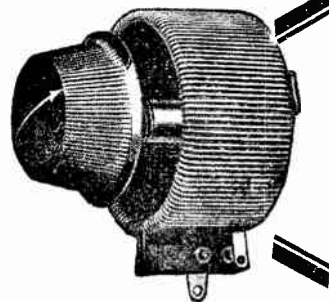
**F. A. HUGHES & COMPANY, LIMITED**  
204-6, Great Portland Street, London, W.1.

*Telephone: Museum 8630 (4 lines)*

*Distributors for Northern England, Scotland and North Wales: H. C. RAWSON (Sheffield and London), Ltd., 100, London Road, Sheffield, and 22, St. Mary's Parsonage, Manchester.*



## Centralab Giant Power Rheostats



Small in diameter, but large in capacity, this rheostat is constructed of heat-resistant material throughout. The wire is wound on a metal core insulated with asbestos.

C.R.L. Giant Power Rheostats will carry a continuous current load throughout the entire resistance of 70 watts at 375° Fahrenheit.

All units are single hole mounting and supplied complete with bakelite arrow knob.

G.R. 002	2 Ohms	8/9
G.R. 006	5 "	8/9
G.R. 010	10 "	8/9
G.R. 030	30 "	8/9
G.R. 060	60 "	8/9
G.R. 150	150 "	8/9
G.R. 400	400 "	8/9
G.R. 1,000	1,000 "	10/6
G.R. 2,000	2,000 "	10/6
G.R. 5,000	5,000 "	11/3
G.R. 8,000	8,000 "	11/3

Write for the Centralab Circuit Booklet and particulars of Centralab Modulators, Power Potentiometers and Volume Controls.

**The Rothermel Corporation Ltd.**

24'26, Maddox St., London, W.1.

Telephone: MAYFAIR 0578/9.

EVERYTHING

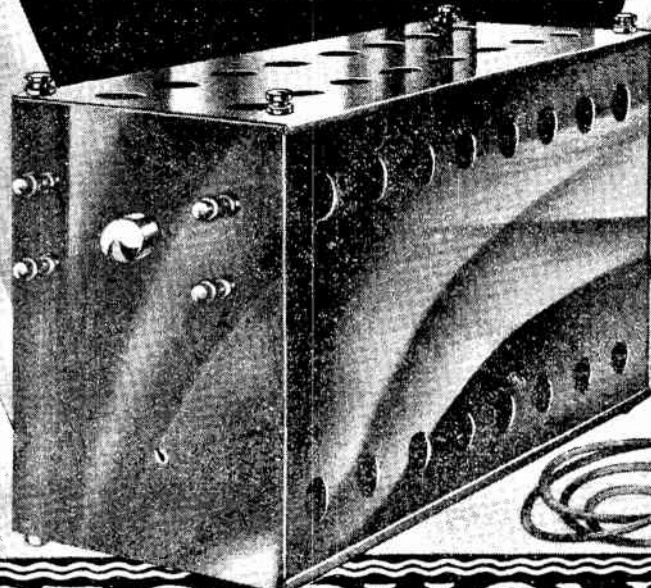


ELECTRICAL

**ENTIRELY NEW**  
**ALL**  
**ELECTRIC**

Made in  
England.

Sold by all  
Wireless  
Dealers.



**GECOPHONE**

REGISTERED TRADE MARK

**POWER**  
**AMPLIFIER**

*for A.C. Supply*

A complete A.C. Power Amplification Unit for real quality and high power output. Metal case finished in light brown crystalline enamel.

Output Valve, OSRAM LS6A, dissipates 25 watts.

Fitted with new transformer giving constant amplification from 50 to 6,000 cycles.

**PRICE**  
(including Royalty)

**£25 0 0**

Advt. of The General Electric Co. Ltd., Magnet House, Kingsway, London, W.C.2.

A 17 Advertisements for "The Wireless World" are only accepted from firms we believe to be thoroughly reliable.

# The bridge from A.C. to D.C.

Change over by means of the metal bridge—  
strong, reliable and durable—

THE



## METAL RECTIFIER.

NO FILAMENTS.  
NO CHEMICAL ACTION.  
NO MOVING PARTS.

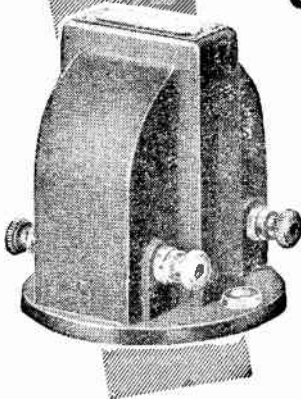
There is a unit for every type of eliminator. Whether you construct, or purchase complete, an eliminator or mains set, for your own satisfaction see that a Westinghouse Metal Rectifier is used.

Did you get your copy of "The All Metal Way, 1930," from the Radio Shows?

This 32-page book of instructions and circuits is invaluable to all users and prospective users of A.C. mains. A copy will be sent on receipt of a 2d. stamp.

The Westinghouse Brake & Saxby Signal Co., Ltd., 82, York Rd., King's Cross,  
London, N.1.

*One of the  
outstanding  
successes of  
Olympia*



The new British General Midget Transformer created remarkable interest. In accordance with modern practice of economising in weight and space this transformer has been produced in a remarkably small size. The core is of the latest Nickel Alloy (specially treated) and the performance is as good as many transformers at three times the price.

# 11'6

*From all dealers of repute or  
direct from the manufacturers.*

The British General Manufacturing Co., Ltd.  
Brockley Works, London S.E.4.

## WEARITE COMPONENTS

### 1930 EVERYMAN FOUR.

Coils per set £2-7-6

### NEW KILOMAG FOUR.

Coils per set £2-5-0

### WIRELESS WORLD KIT SET.

Coils per set £2-5-6

### DECOUPLING RESISTANCES.

500 or 600 ohms .. 1s. 6d.

Fixed resistances wire wound

1,000-5,000 10,000 15,000 20,000 25,000 ohms

2/- 2/6 3/- 3/6 4/- each

### FOREIGN LISTENERS FOUR.

B.B.C. Coils, per set of 3 £1-2-6

5XX Coils, per set of 3 £1-17-6

Coil Bases, per set of 3 £0-7-6

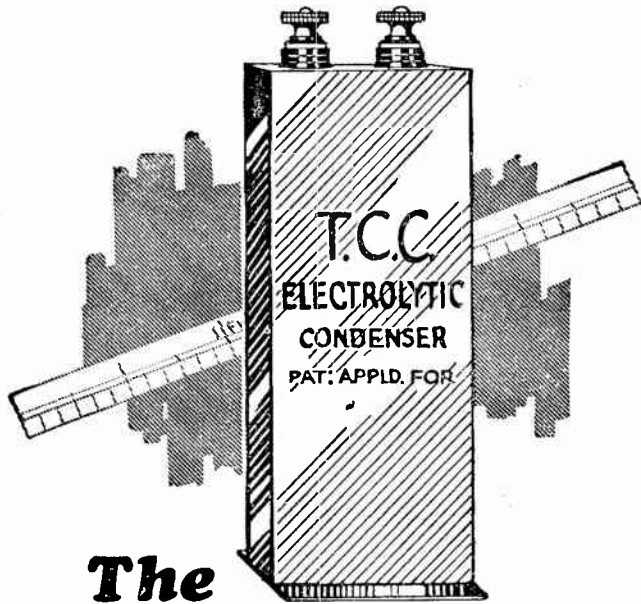
*Write for illustrated lists:*

**WRIGHT & WEAIRE, LTD.**  
740, HIGH ROAD, TOTTENHAM, N.17.

*Telephone: Tottenham 3847/8.*

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# STANDARDS



## The "YARD STICK" and T.C.C.

ALL yards—if they are true yards—are exactly the same length as the "Yard Stick"—a standard of length confirmed by Statute. A true three yards of cloth is exactly three times the length of the standard yard—the "Yard Stick."

Accuracy in anything demands a standard, and among condensers that standard is T.C.C. Whenever you see a condenser marked "T.C.C." you are assured that it is true to type—that it is a standard by which all others are judged, whether for accuracy, dependability or service. The considered opinion of all who know what a good condenser should be, have recognised in T.C.C. the standard. Use T.C.C. wherever a condenser is specified, and know that you are safe.

The illustration above shows an Electrolytic Type Condenser. These are made in three capacities, viz. :—Single Type 2,000 mfd. 12 volts D.C., price 15s. od. Double Type 4,000 mfd. 12 volts D.C., price 27s. 6d., and the new Single Type 500 mfd. 40 volts D.C. price 20s. od.



Ad t. Telegraph Condenser Co. Ltd. Wales Farm Road, N. Acton, Lond n. W.3.



1309

# ENQUIRE WITHIN



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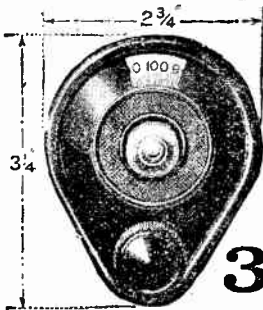
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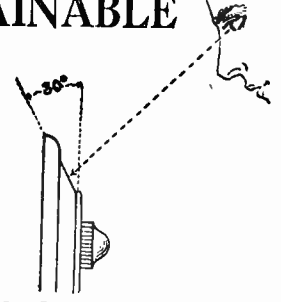
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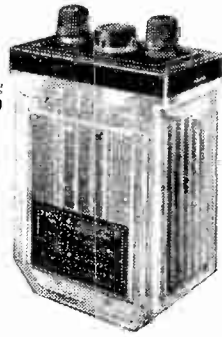
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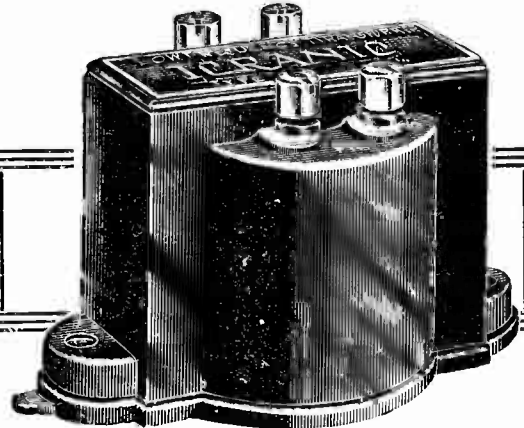
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AND  
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## THE REGIONAL SCHEME.

OUR editorial in the issue of October 16th, under the title "Must the Regional Scheme be Scrapped?" has aroused some of our readers to wrath, whilst others are whole-hearted in their endorsement of our criticism of the power of Brookman's Park. The letters which we are receiving can, with very few exceptions, be divided into two classes; those whose receivers have hitherto been outside the range of efficient reception from the lower-powered 2LO transmitter in Oxford Street and who now get a satisfactory service on account of the higher power of Brookman's Park, and are enthusiastic in their support of the station; and those who have the misfortune to live nearer to Brookman's Park and find that much that they were hitherto able to listen to by way of a choice of programme is now denied to them because of the "wipe out" effect of the new station. These unfortunates look forward with apprehension to the commencement of the dual transmissions from the regional station.

Several letters have commented on the fact that the

receivers described recently in *The Wireless World* have been designed so as to be sufficiently selective to overcome the disadvantages of the high power transmitter and that therefore there should be no occasion for worry. We agree that selective sets will go a long way towards solving the problem for those who want to listen to alternative stations, but the vast majority of the public are to-day using sets which are not sufficiently selective to give them, under the regional scheme, freedom to receive transmissions from abroad which they have hitherto enjoyed.

### B.B.C. Programmes Only.

We know that those who have been responsible for developing the regional scheme hold the view that the listener should have the choice of two B.B.C. programmes from his local regional transmitter, and that he should neither be encouraged nor even permitted to receive any other station, but that from time to time the B.B.C. will put on for his benefit selected portions of the programmes of some of the foreign stations. Now the listener has, we feel, a right to say whether he endorses this policy or not, and whether he is content that his receiver should, by the action of the B.B.C., be rendered virtually incapable of receiving anything beyond the two programmes which the B.B.C. will provide. Our own conception of wireless does not, we fear, harmonise with this policy; the principal fascination of wireless, as we see it, lies in the ability to reach out and pick up programmes of all countries and all languages at will.

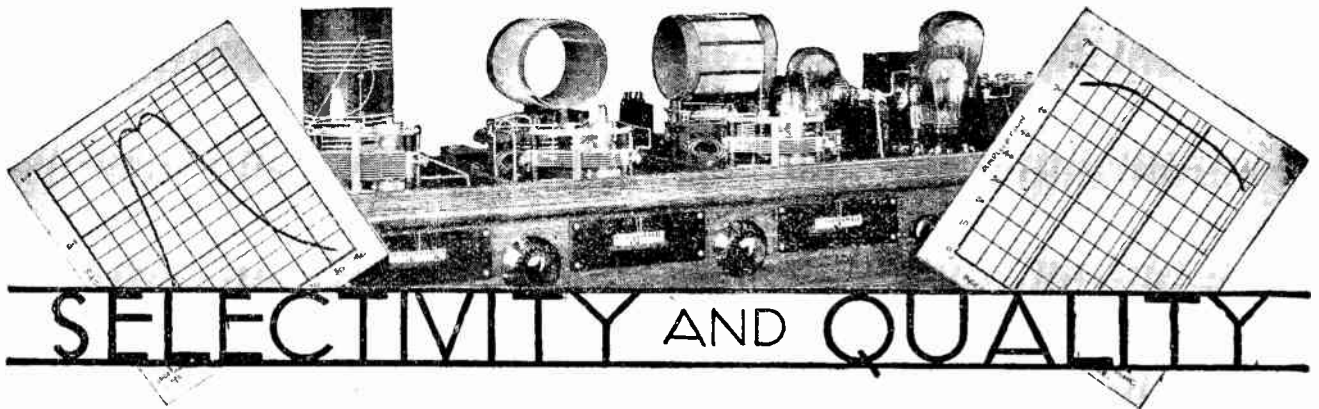
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## OLYMPIA SHOW COMPETITION.

IN this issue we are able to announce the result of the voting of our readers in the Competition which we conducted in connection with the Olympia Radio Show, and we give the names of the receivers and other apparatus gaining the largest number of votes in each of the classes into which the exhibits as a whole were divided.

We are not yet in a position to announce the names of the winners of the cash and other prizes, offered by *The Wireless World* to those competitors whose votes agree most nearly with the views of the majority, but the task of arriving at these totals is a formidable one and some little delay is inevitable. Last year the total of entries was not so great, and it was then possible to make both announcements at the same time.

In our issue of November 13th we propose to illustrate and describe the winning apparatus in the Competition, and we feel sure that these descriptions will be of interest to all our readers.



## Using Band-pass Filters to Avoid Interference and Side-band Cutting.

By W. T. COCKING.

WITH the opening of the first Regional Station at Brookman's Park the problem of obtaining adequate selectivity has become greater than ever before. A method of tuning which of recent years has been somewhat neglected is that employing coupled tuned circuits, which in pre-broadcasting years was often used under the name of the three-circuit tuner. The use of this method, however, has been revived in a few modern receivers, a notable example being the "Wireless World Record III" set; it is also used by the B.B.C. in the transmitting circuits of the Daventry Experimental station.

The reason for its lack of popularity is due to the fact that in its old form it was very difficult to tune, there being three variable controls. Properly designed, however, as in the "Record III," it is no more difficult to handle than more conventional arrangements, and it offers several important advantages.

The great fault of all ordinary tuned circuits is that they reduce to a large extent the strength of the high notes in the received speech and music. This effect is well known, but the amount of the reduction is not so generally realised. The H.F. circuits of a receiver using a Mazda AC/SG valve as the H.F. amplifier will, under certain conditions, reduce a 5,000 cycle note by 89 per cent., when the carrier wavelength is 500 metres, and both the grid and tuned anode coils have inductances of 240 mH. and H.F. resistances of 5 ohms. On the lower wavelengths the loss is not so great, but it is still so serious that it will completely overshadow any normal loss in the L.F. portion of the set.

The selectivity of the arrangement is quite high, the strength of a signal at 40 k.c. off resonance will be only 1/500th of that at resonance; that is, the selectivity

ratio is 500:1. Throughout this article the selectivities of different circuits will be compared by the ratios of the voltage on the grid of the valve at resonance and at a frequency differing from resonance by 40 k.c. The variation in strength over the side-band range (taken as the carrier frequency plus or minus 5,000 cycles) is expressed as a loss in percentage.

With the usual method of tuning by circuits in cascade no improvement in quality is possible without a corresponding reduction in selectivity, unless both the number of the circuits and the H.F. resistance of each are increased. While this is quite effective, it is not very economical, for the resistance of each coil has to be so high that the sensitivity of the receiver is very much reduced.

With coupled tuned circuits, or as they are more

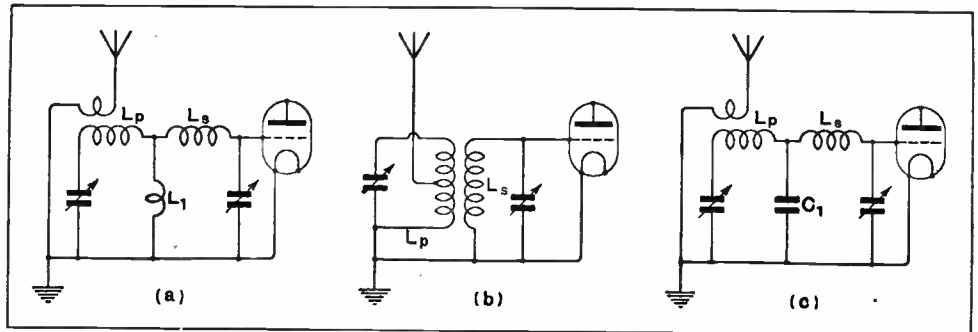


Fig. 1.—Three band-pass filter arrangements. (a) Coupled by inductance; (b) coupled by mutual inductance; (c) capacity-coupled.

usually called, band-pass filters, high selectivity with a good measure of amplification and a high note loss of only about 10 or 20 per cent. can be readily attained. There are three methods of coupling the two halves of these filters, (a) by inductance, (b) by mutual inductance, and (c) by capacity, and the connections for such filters used in the aerial circuit are illustrated in Fig. 1.

Now it is a peculiarity of filter circuits of these types that they are tuned to two different frequencies at the same time. With inductance coupling, one of these frequencies is the same as the normal resonance fre-

**Selectivity and Quality.-**

frequency of either primary or secondary circuit alone, while the second resonance frequency depends upon the value of the coupling inductance  $L_1$ . Expressed algebraically,

$$\text{the normal resonance frequency } f = \frac{I}{6.28\sqrt{LC}}$$

$$\text{the second resonance frequency } f_1 = \frac{I}{6.28\sqrt{C(L+2L_1)}}$$

With mutual inductance coupling, there are still two resonance frequencies, but neither of these occurs at the normal resonance frequency. One is at a higher, and the other at a lower frequency as follows:—

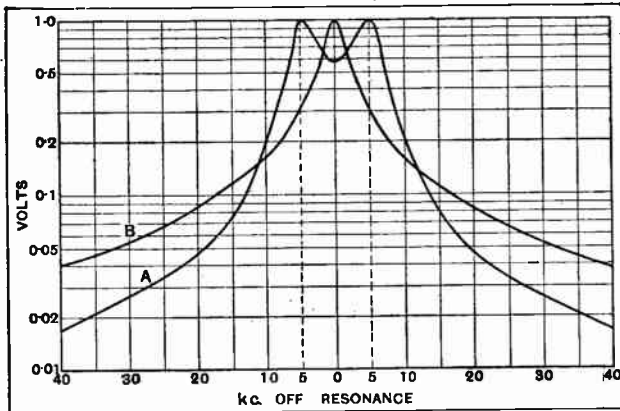


Fig. 2.—Curve A, filter in aerial circuit at 500 metres, 5 ohms coils. Curve B, single coil aerial tuned circuit at 500 metres, 5 ohms coil.

$$\text{one resonance frequency } f_1 = \frac{I}{6.28\sqrt{C(L+M)}}$$

$$\text{the second resonance frequency } f_2 = \frac{I}{6.28\sqrt{C(L-M)}}$$

It is this possession of two resonance frequencies which makes the filter so valuable; for the resulting tuning curve shows two peaks, the distance apart of which depends principally upon the value of the mutual inductance  $M$ , and to a smaller degree upon the resistance of the coils. See formula given in Appendix (1).

The results calculated from the formula show that the shape of the tuning curve is the same for both inductance and mutual inductance couplings. The chief fault of both types of inductance coupling, however, is that the peaks get further apart as the wavelength decreases, and, neglecting the effect of the resistance, the distance between them at 250 metres will be double that at 500 metres. Thus the selectivity on the lower wavelengths is reduced. With capacity coupling, on the other hand, the reverse takes place; and the distance between the peaks is less on the shorter wavelengths.

Curve A, Fig. 2, shows the resonance curve for a mutual inductance-coupled (or inductance-coupled) filter, where each coil has the same constants—240 mH., 5 ohms, the value of mutual inductance being 4 mH.—and the wavelength is 500 metres; while curve B is for an ordinary tuned coil in the aerial circuit, having the same constants. The curves in Fig. 3 are for the same

circuits, but for a wavelength of 250 metres, at which the coil resistance is 10 ohms.

An inspection of these curves shows that with a wavelength of 500 metres (Fig. 2) at a frequency 40 k.c. different from the carrier the selectivity with the filter is much better than that with the ordinary tuned circuit. At frequencies nearer to resonance the filter is not quite so good; but the variation over the side-band range is 42 per cent., as compared with 69 per cent. for the single coil. The efficiency, however (see Table) is only about one-third.

**The Intervalve Coupling.**

The curves of Fig. 3 for the same circuits at 250 metres show that here again the filter is the better, but that the differences between the two circuits are less at this shorter wavelength. At 40 k.c. from resonance the selectivity with the filter is only slightly greater than that with the ordinary circuit, but the shape of the curves shows that at frequencies further from resonance than this it will be by far the more selective. The side-band variation is also less, being only 18 per cent. as compared with 15 per cent. for the single coil. The only fault of this curve (A) is that there may be a danger of receiving stations adjacent in wavelength to that of the desired station, as the peaks coincide with their wavelengths. This fault may be eliminated, as will be shown later.

The behaviour of a filter used as an intervalve coupling in place of the more usual tuned anode or tuned transformer will now be considered. In the Appendix is given the necessary formula (2) for calculating the amplification possible at any frequency.

Since the curves for a filter used in the anode circuit of a valve such as the Mazda AC/SG are very similar to those for the same filter used in the aerial circuit, it is unnecessary to give a series of curves, but Fig. 6, Curve A, shows one for an inductance-coupled filter at

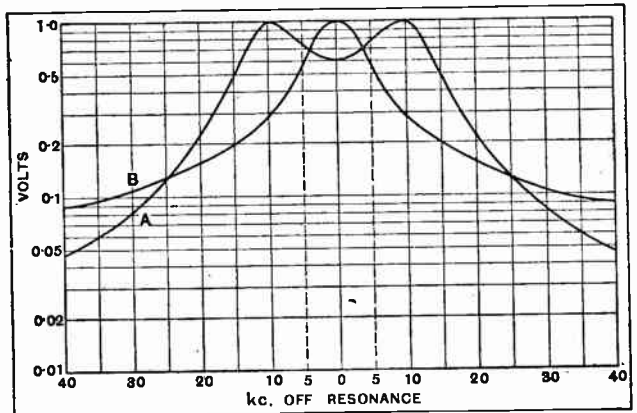


Fig. 3.—Curve A, filter in aerial tuned circuit at 250 metres, 10 ohms coil.

500 metres. The essential characteristics are given in the table, and it is curious that the selectivity is actually higher than when the same filter is used in the aerial circuit.

A comparison of the results for the filter used in the aerial circuit with those for it in the anode circuit shows

**Selectivity and Quality.**—

that there is little difference as regards selectivity and efficiency, but that in the anode circuit it gives a smaller side-band variation.

Now, it will be observed that all these filters give a double-peaked curve, with the result that the high notes in the reproduced speech and music are accentuated. This is not undesirable, since most loud speakers are somewhat deficient in the upper register. There is no base cut-off, for the effect is similar to that obtained

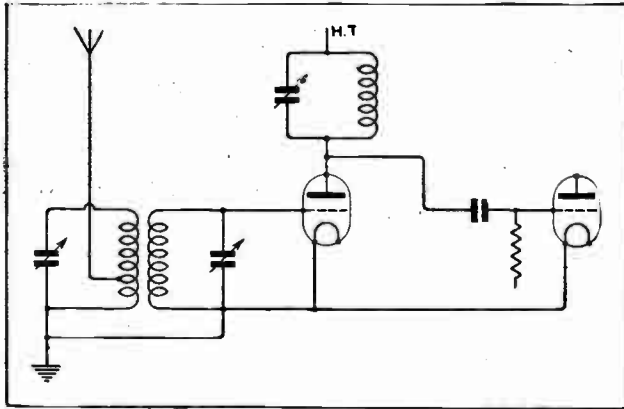


Fig. 4.—A curve with a single peak is obtained when using this circuit.

with an L.F. transformer having a rising characteristic. If this were the whole story it would be advantageous to use suitably designed filters in order to compensate for the loud speaker deficiencies. Unfortunately, however, such an arrangement would be difficult to handle, for it would be necessary to tune, not for maximum strength, but for a minimum occurring between two maxima. For ease in tuning, therefore, the overall curve must have only a single peak, and this can easily be obtained by using a tuned-anode intervalve coupling with a filter in the aerial circuit.

**Avoiding Interference from Brookman's Park.**

A circuit of this nature is shown in Fig. 4, and the overall tuning curve is the product of the individual curves for the filter and tuned-anode. Overall curves are given in Fig. 5 for the case when the components have the values given earlier; curve A is for a wavelength of 500 metres, and B for 250 metres; the figures for selectivity and amplification are given in the table.

At this point it is of interest to note a few characteristics of the filter circuit. When the H.F. resistance of the coils is raised sufficiently, the value of the mutual inductance being unaltered, the double-peaked curve will disappear and be replaced by a single very flat peak; and although the efficiency and selectivity are slightly lowered the amount is by no means as great as one would expect. This is shown in Fig. 6, where curves A and B are for identical circuits in the anode of an AC/SG valve, but the coil resistances are 5 and 10 ohms respectively. The figures for amplification are 71.5 and 56.7, for selectivity 54.5 and 41.5, and for side-band variation 34.5 per cent. and 2 per cent. ! The improvement in the side-band variation is so enormous that in many cases the slight loss in amplification and

selectivity is well worth while, particularly as the former is only low when compared with the results obtainable from the same valve and low-loss coils. In actual fact, it is rather higher than that obtained with the screen-grid valves of only a year ago.

An increase in the resistance of the coils of a filter in the aerial circuit gives similar results, but the alteration in side-band variation is not so marked. The effect of increasing the mutual inductance between primary and secondary circuits is to increase the distance between the peaks in the curve, and in many cases to decrease the side-band variation and efficiency. Lowering the value of the mutual inductance will increase both the selectivity and efficiency up to the point where the single-peaked curve is obtained; it will, however, introduce more high-note loss.

When designing any receiver it is advisable to make the aerial circuit as selective as possible, otherwise jamming of a peculiar kind may be obtained. When listening to a weak signal on a wavelength quite different from that of the local station, no matter how selective the intervalve couplings may be, if the aerial circuit is unselective the local station may cause considerable jamming. This is a rather neglected side of the selectivity question, but one which may be of particular interest to those living near a high-power station. Jamming of this kind is due to the H.F. valve. If the valve is overloaded, or its characteristic curved, it will rectify the voltages produced by the strong local station,

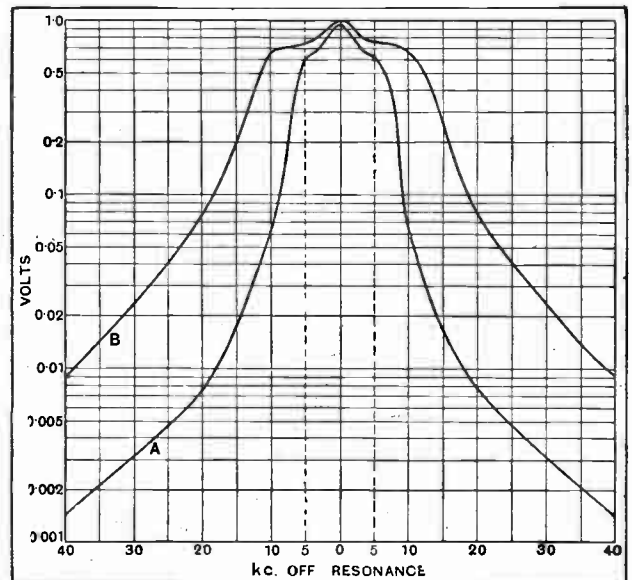


Fig. 5.—Curve A, filter in aerial circuit followed by tuned anode, 5 ohms coils at 500 metres. Curve B, as curve A, but 10 ohms at 250 metres.

and the resulting low-frequency currents will modulate the carrier of the desired station. The result is that the local station is heard, for it will actually pass through the following tuned circuits as a signal of the wavelength to which they are tuned.

A similar form of jamming is obtained under the same conditions if the aerial tuning is very flat. Suppose that the set is tuned to 1,500 k.c. and that the aerial tuning is so flat that it allows a fair proportion

**Selectivity and Quality.—**

of the voltage set up by the signals of two stations working at 700 k.c. and 800 k.c. to reach its grid. These voltages will be rectified by the H.F. valve and will produce a variety of beat frequencies, one of which will be equal to the sum of the two original frequencies.

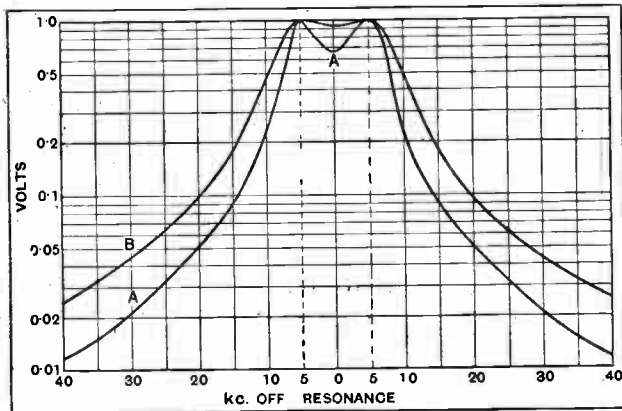


Fig. 6.—Curve A, filter with 5 ohms coils at 500 metres in anode of AC/SG valve. Curve B, as curve A, but 10 ohms coils.

that is, 1,500 k.c. Thus, not only will the desired station be heard, but in addition a jumble of two other stations; and this no matter how selective the tuned interval couplings may be.

Jamming of this character is frequently obtained, and blamed upon the unselective properties of the set, whereas the fault lies rather in the characteristics of the H.F. valve. The cure is always to work the H.F. valve upon the straight part of its curve, and to provide as selective an aerial tuning circuit as possible. The former necessitates a fairly high H.T. voltage and the correct negative grid bias, and the avoidance of those forms of volume control which alter the characteristics, such as filament control, control by alteration of the anode, screen-grid or control grid voltage.

A selective aerial circuit necessitates some form of band-pass filter if excessive side-band variation is to be avoided. For this reason, therefore, it is recommended that if tuning by a combination of filters and single-tuned circuits be used a filter should always be included in the aerial circuit. For volume control a high-resistance potentiometer shunted across the tuned input circuit is probably the best, as used in the "Megavox" receiver.

Coming now to practical considerations, the great fault of both inductive and capacitive couplings is that each coil in the filter must be completely screened. With mutual inductance coupling, however, it is only necessary to screen the filter as a whole, but it is a little more difficult to obtain the correct degree of coupling between primary and secondary circuits. A very good approximation to the correct coupling can be found as follows: Tune both primary and

secondary circuits to a fairly weak station with very loose coupling between the coils; then increase the coupling just beyond the point at which the signals are at their loudest. If low-resistance coils are used a double tuning peak should be just obtained as the ganged tuning condensers are rotated; but if this is found with high-resistance coils the coupling is too tight. Ganging the condensers is quite easy, and is essential to the proper operation of the filter; the initial adjustments are best carried out with very loose coupling between the coils.

**The Use of Solid Wire Coils Preferable.**

If desired, reaction may successfully be applied to the secondary coil of a filter. It affords a useful increase in both the amplification and selectivity, and it does not seem to cause nearly so much distortion as with ordinary circuits. The effect is to decrease the coil resistance, and, in theory, this should actually increase the strength of the high notes!

In the accompanying table will be found the essential figures for magnification, selectivity, and side-band variation for all the circuits mentioned earlier; and, in addition, those for an H.F. amplifier at a wavelength of 500 metres, in order to show the possibilities of the filter circuit in a multi-stage amplifier. The circuit diagram of such an amplifier is shown in Fig. 7, from which the method of connecting a filter as an interval coupling can be seen. A receiver built in accordance with normal present-day practice would have only three tuned circuits, and, as a consequence, not only would the selectivity be much less, but the high-note loss would be very high indeed.

Lest the filter be condemned on the grounds of expense, it is worthy of note that this need be no higher than that of a Litz wound coil tuned by a single high quality condenser. Coils of this type are usually unsuited to the filter characteristics, and small solid-wire coils which can be made for a few shillings are often the most satisfactory. As highly efficient coils are not used, the small variable condensers of the type made for portable sets are admirably adapted for tuning. Certain of these can be obtained in a form eminently suitable for ganging for about 5s. each.

Circuit.	Wavelength.	Magnification.	Selectivity.	Side-band Variation.
Filter in aerial circuit, 5 ohm coils	500	53.8	36.7	42%
Single tuned aerial, 5 ohm coil ..	500	178	25	69%
Filter in aerial circuit, 10 ohm coils .. .. .	250	53.6	12.9	18%
Single tuned aerial, 10 ohm coil ..	250	180	11	52%
Filter in anode of AC/SG, 5 ohm coils .. .. .	500	71.5	54.5	34.5%
Filter in anode of AC/SG, 10 ohm coils .. .. .	500	56.7	41.5	2%
Filter in aerial, followed by tuned anode, 5 ohm coils and AC/SG valve .. .. .	500	11,100	740	39%
As above, but 10 ohm coils .. .. .	250	19,000	108	25%
Anode filter and tuned anode with 10 ohm coil, aerial filter with 5 ohm coils. Two H.F. with AC/SG valves .. .. .	500	340,000	17,500	29%

**Selectivity and Quality.—**

In conclusion, the writer would say that, in his opinion, anyone once using properly designed filters for tuning will never go back to the ordinary cascade tuning circuits. Not only is the selectivity greater, but the improvement in quality is so great that it must be heard to be realised; and, in practice, the loss in amplification is not so noticeable as the figures would indicate. To those troubled by interference from the powerful transmissions of Brookman's Park the trial of one of the band-pass filters already described is suggested.

**APPENDIX.**

(1) The following formula may be used to calculate the voltage *e*, impressed upon the grid of a valve at any frequency for a given voltage *E*, applied in series with the primary circuit.

$$e = \frac{EM}{C \sqrt{[R^2 + \omega^2 M^2 - (\omega L - 1/\omega C)^2] + 4R^2(\omega L - 1/\omega C)^2}}$$

where *M* = mutual inductance in henrys.

*L* = inductance of one coil in henrys.

*C* = capacity of one condenser in farads.

*R* = effective H.F. resistance of coil in ohms.

*e* = voltage developed across secondary tuning condenser.

*E* = voltage applied in series with primary circuit.

For inductance coupling the above formula is modified by substituting *L*<sub>1</sub>, in henrys, for *M*; and the value used for *L*

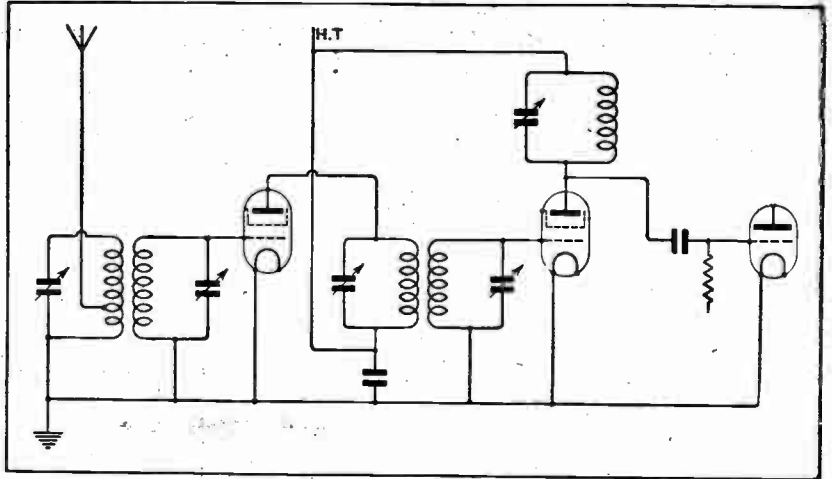


Fig. 7.—A high-frequency amplifier having aerial and inter-valve filters.

should be the inductance of one tuning coil plus the inductance of the coupling coil *L*<sub>1</sub>.

It should be noted that this formula is accurate only when both primary and secondary circuits are identical; that is, when *L*<sub>p</sub> = *L*<sub>s</sub>, *C*<sub>p</sub> = *C*<sub>s</sub>, and *R*<sub>p</sub> = *R*<sub>s</sub>.

(2) Formula for calculating amplification possible at any frequency with filter used as intervalve coupling. The symbols have the same meanings as before, and *μ* and *R*<sub>a</sub> are, of course, the amplification factor and anode A.C. resistance of the valve, respectively.

$$A = \frac{M}{\omega C^2 \sqrt{[R_a(R^2 + \omega^2 M^2 - (\omega L - 1/\omega C)^2) + \frac{LR}{C}]^2 + (\omega L - 1/\omega C)(2RR_a + \frac{L}{C} - \frac{\omega M^2}{C})^2}}$$

**“THE WIRELESS WORLD” OLYMPIA SHOW COMPETITION.**

**Results of the Ballot.**

WE are now in a position to announce the results of *The Wireless World* Competition arranged in connection with the Olympia Radio Show, in so far as giving the names of the winning sets and other apparatus in the various classes into which the exhibits at Olympia were divided.

We shall not be able to announce the names of the winners of the cash and other prizes until a little later, as the task of arriving at the totals for this purpose has not yet been completed.

It will be remembered that, in connection with the voting, we divided apparatus into various classes, which were defined as follows:—

(1) Complete receivers of five valves or more—that is to say, receivers exclusive of loud speaker and batteries—unless these should

**OUTSTANDING SINGLE EXHIBIT AT OLYMPIA.**

“Mazda” Screen Grid A.C. Valve.  
The Edison Swan Electric Co., Ltd.

**WINNING CLASSIFIED EXHIBITS.**

**Class 1.**

A.C. 7 Receiver.  
Burndept Wireless (1928) Ltd.

**Class 2.**

Four-valve Receiver, All-electric,  
No. 2511. Philips Lamps Ltd.

**Class 3.**

Type WY.10 Exide H.T. Accumulator.  
The Chloride Electrical Storage Co.  
Ltd.

**Class 4.**

Ecko Combined A.C. Eliminator,  
Type C2A. E. K. Cole, Ltd.

**Class 5.**

Moving Coil Loud Speaker.  
Ferranti, Ltd.

**Class 6.**

“Mazda” Screen Grid A.C. Valve.  
The Edison Swan Electric Co. Ltd.

**Class 7.**

The Novotone. Gambrell Radio Ltd.

happen to be incorporated as part of the receiver.

(2) Complete receivers of four valves or less, similarly defined.

(3) Batteries of all kinds, including accumulators for both high tension and low tension.

(4) Mains supply units, both D.C. and A.C., and including those which provide filament heating circuits.

(5) Loud speakers of all types.

(6) Valves.

(7) Other apparatus not classified above, also amplifiers, component parts, such as transformers, condensers, tuning coils, resistances, etc., etc.

In addition, readers were asked to vote for what was considered to be the single outstanding exhibit at the Show. In our issue of November 13th we are arranging to illustrate and describe the winning apparatus in the various classes.



MANY methods, widely divergent in principle, have been suggested for converting the mechanical energy from a gramophone record into electrical energy in a suitable form for amplification; but, for various reasons which need not receive our consideration at the moment, only one type has survived commercially, viz., the electromagnetic pick-up. Fig. 1 shows the principle of an early form of electromagnetic pick-up which may be referred to as the "single-acting" type in which a vibrating reed varies the magnetic flux between two pole pieces situated at one side only of the reed. The single-acting pick-up has, however, given place to the differential or "double-acting" type shown diagrammatically in Fig. 2 in which the reed is placed symmetrically between pole-pieces situated on either side of the reed.

The advantage of the latter arrangement will be better appreciated if we first study the disadvantages of the single-acting principle. In the first place, serious amplitude distortion is caused by the fact that the flux varies as the square of the distance of the reed from the pole pieces. Secondly, the whole of the flux passes through the reed and may cause saturation, and, thirdly, as the attractive force is exercised in one direction only, a heavy reed with a powerful restoring force is necessary to prevent it falling on to the pole pieces.

**Principle of the Balanced Armature.**

In the case of the differential movement, the flux in the armature at rest is zero as the diagonal fluxes from the pairs of opposite pole-pieces cancel out (see Fig. 3(a)). When the armature is displaced (Fig 3(b) and (c)) the greater part of the flux flows in one direction, thus inducing an E.M.F. in the coil C (Fig. 2), but a certain residue still flows in the reverse direction, and this tends to annul the square-law effect mentioned in connection with the single-acting pick-up. The cancellation is, however, incomplete, and amplitude distortion still persists. Fortunately, it is now reduced to the degree where it becomes useful in compensating for the restriction in amplitude of the low notes on the average record.<sup>1</sup> The tendency

<sup>1</sup> See p. 177 of the August 21st issue.



**Factors in Design.**

By F. L. DEVEREUX, B.Sc.

proportional to the mass and directly proportional to the restoring force. In order to produce a pick-up of good characteristics this principal resonance should lie outside the range of fundamental frequencies used in speech and music. It is impracticable to arrange for the resonance to occur below, say, 30 cycles, therefore we must endeavour to raise it above 3,500 cycles. To do this the mass of the moving parts must be reduced to a minimum and/or the restoring force increased. The restoring force generally takes the form of rubber pads (D in Fig. 2), which also absorb a certain amount of energy, and thus damp down the resonance peak in the response curve. Record wear, however, limits the restoring force and degree of damping we can employ.

**Reed Resonance.**

The correct procedure, then, in raising the principle resonance above 3,500 cycles is to start with the reed and to reduce its mass to the lowest possible figure, and then to add just sufficient restoring force in the form of rubber damping to raise the frequency to the required value and to hold the reed symmetrically between the pole pieces. When dealing with the reed it must not be forgotten that the needle holder and set-screw are an integral part of the vibrating system and must be made as light as possible. In the B.T.H. pick-up, for instance, the set-screw coincides with the pivot axis (P in Fig. 2) thus reducing its moment of inertia about the point P.

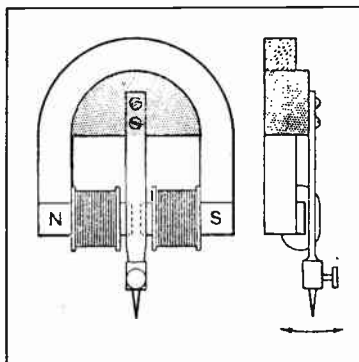


Fig. 1.—Single-acting or unbalanced armature pick-up.

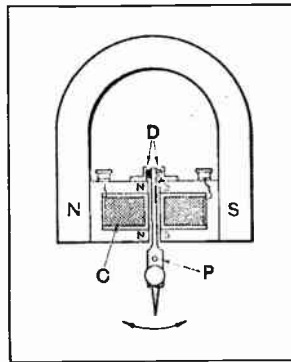


Fig. 2.—Differential or balanced armature pick-up.

**Gramophone Pick-Ups.—**

The lightening of the moving parts has been carried to its logical conclusion in the new Burndep and Lissen pick-ups in which the needle itself forms the vibrating armature and carries the magnetic flux. Naturally, the characteristics of such pick-ups must depend on the type of needle employed, but in the ordinary balanced-armature instrument the effect on the characteristic is small, though the general level of the output may be

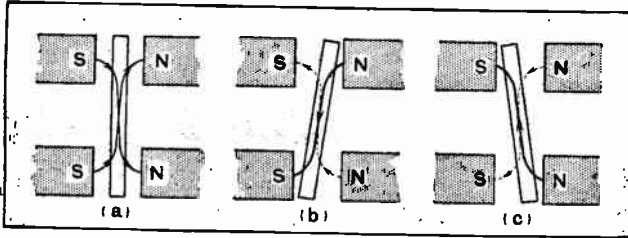


Fig. 3.—Illustrating the principle of the differential or balanced armature.

considerably modified. This is illustrated by the curves in Fig. 4, which are the result of actual measurements on an experimental pick-up with two different types of needle. The general form of the curve remains unchanged, but the resonance in curve A is about 400 cycles lower than in curve B, while the general level of output is nearly doubled. The lowering of the resonance in curve A is due to the extra mass of the thick Tungstyle needle.

As a guide to the relative outputs to be expected from various types of needle the following figures, the results of some measurements with H.M.V. needles, are given.

Needle.	Relative Output. (Per cent.)
Tungstyle Extra Loud Tone .. ..	100
„ Loud .. ..	90
„ Soft .. ..	80
Steel Extra Loud Tone .. ..	85
„ Loud .. ..	80
„ Half .. ..	75
„ Soft .. ..	45

Although the Tungstyle needles give a good output and will play up to 250 records without renewal, their comparatively high mass tends to bring the armature resonance within the range of audibility. The steel "Half Tone" needle is a good compromise for all-round use with electrical pick-ups; its weight is not excessive, yet there is little loss of energy in transferring the record vibrations to the armature.

The three factors most essential to the successful design of an electromagnetic pick-up may therefore be summarised as follows:—

(1) A symmetrical arrangement of the magnet pole pieces to give differential vibrations of flux in the reed or armature. Provided the armature is accurately centred, amplitude distortion will be reduced to a level at which it can be turned to a useful purpose, while the restoring force required to hold the armature in a central position will be small.

(2) An armature of the smallest possible dimensions in which the best distribution of mass to give a small

moment of inertia has been attained without appreciably affecting the efficiency of the magnetic circuit.

(3) The restoring force and damping must be adjusted to compromise between record wear, the frequency of the principal reed resonance, and the peak value of this resonance.

Numerous minor problems follow in the train of these three indispensable conditions. For instance, the small reed demands a large and heavy permanent magnet if an adequate voltage output is to be maintained, and this means increased record and needle wear. Actually, record wear is more a question of the mass and damping of the reed than of the downward pressure of the needle. In fact, damage to the record groove is more likely to occur with a light pressure due to the tendency of the needle to jump the groove. Wear of the *bottom* of the groove due to pressure is unimportant compared with damage to the *sides*, which do the work of transferring the sound energy to the needle. In the writer's experience too little weight on the needle point is a prevalent source of distortion, and where the tone arm is fitted with

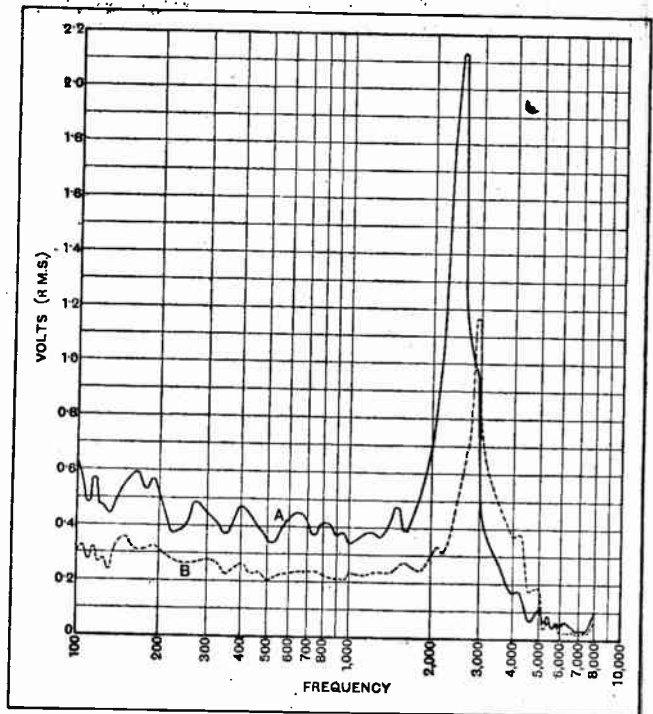


Fig. 4.—Output characteristics of experimental pick-ups, (A) with Tungstyle soft tone needle, (B) with steel soft tone needle.

an adjustable counterweight, best results are almost invariably obtained with the maximum available pressure.

Tone arm resonance should also be taken into account, though its effect on the output characteristic will not be appreciable until the pick-up movement itself is well-nigh perfect.

Now that standard frequency records are available to the public all the foregoing points can be investigated experimentally, and there is no longer any excuse for the manufacturer who continues to market an inferior product.



## Impressions of the Radio World's Fair.

By OUR SPECIAL CORRESPONDENT.

*In the following report readers will be able to draw some interesting comparisons between the latest British and American practice in receiver design. U.S. broadcasting conditions have hitherto given manufacturers across the Atlantic unrivalled experience in producing selective receivers, but their lead in this direction is now being seriously challenged by the British-made article.*

**T**HAT the American broadcast receiver has almost become a standardised article was the impression gained by a visit to the sixth annual Radio World's Fair, held at Madison Square Garden, New York City, at the end of September.

Just as different makes of car now differ only in comparatively minor details, so with the American broadcast receivers of the different manufacturers. The screen-grid tetrode is almost universally used for the radio frequency amplifier stages. There are usually four tuned circuits, including the input stage. All the sets have single tuning con-

trol with an additional knob for controlling volume and usually a third control for adjusting the input circuit, which contains the antenna. This adjustment is not only necessary to cater for different antenna structures, but also to a small extent for different wavelengths.

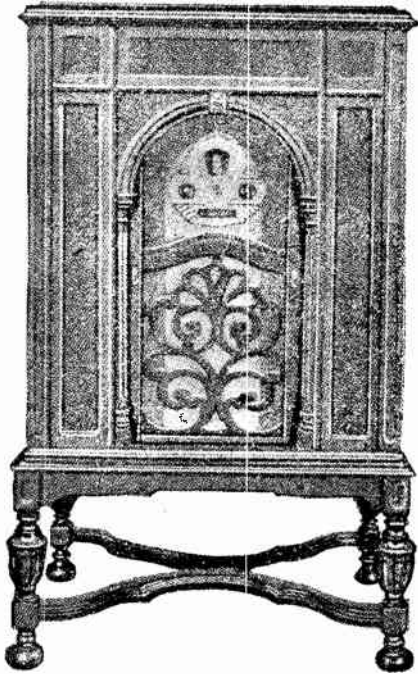
### Ganged Tuning in Evidence.

The tuning of the stages is carried out by means of a gang condenser. Components of this kind can be manufactured by mass-production methods, so that individual condensers do not differ from one another by more than one or two

micro-microfarads on any part of the scale. Using a condenser aerial the step-up obtained by turning the induced E.M.F. into a potential difference across a tuned circuit will depend on the value of the capacity across the aerial. In order to eliminate this effect, a variometer tuning is employed by some manufacturers on the input circuit. There are a number of other different types of input circuits which endeavour to correct this inherent defect of gang condenser tuning, but none gives perfect tuning of the input circuit over the whole wavelength range. This difficulty could be overcome by employing an

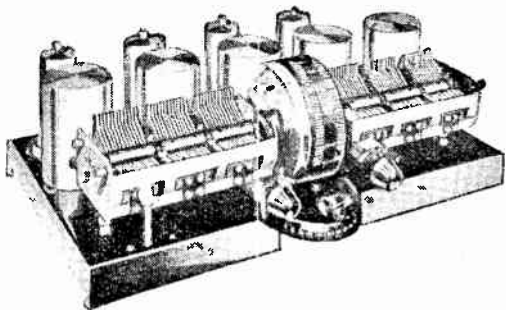
**New York Radio Show.**

untuned input, but in such a case the amplification of the set would be considerably reduced, and if this were compensated for by the insertion of another valve the ratio of valve noise to signal noise would be very considerably increased.



The concert-hall "Grebe," one of the best-known American receivers. Three S.G. valves are employed, but only one stage of L.F. amplification. A gramophone pick-up is included.

All the sets on view at the Show were very compact, and each stage was carefully screened. In American receivers reaction control is absolutely taboo. The sets contain five to seven valves, often using separate heaters in order to reduce the A.C. hum of the supply, practically all the sets being fitted with a power

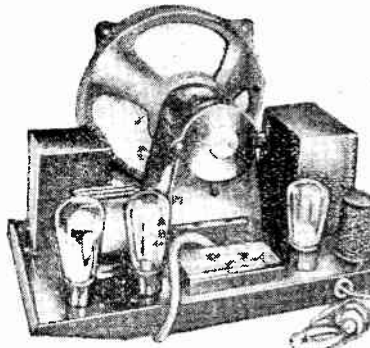


The "Grebe" receiver contains no fewer than six tuned circuits all controlled by a single knob.

pack suitable for A.C. mains. In such conditions, of course, it is not necessary to economise in filament voltage and most valves work on a five-volt filament. Many sets are fitted with automatic volume control, an arrangement by which, if the carrier amplitude is large, the overall amplification of the set is automatically reduced. If such an arrangement were perfect, all stations transmitting with the same percentage modulation would produce the same output intensity for a given setting of the volume control. In practice, the arrangement is not perfect, but is very convenient.

**Automatic Tuning.**

Although the space available in the exhibition was not so large as that at Olympia, there was a comprehensive display of sets and components fully representative of the latest practice in American radio. About 300,000 people visited the Show during the week it was open, an increase of 50,000 over last year.



The moving-coil loud speaker fitted as standard in all the "Grebe" models.

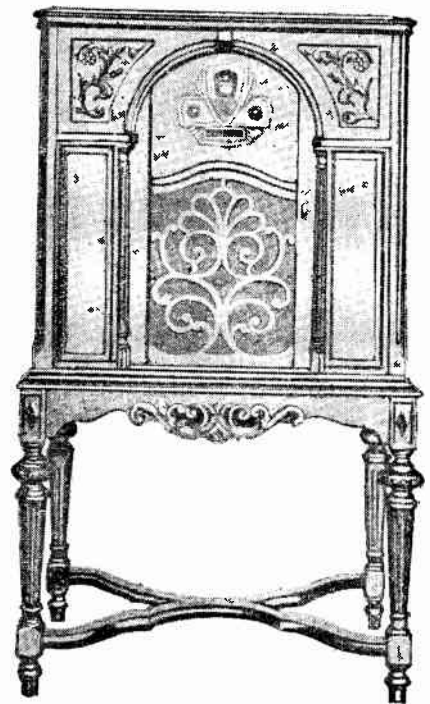
The fact that orders were booked for no less than six million pounds sterling is sufficient indication that radio in the U.S. is in a flourishing condition.

The genius of the American manufacturer in the production of labour-saving devices was strikingly exemplified in nearly all of the well-known models. Knobs and dials, switches, etc., were conspicuous by their absence, two small controls harmonising with the general ensemble of the set being sufficient for tuning and control of volume. Many

sets have automatic tuning, such as the Zenith and the Earl receivers. The latter is fitted with a device which enables the listener to choose a number of stations by first tuning them in in the ordinary way; by pressing a knob at each point of tune the mechanism is locked to that particular station. This knob moves in a horizontal slot under the tuning device, whilst above the slot are a number of name plates for logging the particular stations chosen. When a certain number have been tuned in and locked, it is merely necessary to slide the lever along the slot to register with the station logged there, and pull out the knob, when the required station is perfectly tuned in, no further adjustment being necessary.

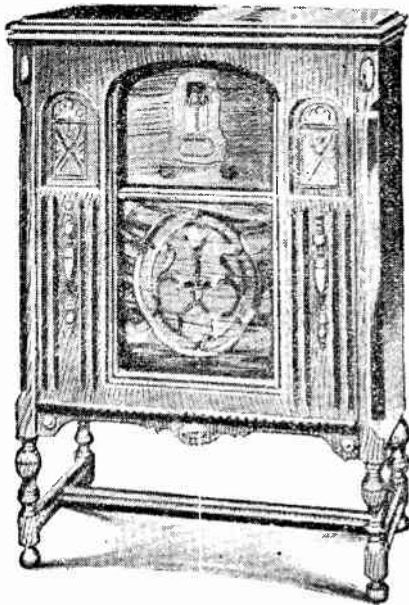
The Edison receiver possesses another automatic tuning device which gives out a flash of light when the desired wave is obtained. Other receivers are fitted with automatic volume controls, automatic voltage regulators, and other details making for easy operation and fool-proof working.

Screening in practically all the American sets has reached a high state of perfection. There is no wire to be seen, all the connections



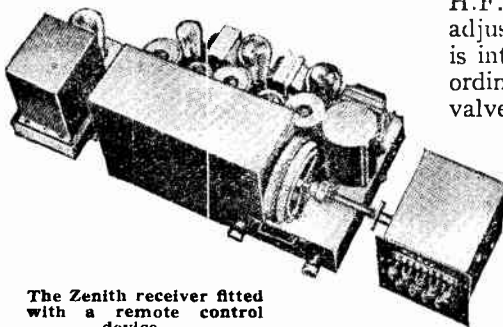
A home edition of the "Grebe" receiver.

**New York Radio Show.**—  
being made by "bunching" leads  
under sub-panels and double base  
plates (one cannot say "boards")



The eight-valve Zenith instrument, incorporating three S.G. valves, anode bend detector and double push-pull output. Full power equipment is included.

as there is practically no wood or ebonite to be seen otherwise than in the actual cabinets). Every component is encased in a metal cover, excepting perhaps the valves, and the appearance of the chassis is extraordinarily neat and business-like. In several sets even the valves are covered. The "First National" receiver, for instance, suggests an armoured car. Its chassis is built of cold rolled steel,

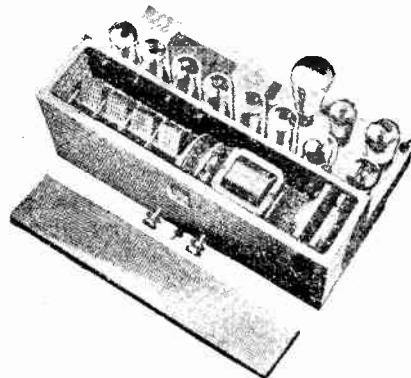


The Zenith receiver fitted with a remote control device.

silver-plated, and not a connection is visible. The four S.G. H.F. amplifiers are all covered with metal frames.

In the realm of loud speakers the moving coil type reigns as practically standard. One departure from this type at the Show was the "Kylectron" instrument with a rather large chassis of the condenser type carrying a grid of aluminium sheet covered on one side with tinfoil. This speaker is supplied as standard with the "Peerless" receivers, which are of the luxury class, selling at between £40 and £120 without valves. Several "balanced armature" loud speakers were on view, besides all shapes and sizes of exponential horns. One of the largest had an air column of 10 feet and weighed 45 lb.

Component parts were noticeably few, and even separate battery eliminators were rare, these being



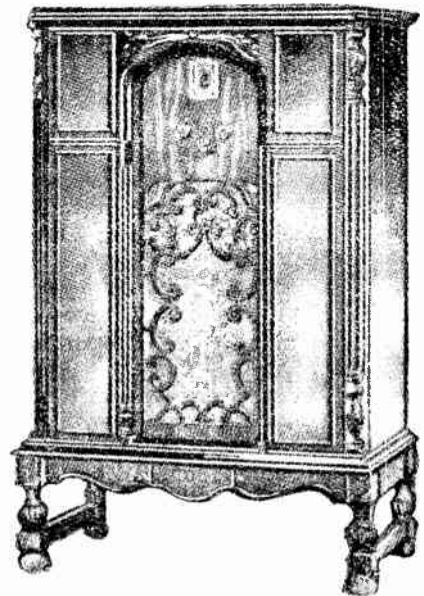
The "Peerless" receiver as incorporated in the most expensive models.

included in the majority of the receivers exhibited.

An interesting item among the "gadgets" was described as "a built-in high impedance link circuit H.F. coupler, with automatic self-adjusting grid bias." The device is intended for the conversion of an ordinary receiver to screen-grid valve working and consists of an external filament transformer, resistances, etc., together with a perforated metal cover for the valve.

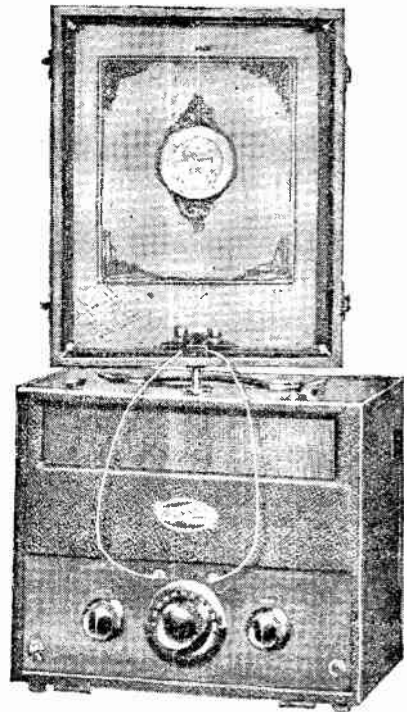
The astonishing paucity of portables was a subject of comment at the Show. The "Trav-Ler," one of the few exhibited, included a loud speaker of the horn type.

The lower floor of the Exhibition was devoted to numerous scale models of transmitting and receiv-



A "Peerless" receiver, one of a range of luxury sets, some of which embody a loud speaker of the condenser type known as the "Kylectron." Three screen-grid valves are used, with anode bend detection.

ing stations. A full size studio was in use and visitors were able to watch the performance of broadcast programmes which were sent out over the networks of the National Broadcasting Company and the Columbia system. Picture trans-



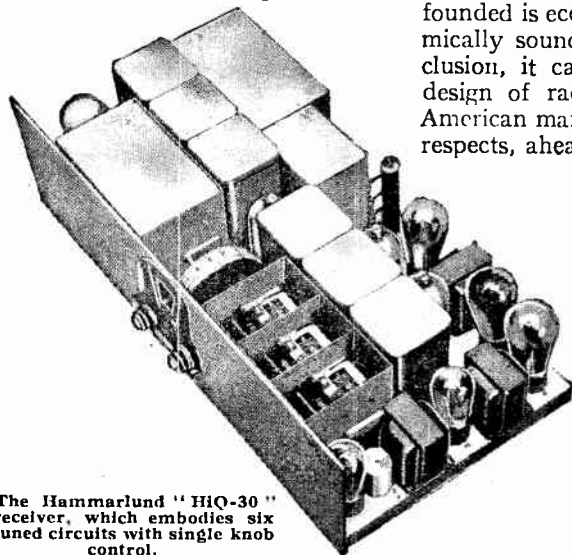
The "Trav-Ler," one of the few portables at the Show. Although five valves are included, the price is just under £10.

**New York Radio Show.—**

mission and reception was well demonstrated.

One exhibit which deserves special mention was that of the Radio Frequency Laboratories, who showed a large number of sets divested of their cabinets so that visitors could easily examine their construction.

This concern, Radio Frequency Laboratories, carries out research work for the benefit of its licensees, providing designs for set manufacture. The engineers of the licensees may alter the designs as they think fit for the purpose of facilitating production. The sets are then tested in the laboratories and finally put into production.



The Hammarlund "HQ-30" receiver, which embodies six tuned circuits with single knob control.

**THE NEW CALL.**

The expression "London Regional Station calling" seems to have been misheard in France. A Paris wireless journal states that the new 2LO comes on the air with: "London Bridge calling!"

o o o o

**A SCOTTISH COINCIDENCE.**

Since the Post Office direction-finding van arrived in Glasgow a fortnight ago it is reported that the number of wireless licences taken out during the period has shown an increase above the average of over a thousand.

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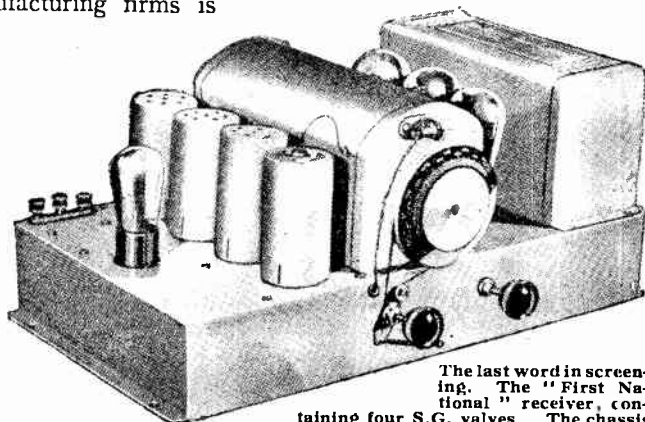
**BEIRA TELLS THE WORLD.**

The erection of a short-wave station has placed Beira (Portuguese East Africa) in touch with practically the whole world. During the past year, says *The African World*, the station has been in communication with Tokio, Cachila (Chile),

The licensees can call on the Laboratories at any time for any consulting and engineering service. In this way the research work of a number of manufacturing firms is concentrated at one point, and can consequently be carried out more satisfactorily and at a cheaper price than if each firm had its own research organisation. The success of the undertaking shows that the basic idea on which it was founded is economically sound.

As a general conclusion, it can be said that in the design of radio receiving sets, the American manufacturers are, in some respects, ahead of the British. They have been working under different conditions. The enormous market open to the American manufacturer has been the chief reason of his rapid progress, and he has not found it worth while to economise on research. Moreover, the generally high level of wealth in

the United States has permitted the manufacturer to neglect the very cheap set and concentrate all his energy on the reproduction of a



The last word in screening. The "First National" receiver, containing four S.G. valves. The chassis is of cold rolled steel, silver plated.

higher quality product. Sets such as described above range from about £25 up, a price which could not be approached unless a very large market were available. In another respect the conditions in America and England differ. Instead of the well ordered state of affairs existing in England regarding the erection of broadcast stations, there are innumerable stations in America. This necessitates the construction of highly selective receiving sets, and a very cheap set cannot be highly selective. That is the reason why four tuned circuits are used in most sets, and perhaps also why the manufacturers do not cater for the cheap product.

## CURRENT TOPICS.

Torrensville (Australia), Pasa de Toros (Uruguay), Santos (Brazil), and Karachi (India).

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**PORTRAIT UNVEILING BY WIRELESS.**

Pressing the key of his short-wave transmitter at Little America Camp, in the Antarctic, Commander Byrd blew a motor horn and drew aside curtains covering his enlarged portrait at the recent National Radio Exposition at Los Angeles.

The pre-arranged signal from Byrd's camp was picked up by KPH, San Francisco, and relayed by wireless to KSE,

Torrance, twenty miles from Los Angeles. From Torrance the impulse travelled by land line to the exposition hall, where a crowd of 10,000 watched the experiment.

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**I.E.E. WIRELESS SECTION.**

Captain C. E. Kennedy-Purvis, R.N., chairman of the Wireless Section of the Institution of Electrical Engineers, will give an inaugural address at a meeting of the Section on Wednesday next, November 6th, to be held at the Institution, Savoy Place, W.C.2, at 6 p.m.

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**FRANCO-NORWEGIAN BROADCASTING EXCHANGE.**

An exchange of broadcast programmes between Norway and France is being sought by the *Service de la Radiodiffusion Française*, which is negotiating with the Norwegian Broadcasting Company at Oslo

for land line relays. In a few days' time it is hoped that the Oslo evening programme will be relayed to all the State transmitters in France. Later a symphony concert from Paris will be relayed to Norway.

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**WIRELESS FOR JAPANESE TIME-SERVERS.**

Following America's example, the Japanese prison authorities have decided that convicts shall enjoy special radio concerts. They must also listen to educational talks.

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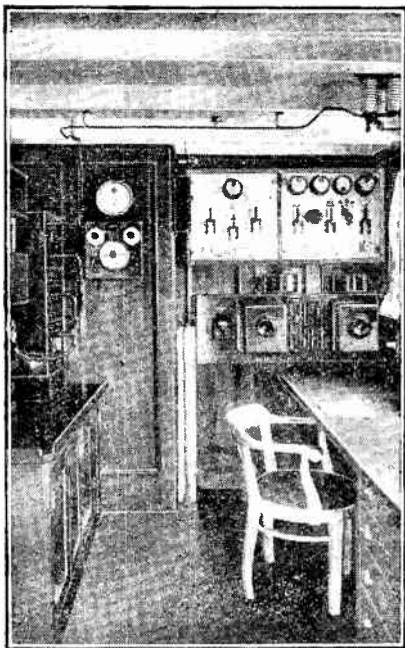
**INTERMEDIATE WAVES FROM FRANCE.**

Gramophone transmissions on 175 metres (coming within "intermediate" wave-band of the Hague Conference) are given on Tuesdays and Fridays between 21.30 and 22.30 G.M.T. from a small experimental station at St. Quentin. The call-sign is F8GM.

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**A RUM-RUNNERS' WIRELESS STATION.**

The discovery and seizure by the U.S. Government of an unlicensed wireless station operated by rum-runners is described by the New York correspondent of *The Times*. The capture resulted from preparations extending over six months, which culminated on October 16th in a series of police raids along a front of 100



**THE PERFECT YACHT.** The wireless cabin on the motor yacht "Orion," stated to be the biggest privately owned yacht in the world. Built at Kiel with a tonnage of 3,000, the "Orion" has just been delivered to her owner, Mr. Julius Forstmann, a New York millionaire.

miles from Atlantic City, New Jersey, to Sag Harbour, Long Island.

The campaign started in April last, when an inspector for the Federal Wireless Commission reported the existence somewhere near New York of an un-

licensed wireless station which habitually sent out its messages in code. The messages were deciphered and the code learned, and the Treasury Department was informed of the discovery. Thereafter, every message this station sent out was recorded.

The information secured by the Treasury through these wireless messages was invaluable in its preparations for its attack on the "ring."

On the day of the raid, the police came upon the station in the Atlantic highlands, close to New York, at the very moment when the operator was sending out one of his code messages. Before he could give a warning he was thrust from his seat and a Government expert, using the same code, sent out messages which brought one of the largest of the expected rum-running ships into the reach of a Revenue cutter.

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**LIFEBOAT WIRELESS.**

The Plymouth lifeboat is the latest to be equipped with wireless telephony.

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**INVESTIGATION INTO PATENT LAW?**

The committee, which was set up under the chairmanship of the Right Hon. Sir Charles Sargant to consider whether any amendments in the Patents and Designs Acts, or any changes in Patent Office practice, were desirable, are continuing their meetings at the Board of Trade for the purpose of hearing evidence from interested persons and associations.

Those who desire to submit any suggestions, or to give evidence, are invited to communicate with the secretary, Mr. R. W. Luce, Industrial Property Department, Board of Trade, 25, Southampton Buildings, W.C.2.

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**CHICAGO AS U.S. BROADCASTING CENTRE.**

Complete plans for "the world's most pretentious broadcasting quarters" have been prepared by the National Broadcasting Company of America. These will be the new Chicago studios on the roof of the Merchandise Mart, in the heart of the city.

It is hoped that January 1st, 1930, will be the opening date, when six studios should be ready for use. Studio "A," it is stated, will be the largest radio theatre in the world, with standing room for more than a thousand persons. (The biggest "studio" in "Broadcasting House," Portland Place, will provide seats for this number!)

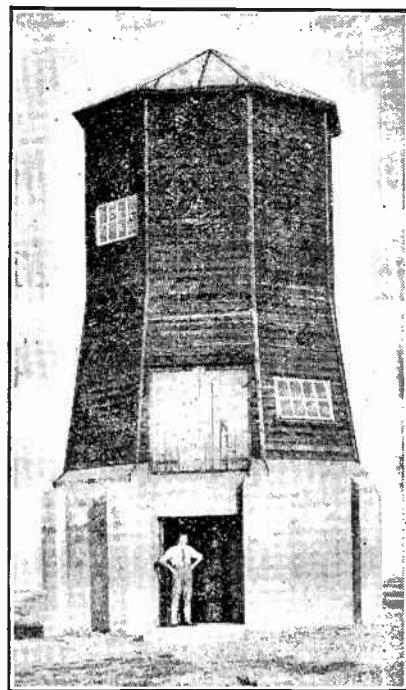
The Chicago headquarters of the N.B.C. will be larger and more imposing than those at New York, Washington, and San Francisco.

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**MAKING SPANISH WIRELESS HISTORY.**

By the opening of a new group of beam stations at Araujuez by the King of Spain last week, Madrid is now placed for the first time in direct wireless telegraphic communication with both North and South America. In addition, a Marconi short wave beam installation included in the equipment provides a regular commercial telephone service between Spain and the Argentine Republic.

The supply of this apparatus to 'Trans-radio Espanola is the second big order for British wireless equipment recently received from Spain, the Marconi Company having also supplied a short-wave station to the Spanish Government to establish



**RADIO "LIGHTHOUSE" FOR AIRMEN.** An experimental beacon at Orfordness, Suffolk, operating with a rotating frame aerial. Continuous-wave signals are transmitted for five minutes at a time, with alternate five-minute periods of silence. The apparatus, which is automatic, changes hourly to interrupted C.W.

a direct wireless service between Madrid and the Spanish colony at Fernando Po, in Equatorial Africa.

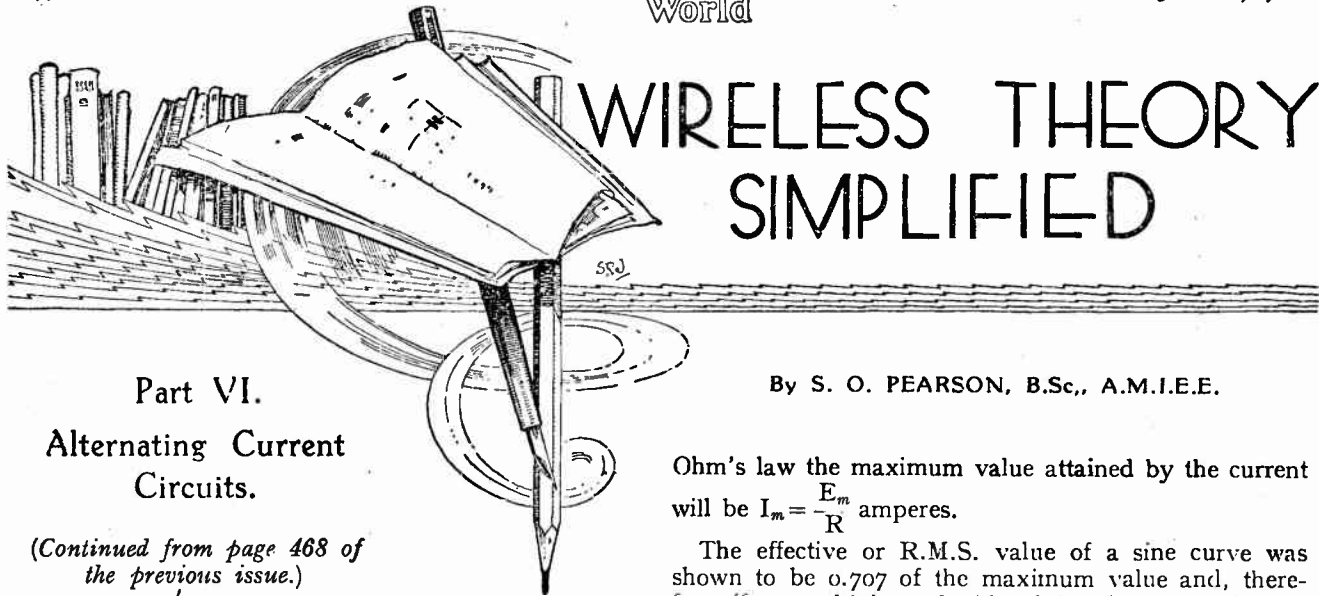
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**NEW EMPIRE BROADCASTING SCHEME?**

In the Editorial of Wednesday last, *The Wireless World* criticised the B.B.C.'s policy in regard to Empire broadcasting and urged the new Chief Engineer and his staff to show the same degree of enthusiasm for achieving an Empire short-wave service as, on other wavebands, has already won for British broadcasting a reputation second to none.

Subsequently a note appeared in the daily Press suggesting the strong possibility that the present Empire experimental short-wave broadcasting service from 5SW, Chelmsford, will shortly be superseded by regular Empire transmissions from a new B.B.C. short-wave station.

A statement was made to *The Wireless World* by the B.B.C. at the time of going to press to the effect that the Corporation is considering the future of short-wave broadcasting from this country and is already negotiating on the question, but that no decision has been taken to build a station at Daventry or elsewhere.



## Part VI.

Alternating Current  
Circuits.

(Continued from page 468 of  
the previous issue.)

HAVING learned a little about inductance and its effects we are in a position to proceed with the discussion of alternating current circuits. In dealing with a steady direct current, the relationship between the current and the voltage can be determined if we know only the resistance of the circuit, by the application of Ohm's law. With alternating currents, however, the other constants, namely, inductance and capacity, must be taken into account. For the time being we shall consider one or two circuits possessing resistance and inductance both singly and together, and assume that no capacity is present.

## Simple Circuit with Resistance Only.

For the moment let us consider the simplest A.C. circuit imaginable, namely, a straight piece of resistance wire connected to a source of A.C. supply, or to the terminals of an alternator as shown in Fig. 1. We can treat such a wire as a pure resistance of  $R$  ohms possessing neither inductance nor capacity, and apply Ohm's

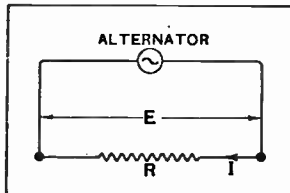


Fig. 1.—Simple A.C. circuit  
with resistance only.

law in the ordinary way. If a sine wave of alternating voltage is applied to its ends, the current taken will be at every instant proportional to the voltage and will, therefore, also vary according to a sine law. When the voltage reaches its maximum value the current will be greatest, and when the voltage is passing through one of its zero values the current will be doing likewise. Hence for a pure resistance the current and voltage waves are exactly in step or in phase. These conditions are clearly shown by the curves and vector diagram of Fig. 2.

## Relationship Between Current and Voltage.

Let  $E_m$  be the maximum or peak value reached by the alternating voltage every half cycle. Then by

By S. O. PEARSON, B.Sc., A.M.I.E.E.

Ohm's law the maximum value attained by the current will be  $I_m = \frac{E_m}{R}$  amperes.

The effective or R.M.S. value of a sine curve was shown to be 0.707 of the maximum value and, therefore, if we multiply each side of the above equation by 0.707 it will give the relationship between the R.M.S. values of the current and voltage, namely,  $I = \frac{E}{R}$  amperes, where  $I$  and  $E$  are the effective values as indicated by an ammeter and voltmeter respectively.

The conclusions are then that for a simple A.C. circuit with resistance only, (a) Ohm's law may be applied as in the case of a direct-current circuit; and (b) the current and voltage waves are exactly in phase.

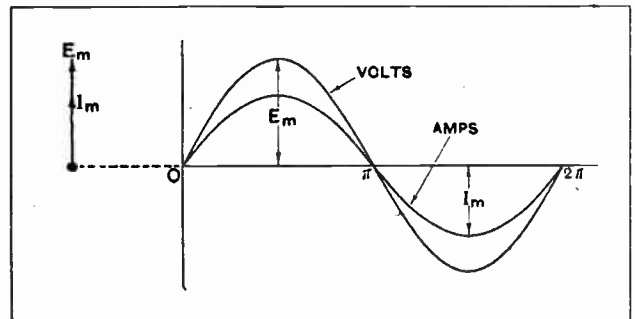


Fig. 2.—For a simple resistance the current and voltage are in phase and the corresponding vectors are parallel with each other.

Frequency plays no part whatever providing the resistance remains constant. When we come to consider high-frequency effects it will be seen that the resistance of a conductor actually increases as the frequency is raised, but for the present we shall assume that we are dealing with low-frequency currents only and that the resistance remains constant.

## Power in Simple A.C. Circuit.

Since the effective value of an alternating current was defined as the value of the direct current which would have the same heating effect in the resistance, it follows that the average power expended in the resistance  $R$  is given by  $P = I^2 R = IR \times I$  watts. But we have just seen that  $E = IR$  for a pure resistance and, therefore, the power is given by  $P = E \cdot I$  watts, just as though we were dealing with a direct-current circuit.



**Wireless Theory Simplified.—**

It will be shown presently that this is not true if the circuit contains inductance—it only applies to a pure resistance.

**The Effect of Inductance.**

In an A.C. circuit the current is changing at all times, except during the minute fraction of a second every half-cycle when it ceases to increase and begins to fall again. In the last part it was explained how

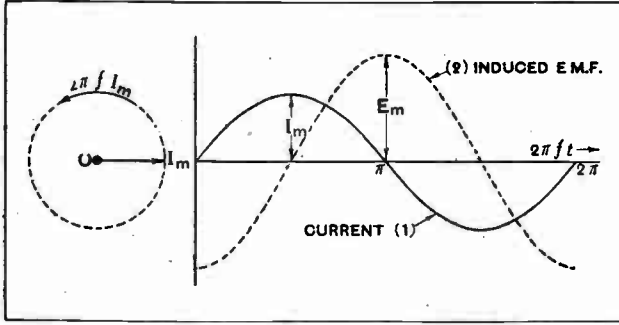


Fig. 3.—The speed of the end of the vector  $OI_m$  gives the maximum rate of change of current. The induced E.M.F. is out of step by a quarter of a cycle, with respect to the current.

the changing of a current in a circuit containing inductance caused an E.M.F. to be generated in the circuit, and it was shown that the magnitude of this induced E.M.F. was given by the product of the inductance in henrys, and the rate at which the current is changing in amperes per second.

Now suppose that we cause a sine wave of alternating current, whose maximum value is  $I_m$  amperes, to flow through a coil having an inductance of  $L$  henrys. The resulting magnetic flux linked with the coil will also vary according to the sine law, being at every instant proportional to the current producing it, and this varying magnetic flux will generate a sine wave of E.M.F. in the coil. The sine wave of current is shown by curve (1) of Fig. 3.

Our immediate task is to find out the magnitude of this induced E.M.F. and its phase relationship to the current, that is, whether it is in step with the current or not, and in the latter event, how far out of step it is. In the first place we do know that the induced E.M.F. always acts in such a direction that it tries to prevent the changing of the current (Lenz's law as explained in the previous part), and we shall make this our starting point.

Just as the current is passing through its maximum value, it is neither increasing nor decreasing—its rate of change is zero—and therefore at these instants the back E.M.F. will be zero. Thus the induced E.M.F. wave must be exactly a quarter of a cycle out of step with respect to the current wave. Now when the current is increasing from zero to the maximum positive value the induced E.M.F. will be negative, because it is opposing the growth of the current. Thus the induced E.M.F. wave will be in the position shown by the dotted curve (2) of Fig. 3. A glance at the curves will show that the current reaches its maximum positive value a quarter of a cycle before the induced

E.M.F. wave, and therefore that the current leads the induced voltage by an angle of exactly 90 degrees.

**Magnitude of the Back E.M.F.**

Obviously the current is changing at its greatest rate just as it passes through its zero values, because the slope of the current curve is steepest at these points. The curves of Fig. 3 confirm that the E.M.F. is a maximum when the current is zero. Now if the maximum value of the current is  $I_m$  amperes, and its frequency  $f$  cycles per second, it can be represented by a vector whose length is  $I_m$  to some suitable scale, rotating about one end with a speed of  $f$  revolutions per second, or  $2\pi f$  radians per second (see Part IV, October 16th issue). The actual speed of movement of the extremity of this vector round the circle of radius  $I_m$  will be represented by a distance equal to  $f$  circumferences every second. But the circumference is  $2\pi$  times the radius, and therefore, the speed of the end of the vector  $OI_m$  is  $2\pi I_m \times f$ , and since the vertical scale of the current curve is in amperes, this speed will represent amperes per second. This value then gives us the maximum rate of change of current, being  $2\pi f I_m$  amperes per second.

The induced E.M.F. is equal to the product of the rate of change of current and the inductance (explained in Part V). Hence the induced or back E.M.F. will have a maximum value of  $E_m = 2\pi f I_m \times L$  volts, where  $L$  is in henrys; or  $E_m = 2\pi f L \times I_m$  volts.

**Coil with Inductance Only.**

We shall first assume that the coil of inductance  $L$  henrys under consideration has no resistance whatever. Hence to drive a current through it there is only the back E.M.F. of self-induction to be overcome by the

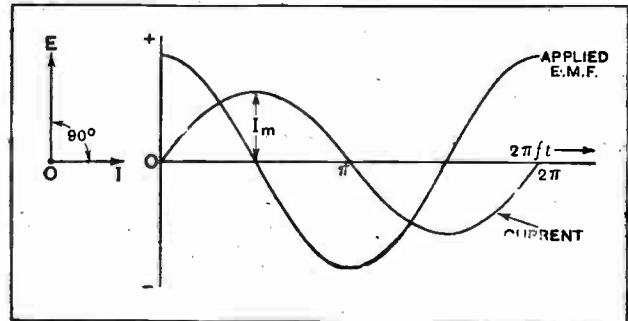


Fig. 4.—For a pure inductance the current lags by 90 degrees behind the supply voltage.

supply voltage, and therefore the maximum value of the applied E.M.F. will also be given by  $E_m = 2\pi f L \times I_m$ .

The applied E.M.F. or supply voltage must exactly neutralise the induced E.M.F. at every instant, and is, therefore, represented by another sine wave in exact opposition to the wave of induced E.M.F. The phase relationship between the applied voltage and the current is shown by the curves of Fig. 4.

Note that the current curve reaches its maximum value a quarter of a cycle later than the applied E.M.F. and therefore for a circuit possessing inductance only, the current lags behind the supply voltage by exactly

**Wireless Theory Simplified.—**

90 degrees. Also note that the vectors on the left of Fig. 4, representing the current and voltage, are drawn at right angles to each other. In future we shall dispense with curves as far as possible and use the vectors only.

**Reactance.**

So far we have found the relationship between the maximum values or amplitudes only of the current and

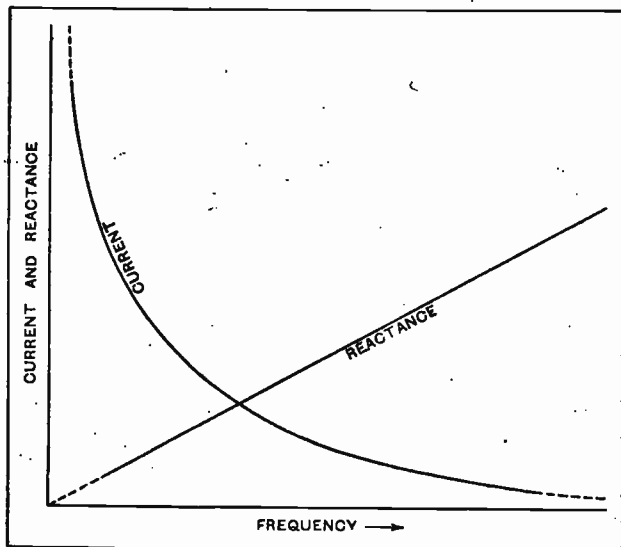


Fig. 5.—Curves showing how reactance and current vary with frequency for a coil having inductance only.

voltage for a pure inductance. If we multiply each side of the last equation by 0.707 we obtain the R.M.S. value of the voltage, viz.:  $E = 0.707E_m = 2\pi fL \times 0.707I_m$ ; or  $E = 2\pi fL \times I$  volts, where  $I = 0.707I_m$  is the effective value of the current. This result may be rewritten thus  $I = \frac{E}{2\pi fL}$  amps.

We have here an extremely important result. It is a relationship of the same kind as Ohm's law, the only difference being that in place of the resistance  $R$  we have the quantity  $2\pi fL$ . This is called the *reactance* of the coil and is expressed in ohms. It is usually denoted by  $X$  and so for a coil with inductance only the current is given by  $I = \frac{E}{X}$  amperes, and lags behind the voltage by 90 degrees. Expressed in words the inductive reactance of a circuit may be defined as the opposition set up to the passage of an alternating current by the induced E.M.F. of self-induction. This definition is of fundamental importance.

It should be noted that the reactance of the coil is directly proportional to the frequency of the current, so that at very high frequencies such as those met with in radio work even a coil of a few turns and low inductance will have a comparatively high reactance. Suppose that a voltage of constant R.M.S. value is applied to a coil of  $L$  henrys inductance and that the frequency is gradually increased from a very low value upwards. The reactance will increase in direct propor-

tion, and if plotted as a graph against the frequency will give a straight line passing upwards from the origin  $O$  as shown by the curve of Fig. 5. The current, being inversely proportional to the reactance, will vary in inverse proportion to the frequency, and the curve showing their relationship will be of the form indicated in the figure, the curve being a hyperbola.

**Numerical Example.**

Consider a coil of negligibly small resistance having a self-inductance of 20 henrys. We shall calculate what current will be passed if 10 volts (R.M.S. value) are applied to the terminals when the frequency is (a) 50 cycles per second and (b) 2,000 cycles per second. At 50 cycles the reactance will be  $X = 2\pi fL = 2\pi \times 50 \times 20 = 6,280$  ohms, and at 2,000 cycles  $X$  works out to 251,200 ohms. The currents will thus be (a)  $I = \frac{10}{6,280} = 0.00159$  amp. or 1.59 milliamps. and (b)  $I = \frac{10}{251,200} = 0.0000398$  amp. or 0.0398 milliamp. Figures of this order are encountered in connection with low-frequency chokes in receiving circuits.

**Choking Coils.**

The property of an inductance coil of opposing the passage of an alternating current through it is used to a very large extent. A coil without any resistance whatever, if such were possible, would allow a direct current to pass through it unimpeded, although choking back alternating currents to an extent depending on the frequency. An actual coil with low resistance has approximately the same effect. Such a coil is usually referred to as a *choking coil* or *choke*. To produce a desired choking effect or reactance, the value of the inductance must be chosen to suit the frequency of the current—high inductance is required where the frequency is low and vice versa. To obtain a high reactance at low frequencies the coil is wound with many turns on a closed iron core and is referred to as a "low-frequency choke" when used in a wireless circuit.

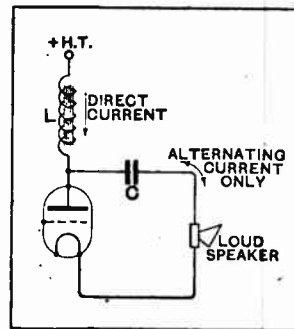


Fig. 6.—Normal output circuit for the last stage of an amplifier. By the action of the choke  $L$  the alternating currents in the plate circuit are forced to pass through the loud speaker.

In a receiving circuit choking coils are used in various places where it is required to pass a direct current freely and to prevent as far as possible the passage of alternating current, the object being to filter out the alternating current from the direct. A case in point is the output filter circuit between the last valve of an amplifier and the loud speaker. It will be shown later that a condenser has the reverse effect—allowing alternating currents to pass whilst totally preventing the passage of any direct current.

(To be continued.)

# Broadcast Brevities

By Our Special Correspondent.

## The Twin Regional Station.—What of the Prague Plan?—Missing Bass.

### Listeners and Brookman's Park.

Optimistic though the Technical Correspondence people at Savoy Hill undoubtedly are, they fully expected a storm to break over their heads on the morning after the change-over from Oxford Street to Brookman's Park. At the time of writing there has been no storm, but only sunshine and shower as represented by a nearly equal proportion of favourable to unfavourable reports.

As might be expected, crystal users are loudest in their disapproval of the new order. Valve set owners, even if they suffer some inconvenience in areas near the new transmitter, have a technical grasp of the situation which the average crystal user seems unable to obtain.

### The Real Test to Come.

The mass of reports from all districts within the service area of Brookman's Park confirm predictions in a remarkable manner. Listeners far afield who obtained only an indifferent service from Oxford Street are unanimous in praising the new station, while those who have enjoyed the London transmissions without disturbance are inclined to criticise the quality of signals and the comparative coarseness of tuning.

But the real test has yet to come. Tweedledum and Tweedledee must perform simultaneously before we can justly assess the value of either.

### Is Tweedledee Performing?

A rumour has reached me that the second transmitter has already been in action.

When I recall the vision of that noble transmitter standing idle, merely awaiting the manipulation of a few switches to set it in operation, I find myself wondering whether B.B.C. engineers have super-human powers of restraint. It might be worth while to test this theory by listening after midnight in the region of 262 metres.

### Another Mouth to Feed.

I can discover no anxiety among the members of the Programme Department regarding the additional work lying in wait for them when the second station begins regular transmissions.

"There's plenty of time yet," was the airy reply to my query. "Tweedledee must undergo its tests first; the question of a programme won't crop up until January."

During the testing period, timed to

begin in mid-December, the second station will relay the programme of 5GB.

### The Passing of the Prague Plan.

"The Prague Plan is already dead," says a friend of mine who, with a hyper-selective super-sensitive receiver, has spent the last fortnight in "touring" Europe. "Heterodyning on the British stations is bad enough," he asserts, "but on the Continent it is infinitely worse, and the U.I.D.R. at Brussels seems unable to control the pandemonium."

He considers that the present separation of 9 kilocycles between stations is useless in view of the universal tendency towards higher power, and he pleads for a separation of 15 kilocycles as the irreducible minimum.

### Mañana.

An instance of the way in which the instructions of the Brussels frequency measuring centre are ignored occurred last week when, at the request of the B.B.C., a message was sent from Brussels to the San Sebastian broadcasting authorities asking them to keep off Glasgow's frequency of 752 k.c. "Mañana," said the Spaniards, and nothing was done. The British Post Office is now approaching the Spanish Government on the question so possibly Glasgow will soon be relieved of San Sebastian's whistle, but at whose expense? No doubt San Sebastian had splendid reasons for quitting its allotted frequency. Every station has.

### The Missing Bass.

There was a state of ferment at Savoy Hill a few days ago when a listener whose opinion carries weight telephoned to say that the bass notes were not coming through. A rushing hither and thither, with hurried consultations in the control room, revealed nothing amiss on the technical side. Then somebody smitten with a brain-wave dashed to the studio in which a well-known "Auntie" was providing a pianoforte interlude.

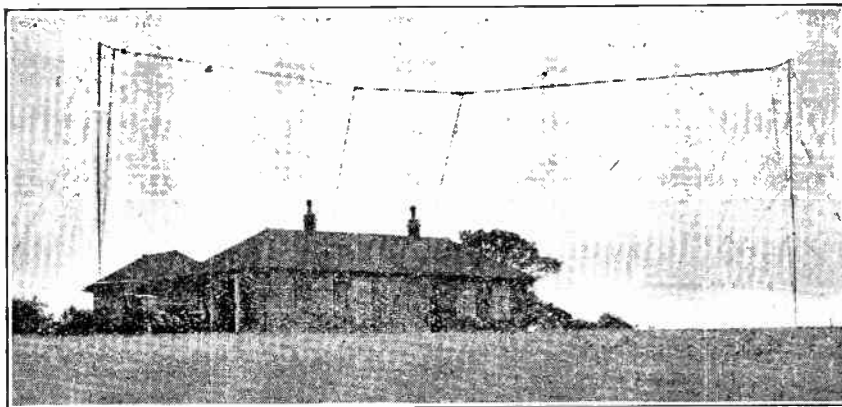
"Bass notes not coming through?" said the pianist. "No, of course not. That last piece was for the right hand only!"

### For Scots in Exile.

St. Andrew's Night is an even greater occasion for the exiled Scot than for the Scot who still lives on the right side of the border. With this thought definitely in mind, a St. Andrew's Night programme will be relayed on November 30th from Glasgow to 2LO, 5XX and other stations.

### The Week in Parliament.

Women M.P.s are to describe "The Week in Parliament," in a series of weekly broadcasts, starting on November 6th. Mrs. M. A. Hamilton, the member for Blackburn, launches the new feature, and will be followed a week later by the Duchess of Atholl. These broadcasts will run throughout the session.



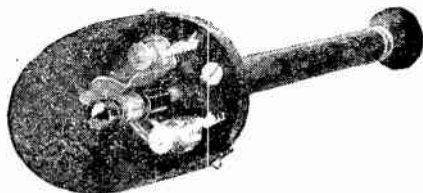
THE B.B.C.'S RECEIVING STATION. The newly completed listening post at Tatsfield, Surrey, where British and European wavelengths are checked. The masts are 60 feet high and the site is 900 feet above sea level. During the winter the station may be used for relays from America.



## A Review of Manufacturers' Recent Products.

### "MELBOURNE" SAFETY LEAD-IN.

Many ingenious devices have appeared to ensure complete isolation of the wireless set from the outside aerial, thus safeguarding the apparatus against damage during electrical storms. To these must be added the "Melbourne" combined lightning arrester, earthing switch and lead-in tube.



"Melbourne" lead-in tube with outside earthing switch controlled from inside the building.

It consists of a polished ebonite tube terminating, at the outdoor end, in a circular disc which supports aerial and earth terminals, earthing switch and a safety gap. At the other end is a large diameter knob for controlling the switch and a contact for the lead to the set. When the knob is pulled out, the aerial is disconnected from the receiver and switched to earth. Pushing in the knob disconnects the aerial from earth and connects it to a metal band, in electrical connection with the tag on the indoor side of the tube, to which the lead from the aerial terminal on the set is attached. As an additional safety measure, the outside aerial and earth connections are attached to two strips of copper mounted so that a gap of  $\frac{1}{2}$  in. is left between them. A semi-circular cowl is fitted as a protection against rain.

This useful device is offered at 3s. 6d., and the makers are Melbourne Radio Supply, Norwood Buildings, Hatherley Road, Walthamstow, London, E.17.

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### "PILOT" RESISTANCES.

"Pilot" components, which are manufactured in America by the Pilot Radio and Tube Corporation, are now available

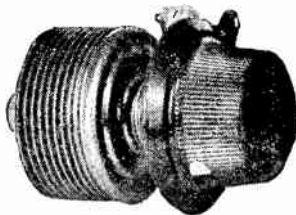
in this country, the sole concession for their distribution having been acquired by Messrs. T. A. Rowley, Ltd., 59, Skinner Lane, Dean Street, Birmingham. The samples sent in for test comprise a "Pilot" Resistograd and a Volungrad.

The first mentioned is a variable high resistance of the compression type, rated to be adjustable to any resistance value between 40 ohms and 10 megohms. This range is covered by four complete revolutions of the knob.

A curve is supplied with each component, showing the change in resistance with rotation of the knob. Measurements gave the minimum and maximum values as 20 ohms and 20 megohms respectively.

The resistance element is enclosed in a strong metal case  $1\frac{1}{2}$  in. in diameter and  $1\frac{1}{2}$  in. deep over the back terminal. The outside of the container is provided with fins, presumably to radiate rapidly any heat that may be generated. It can be used, therefore, in circuits passing current, such as voltage control in battery eliminators, or as a volume control across the primary of the L.F. transformer. The price is 4s. 3d.

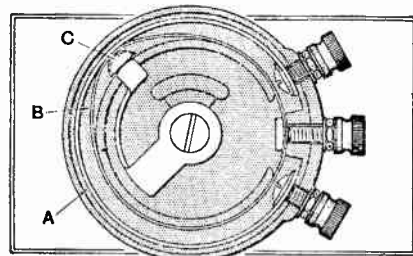
The Volungrad is a high-resistance potentiometer, and is made in four values - 0-50,000 ohms, 0-100,000 ohms, 0-200,000 ohms, and 0-500,000 ohms. The sample supplied was the last-mentioned type - viz., 0-500,000 ohms. The measured value of this was found to be 0-550,000 ohms.



"Pilot" Resistograd. A variable high resistance for power use.

The device consists of a moulded bakelite case 2 in. in diameter. The resistance element, which is a strip of non-hygroscopic material coated with a special pre-

paration, is attached to the side of the hollow case, and a connection is made at both ends by means of small terminals. The variable contact is made through the medium of a flexible phosphor-bronze spring, of slightly smaller diameter than the resistance element. An insulated button, attached to the rotating arm, presses a section of this spring onto the



Track wear is obviated in the "Pilot" Volungrad by rolling a spring onto the resistance element. "A" is the resistance, "B" the spring and "C" the insulated button attached to the operating arm.

surface of the resistance. Since the action is more in the nature of a rolling movement than a rubbing contact, wear on the element itself is reduced to a minimum. A single-hole fixing bush, completely insulated, is fitted.

This component should not be used in circuits passing any appreciable current. It will find favour as a potentiometer volume control in grid circuits, or across the terminals of a gramophone pick-up. The price of all models is 6s. 6d. each.

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### HAW'S MAINS EQUIPMENT.

A wide range of A.C. mains transformers, smoothing chokes, and all parts necessary for the construction of H.T. battery eliminators and L.T. trickle chargers, have been introduced recently by Messrs. Haw & Co., Ltd., 20, Cheap-side, London, E.C.2. In addition, factory-made models embodying similar components are available for those not

possessing the facilities for building these at home.

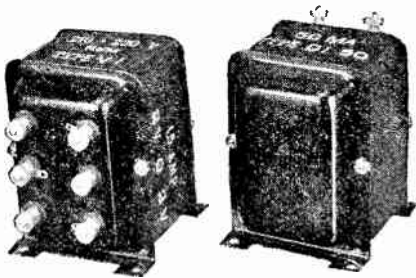
The complete units and parts, which are of foreign make, are being marketed at attractive prices. The A.C. eliminator,



Haw's half-wave rectifier H.T. battery eliminator, Model N.G. A Philips 373 valve is recommended.

Model N.G., designed for use on 200-230 volts, 50 cycle mains, is fitted with a half-wave rectifier rated to give 20 mA., and should be suitable for most 3- and 4-valve sets fitted with a small power valve. One variable tapping, 0-100 volts, and one fixed 150-volt output are provided. Complete with valve this costs 68s.

The Model VI power transformer, for use on 210-230 volts, 50 cycle mains, is designed to deliver 50 mA. at 180 volts after rectification. This carries two secondary



Haw's mains transformer, Type VI, and large smoothing choke, D.150, rated to carry 50 mA.

windings, 200+200 volts for H.T., and 2+2 volts, at 1.5 amps. for the filament of the valve rectifier. All terminals are clearly marked, and the price is 14s.

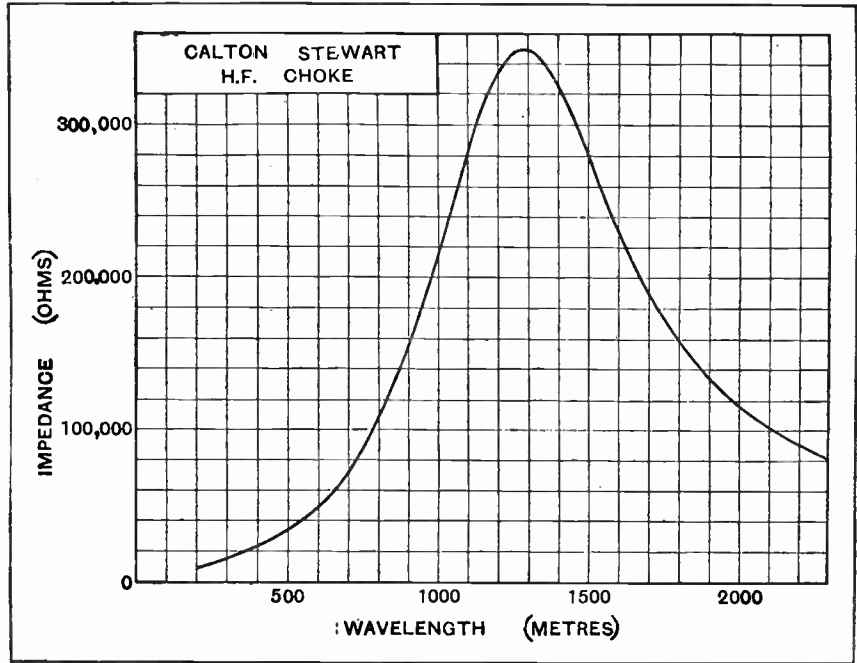
Smoothing chokes, ranging from 10 henrys to 40 henrys are now listed. The D.150, which is the model illustrated, has a rated inductance of 40 henrys, and is stated to carry 50 mA. The price is 13s. 9d. The small model, D.30, of 10 henrys, costs 5s. 6d.

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**CALTON STEWART H.F. CHOKE.**

The construction of this choke enables it to be mounted in spring clips on the baseboard or suspended in the wiring

A 41



Impedance curve of Calton Stewart H.F. choke; external capacity 8 micro-mfd.

of the receiver. The choke is light in weight, and is eminently suitable for the latter method of wiring, which has many points in its favour.

The windings are supported on skeleton paxolin former, and are enclosed in a celluloid tube 2½ in. long and 1 in. in diameter. Terminals are carried in the moulded ebonite end plates as shown in the illustration.

Having regard to the low price of 2s., the performance is remarkably good. The curve is free from subsidiary resonances, and under working conditions the choke should be safe as regards self-oscillation up to the wavelength of 5XX. Under the conditions of the test with a small external capacity of 8 micro-mfds., the resonance is at 1,300 metres, at which point the impedance reaches 348,000 ohms. Over the 200-500-metre band the impedance rises from 9,640 to 30,600



Calton Stewart H.F. choke; D.C. resistance 700 ohms.

metres, while on ultra short wavelengths the choking effect is still adequate.

Supplies are available from Messrs. J. McMillan and Co., 1, Hunter Square, Edinburgh.

**CATALOGUES  
RECEIVED.**

The Benjamin Electric, Ltd., Brantwood Works, Tottenham, London, N.17.—Illustrated broadsheet dealing with seven components introduced recently.

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Radio Instruments, Ltd., 12, Hyde Street, New Oxford Street, London, W.C.1.—Descriptive folder of the R.I. Screened-Grid All-Electric 3-valve receiver.

o o o o

Messrs. A. F. Bulgin and Co., 9-11, Cursitor Street, Chancery Lane, London, E.C.4.—A 55-page catalogue of Bulgin products. Profusely illustrated and devoting 20 pages to a technical description of the method of using some of the principal components now listed.

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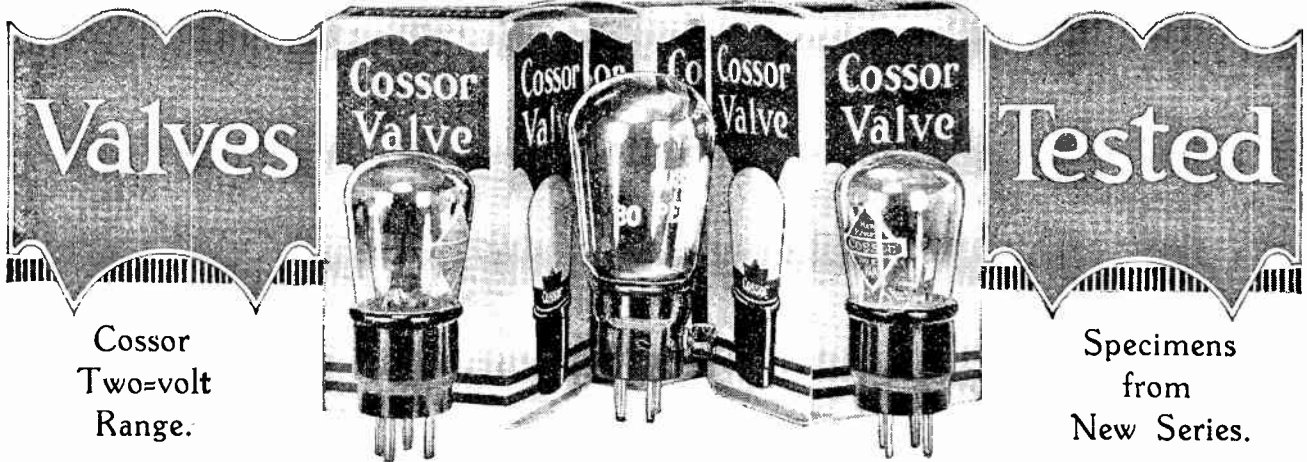
Messrs. Garnet, Whiteley and Co., Ltd., Lotus Works, Mill Lane, Liverpool.—A 20-page catalogue illustrating their new season's components. Also a 12-page descriptive booklet of "Lotus" receivers.

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Messrs. J. J. Eastick and Sons, Eelex House, 118, Bunhill Row, London, E.C.1.—Illustrated catalogue of proprietary radio equipment handled by this firm.

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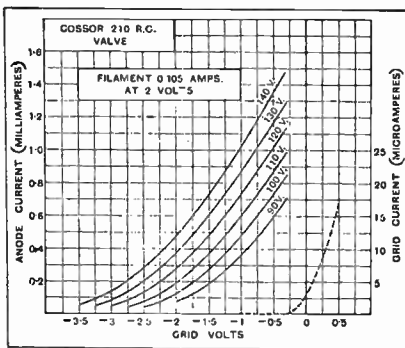
The Portable Electric Light Co., Ltd., 120, Shaftesbury Avenue, London, W.1.—Illustrated price list of Ever-Ready batteries for wireless and portable hand lamp uses.



THE complete range of two-volt valves in the Cosmor series comprise seven types in all, but owing to certain specimens not being available we are restricted in this review to a consideration of the merits of five. Those to be dealt with are the 210 R.C., 210 H.F., 210 L.F., 220 P., and the 230 P.T. The first four are triodes, and the last-mentioned a pentode. The complete range includes, in addition, a super-power three-electrode output valve, the 230 X.P., and a screen-grid type, the 220 S.G. It is hoped that an opportunity may arise to deal with these two valves later.

**210 R.C.**

This is a high-impedance valve with a nominal A.C. resistance of 60,000 ohms and an amplification



Average values under working conditions : A.C. resistance, 67,000 ohms; amplification factor, 40; mutual conductance, 0.6 mA/v.

factor of 40. The particular function allotted to a valve in this class hitherto was that of an amplifier followed by resistance-capacity coupling. Today this practice is not usually

adopted, as it has the disadvantage that the higher musical frequencies are not amplified in the same proportion as the very low notes, so that its usefulness is generally restricted to that of an anode bend detector. However, as this must be used in conjunction with a high value of anode resistance, some loss in the amplification of the higher musical notes will be inevitable. Where superlative quality of reproduction is not of paramount importance, but high sensitivity and selectivity is the first consideration, this valve will find a useful application.

As will be seen from the table below, the measured characteristics agreed sensibly with the makers' figures.

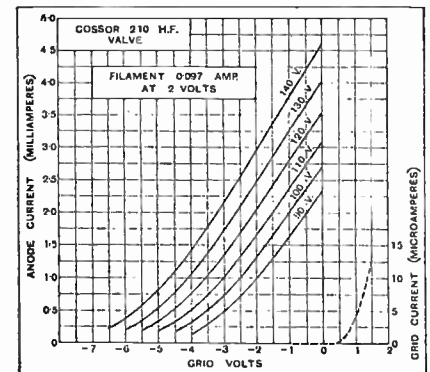
It was noticed that grid current commenced to flow when the grid was given a negative bias of 0.3 of a volt, so that it would be advisable to apply the maximum permissible voltage to the anode, thereby enabling a negative bias of such order to be used that the operating signal does not override the permissible peak voltage that can be applied to the grid.

For dealing with relatively large inputs the suggested working conditions are 120 anode volts, and -3 volts grid bias. Small inputs can be

dealt with satisfactorily by biasing the grid to -1.5 volts only. Of course the anode voltage should be reduced accordingly.

**210 H.F.**

As its description implies, this valve is intended for use as an H.F. amplifier, but as it is a three-electrode type a neutralised circuit must



Average values under working conditions : A.C. resistance, 26,500 ohms; amplification factor, 20; mutual conductance, 0.75 mA/v.

be employed to obtain worth-while results. Since this type of H.F. circuit is a relic of the past, the present-day function of the 210 H.F. valve is either that of a leaky grid detector or of an L.F. amplifier between the detector and output stages. When a

**Characteristics at 100 Volts H.T. and Zero Grid Bias.**

	210 R.C.	A.C. Resistance.	Amplification factor.	Mutual conductance.
Makers' Rating	.. ..	60,000 ohms	40	0.66 mA/v.
Specimen I	.. ..	66,500 "	37	0.56 "
Specimen II	.. ..	67,000 "	39	0.58 "

**Valves Tested.—**

low-frequency transformer follows this valve, preference should be given to one which possesses a high inductive primary winding, as the A.C. resistance of the valve is of the order of 20,000 ohms.

fier. Its rated characteristics are: A.C. resistance, 12,000 ohms; amplification factor, 10; and mutual conductance 0.83 mA. per volt. Transformer coupling can be used, therefore, provided the component chosen is capable of carrying the anode cur-

rent, showing that the vacuum in these samples is dead hard.

The three types dealt with so far all require 0.1 of an ampere at 2 volts for the filament.

**Characteristics at 100 Volts H.T. and Zero Grid Bias.**

210 H.F.	A.C. Resistance.	Amplification factor.	Mutual conductance.
Makers' Rating .. .. .	20,000 ohms	20	1.0 mA/v.
Specimen I .. .. .	25,000 ,,	20	0.8 ,,

Owing to the improved efficiency of modern valves, it is usually permissible to employ choke-capacity coupling between the penultimate L.F. amplifier and the output stage. This possesses certain advantages, particularly as regards initial cost. A choke of not less than 100 henrys is recommended.

One specimen only of this type was suitable for test. The other showed a trace of reversed grid current which was attributed to a slight softening of the vacuum. Grid current started at zero grid volts in the specimen tested, so that with a working anode voltage of 120 a maximum grid swing of 6 volts, peak value, can be handled. The normal anode current with the above stated H.T. and -3 volts grid bias will be about 1.4 mA.

**210 L.F.**

This is essentially a low-frequency amplifying valve, and its characteristics suggest that its most useful function will be in the penultimate position in a two or more stage ampli-

rent without leading to saturation of the iron circuit. Average values of anode current with various anode voltages are given below.

H.T.	G.B.	Anode current.
110	-4.5	2.8 mA.
120	-4.5	3.5 ,,
130	-6	3.05 ,,
140	-6	3.75 ,,

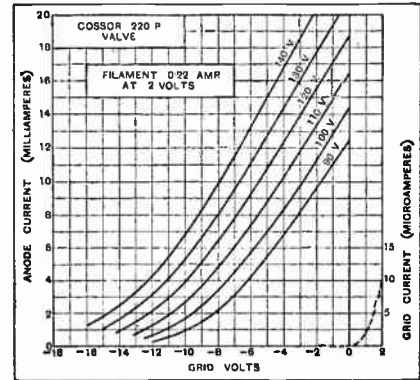
Grid bias values are given to the nearest 1.5 volts, since without the use of a potentiometer the grid bias cannot be varied in smaller steps than this.

Should it be desired to use one of the many types of L.F. transformers wound on special high-permeability iron, which limits the primary current to one or two milliamps, the parallel feed arrangement using an anode resistance and large feed condenser may be used. An anode resistance of about 30,000 ohms would be suitable, and a 1 mfd. condenser is recommended. This circuit deflects the steady D.C. current through the resistance and allows the A.C. component only to pass to the transformer.

Two samples of this type were tested and the measured characteristics were found to agree fairly closely with the makers' figures. Grid current commenced at zero grid bias. There was no trace of reversed grid

**220P.**

This is a power-amplifying valve, and will be used as a terminal valve in a receiver, or amplifier, designed for loud speaker reproduction. It cannot be included in the "super" class, but will be suitable for operating reasonably sensitive loud



Average values under working conditions: A.C. resistance, 5,400 ohms; amplification factor, 8.5; mutual conductance, 1.6 mA/v.

speakers at sufficient volume for rooms of average size. It should appeal to those listeners restricted to the use of dry batteries for the H.T. supply, as the anode current is comparatively low for a power output valve. The demand made on the battery at various anode potentials is given in the following table:—

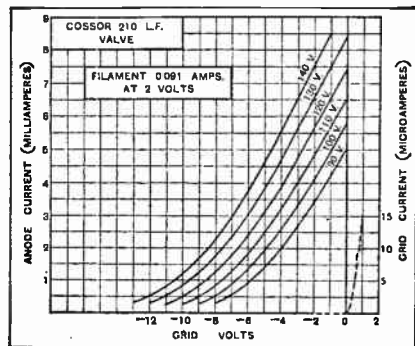
H.T.	G.B.	Anode current.
110	-7.5	5.5 mA.
120	-7.5	7.1 ,,
130	-9	6.7 ,,
140	-9	8.4 ,,

Suggested grid bias values are shown to the nearest 1.5 volt for the reason mentioned earlier.

The makers give the mutual con-

**Characteristics at 100 Volts H.T. and Zero Grid Bias.**

210 L.F.	A.C. Resistance.	Amplification factor.	Mutual conductance.
Makers' Rating .. .. .	12,000 ohms	10	0.83 mA/v.
Specimen I .. .. .	12,500 ,,	10.5	0.84 ,,
Specimen II .. .. .	16,000 ,,	11.0	0.7 ,,



Average values under working conditions: A.C. resistance, 16,000 ohms; amplification factor, 11.0; mutual conductance, 0.7 mA/v.

**Valves Tested.—**

ductance of the 220 P. as being 2mA. per volt, but this figure was not quite attained with the two specimens tested. With one, a mutual conductance of 1.6 was attained, and with the other 1.87 mA. per volt. How the measured characteristics compare with the makers' rating can be seen best from the following table:—

**Characteristics at 100 Volts H.T. and Zero Grid Bias.**

220 P.	A.C. Resistance.	Amplification factor.	Mutual conductance.
Makers' Rating .. .. .	4,000 ohms	8	2.0 mA/v.
Specimen I .. .. .	4,880 "	7.7	1.6 "
Specimen II .. .. .	4,650 "	8.7	1.87 "

Grid current started to flow at zero grid volts, and both specimens were found to be satisfactorily evacuated, as there was not the slightest trace of reversed grid current.

**230 P.T.**

The 230 P.T. is a five-electrode, or pentode, valve, and is, of course, a power amplifier. Pentodes will not accept, in general, a large grid input, so for this reason their usefulness is restricted to sets having but one low-frequency amplifying stage. As has been shown in a recent article, the characteristics of these particular valves vary between wide limits with change in auxiliary-grid and working-grid voltages, so that unless the conditions under which the makers measured the characteristics of the valve are known, comparison between figures obtained under dif-

ferent conditions would be misleading. This information is not available.

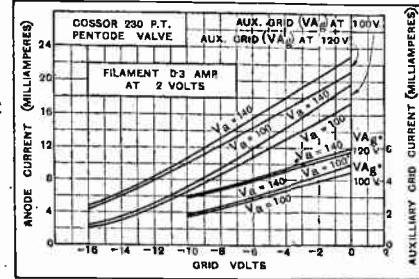
Our measurements were made under two conditions: first, average values between 100 and 140 volts on the anode with a fixed auxiliary grid potential of 120 volts and zero working grid bias. The second set of measurements were made with be-

tween 120 and 140 anode volts and with the auxiliary grid at the same potential. The working grid was biased to -7.5 volts.

The average characteristics from the first set of readings were: A.C. resistance, 20,000 ohms; amplification factor, 30.8; and mutual conductance, 1.54 mA. per volt. In the second case the average A.C. resistance was found to be 40,000 ohms; amplification factor, 50; and mutual conductance 1.25 mA. per volt. The makers' rating is 20,000 ohms, 40 and 2 respectively.

Anode volts.	Auxiliary grid volts.	G.B.	Anode current.	Auxiliary grid current.	Total (mA).
100	100	-6	10.8 mA.	2.8 mA.	13.6
140	100	-6	11.8 "	3 "	14.8
100	120	-7.5	12.7 "	3.5 "	16.2
140	120	-7.5	13.7 "	3.7 "	17.4

When choosing an H.T. battery, or supply unit, for these valves, consideration has to be given to the current flowing in the auxiliary grid circuit. To facilitate this, the curves shown are the anode-current-grid-volt curves, together with auxiliary-grid-current-grid-volt curves. The total current can be found readily at any grid bias values.



Average values under working conditions: A.C. resistance, 40,000 ohms; amplification factor, 50; mutual conductance, 1.25 mA/v.

The total current demands are rather heavy for most dry-cell type batteries, and where mains are available an H.T. supply unit would be preferable. Otherwise an accumulator H.T. battery would be, perhaps, the most economical source of H.T. supply.

**Speech and Hearing.**

By H Fletcher. (Macmillan and Co., Ltd. 1929. 20s.)

The recent work on speech and hearing from the point of view of telephonic communication is ably summarised in this book.

It is surprising to learn that, while most of the energy of speech sounds is carried by frequencies below 500 c.p.s., the intelligibility is only reduced three per cent. when these frequencies are removed by a filter. The speech power emitted during average conversation is about ten microwatts, so that it would require a million people talking simultaneously to light a ten-watt lamp. Very loud speech corresponds to 1,000 microwatts, and 0.001 microwatts is the power for a soft whisper.

In the analysis of musical sounds we find that a piano emits bass notes almost entirely on harmonics, and that with the

'cello organ pipe the 3rd harmonic has about five times the amplitude of the fundamental.

The work on noise is of great interest. In perfectly silent surroundings conversation is possible over a range of 1,000ft., in a busy office over 30ft., in a boiler factory over 4in.

The masking of one tone by another shows that intense sound of low pitch can, by generating harmonics in the ear, obliterate the power of hearing all other sounds of higher pitch, but a high-pitched sound does not obliterate sound of lower pitch.

The book is packed with quantitative results about all phases of sound production and reception, and shows clearly what

**BOOK REVIEW.**

defects are permissible in telephone or wireless systems without undue depreciation of quality. R. T. B.

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**BOOKS RECEIVED.**

*A.B.C. of Television or Seeing by Radio.* By R. F. Yates. The theory, construction, and operation of telephotographic and television transmitters and receivers, explained in simple language. Pp. 210, with 78 diagrams and 20 illustrations. Published by Chapman and Hall, Ltd., London. Price 10s. 6d. net.

*A Course-shift Indicator for the Double-modulation Type Radiobeacon.* By H. Diamond and F. W. Dunmore. (Bureau of Standards, Research Paper No. 77.) A short description of the indicator used at beacon stations in U.S.A. Pp. 10, with six diagrams and illustrations. Published by the Department of Commerce, Washington, D.C. Price 5 cents.



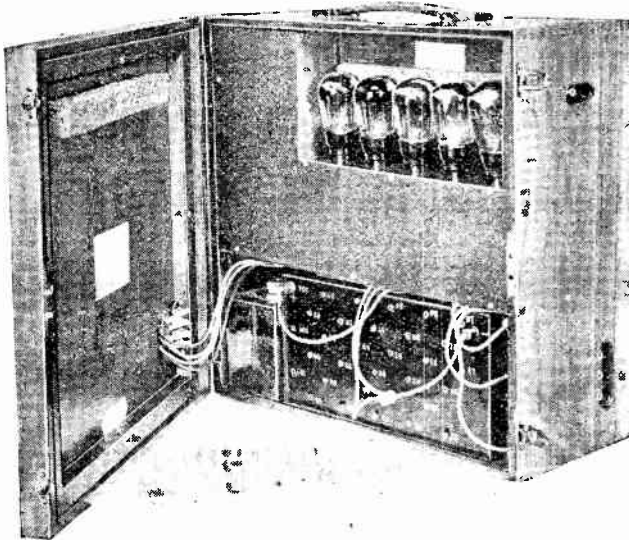
# Broadcast Receivers

## The 1930 PYE PORTABLE

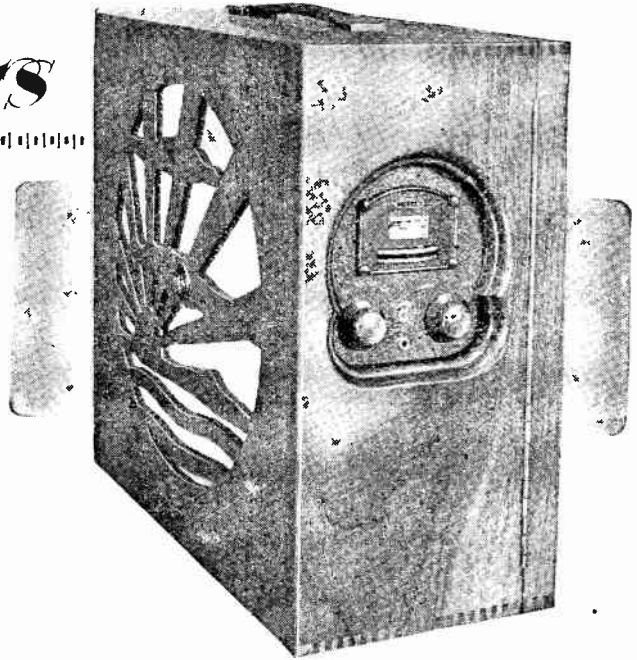
Aperiodic H.F. Coupling Retained:  
Many Detail Refinements.

THE two aperiodic H.F. stages in the Pye Portable, using three-electrode valves, have given such satisfactory results in the past that it has been decided to retain this form of coupling in the 1930 model. Although the circuit principle and the general interior appearance of the set remains unchanged, the removal of the inside cover plate reveals that the circuit has been completely redesigned in detail. Instead of the rotating reaction coil and damping ring of last year there is a differential reaction condenser and regeneration is now confined to the detector stage. This has resulted in an improvement in selectivity on long waves.

Another important modification is the provision of sockets at the back of the set for the attachment of an external battery eliminator for H.T. supply. There are three sockets coloured to correspond with the H.T. wander plugs, which are plugged into the sockets inside the set after removing the battery. Decoupling resistances are incorporated in both positive leads and in other branches of the H.T. circuit, so there should be no trouble due to back coupling.



Interior of the new Pye Portable, showing sponge rubber damping for the valves. Note sockets on extreme right for the connection of a battery eliminator.



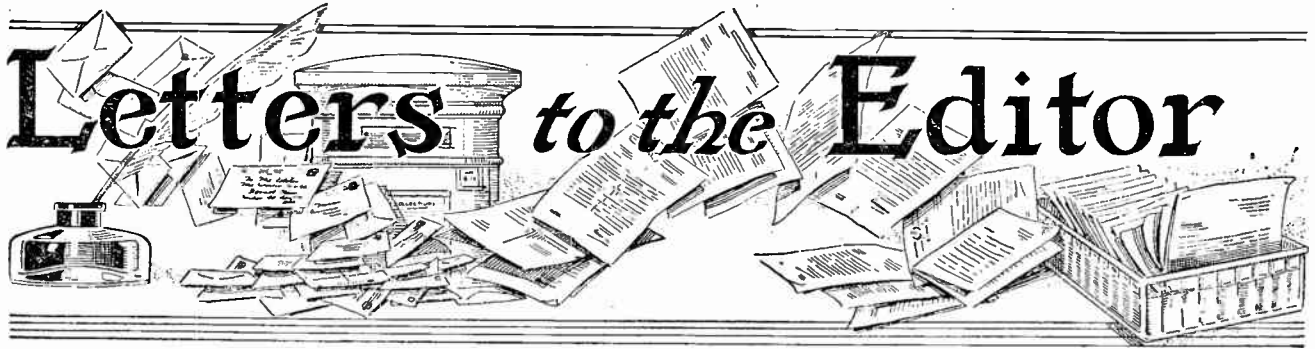
The control panel has been completely redesigned and is extremely pleasing to the eye. The tuning condenser is now mounted with the spindle vertical and the original bevelled dial has been replaced by a slow-motion edge-wise drum dial. The scale is calibrated in metres on both wave bands and is framed in a handsome moulded escutcheon plate provided with a celluloid window and hair line. The reaction control is now placed in an accessible position below the main tuning dial in line with the wave range switch.

One of the first questions to be asked about a receiver to-day is the degree of selectivity to be expected and the manner in which it will react to the new Regional stations. Tests were made with the new Pye in central London during transmissions from Brookman's Park, and the tuning control was set first to the wavelength of 5GB and then at 261 metres—the approximate wavelength of the alternative programme transmitter at Brookman's Park. At both these settings the 356 metre transmission was still just audible even with reaction critically adjusted. The volume, however, would be insufficient to cause interference during periods of modulation and would only be heard during intervals in the programme being received.

The long wave selectivity has been much improved and there is little difficulty now in separating Radio Paris, Königswusterhausen, and Daventry 5XX.

The range and quality of reproduction are quite up to the standard of the earlier model. There is evidence that the set is sufficiently sensitive to overload the P.215 valve in the last stage, and it might be a good plan to invest in a P.240 for use with an H.T. eliminator. The P.215 would then be kept in reserve for outdoor use with the dry cell H.T.

An A.C. battery eliminator, specially designed for the Pye Portable, is available, and costs £5, while the price of the set itself is £23 10s.



The Editor does not hold himself responsible for the opinions of his correspondents.

Correspondence should be addressed to the Editor, "The Wireless World," Dorset House, Tador Street, E.C.4, and must be accompanied by the writer's name and address.

### THE REGIONAL SCHEME.

Sir,—I cannot understand your attitude towards the Regional Scheme, involving, as it does, dual-wave, high-power transmissions.

You have recently described a series of excellent receivers, which you state will function satisfactorily with the advent of the new conditions. Surely it is up to listeners to bring their sets up to date rather than retard the progress of efficient transmission.

The power used in the tests from Brookman's Park, while adequate during daylight, is only just sufficient, at 100 miles from the transmitter (the limit of its range) to overcome interference from foreign stations after dark.

Lowestoft.

A. E. MANNING.

Sir,—The views which you expressed in your editorial in the issue of October 16th will, I think, be endorsed by very many of your readers. There has, in my opinion, been too much confidence shown by the B.B.C. in the success of the regional stations.

Brookman's Park is, of course, a remarkably fine achievement as an engineering job, and the technical staff of the B.B.C. are entitled to be proud of it, but whether the regional scheme is the best solution to providing satisfactory broadcasting in this country has yet to be proved. The B.B.C. has always contended that they have to cater for the crystal set user and that they are not entitled to force him to buy a valve set, but now that they have rendered so many valve sets obsolete because of the power of the new transmitter, how are they going to reconcile this action with their attitude of the past? Nobody wants to stop progress, and no doubt the designs for receivers which *The Wireless World* produces will be a complete answer to the requirements of selectivity, but is it fair that the B.B.C. should have the power to compel listeners to spend money on buying new sets, or on bringing their old sets up to date? It seems scarcely right.

Golders Green.

"FAIR PLAY."

Sir,—Your views in the Editorial of *The Wireless World* issue of October 16th are so remarkable that I feel a little explanation is due, and so I am setting out one or two points that you may care to reply to.

With regard to the new Regional station, may I ask why all the concern for listeners around this station, including London and suburbs?

When the Daventry station, 5GB, was started up I do not recollect any great sounding of trumpets from you, and I, incidentally, lived about 12 miles from this station at that time and had to get over the difficulty as best I could, and many other people did the same. We did not even bother you or the B.B.C. about it, but adapted our sets to suit.

Are we to assume that your outburst is due to the trouble being a little nearer you, in the Brookman's Park transmitter? As for the Press outcry, well, that should go the way of most of their articles, and I sincerely hope will cause no fear at Savoy Hill.

But now we come to a serious side of the question. What of the new receivers designed especially for the Regional Scheme? Are the manufacturers' claims all wrong? Is it impossible to design a sufficiently selective set?

What of your own articles *re* means for obtaining selectivity? Are these no good, too? Or do you suggest that listeners should retain their old sets and that the B.B.C. should make their strides of progress to suit.

And last, but not least, would not this latter way hit the radio trade badly?

Come! We who are old readers do not like to see you indulging in what appears to be a fit of temper because Savoy Hill have not told you why the new station did not take over on October 14th as scheduled, and this is the first thing that will occur to some of your readers when reading your Editorial.

You are surely not averse to progress, and your technical experts should be able to deliver us poor amateurs from the paths of unselectivity unto the future of selectivity.

We look to you to lead the way technically. Let the newspapers do the grumbling; no one takes any notice of them, anyway.

W. H. CHIPPERFIELD.

London, W.12.

Sir,—You ask, "Must the Regional Scheme be scrapped?" Certainly not. The B.B.C. exists to give the best possible service to the greatest number of listeners. Therefore the fact that those within a few miles of the transmitter have in the past been unduly favoured is no reason why this monopoly of easy and good quality reception should continue. It will be necessary now for them to use selective sets, but they will still be much better off than those 100 miles away and near the coast.

It will mean a little trouble for the minority, but the majority will immensely benefit. As for the Continental stations, I often hear them and can say that their programmes, on the whole, are distinctly inferior to those given by the B.B.C., and as all announcements, talks, etc., are naturally given in the native language, comparatively few English people can understand them. Of course, there are specially good items at times, but these do not occur sufficiently often to make their reception a vital question.

Margate.

ARTHUR HOBDAV.

### SPARE APPARATUS.

Sir,—May I appeal through the columns of your magazine for the gift of any spare wireless gear that may be at the disposal of your readers.

This mission for social work among East End boys is unfortunately very cramped for funds. We have started a wireless class, and despite the enthusiasm of the boys we are painfully short of gear; in fact, we have practically nothing at all.

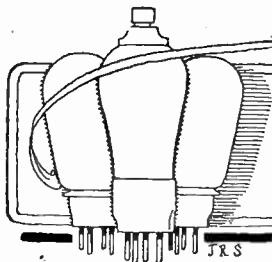
If any of your readers will send to me at this address, anything they are willing to give, I shall be most grateful.

Those who respond to this appeal will have the satisfaction of knowing that their gifts are being used to the utmost advantage, and also that they have been the means of bringing a good deal of happiness to those whose opportunities for enjoyment are at the best somewhat limited.

London, E.2.

W. A. CROWE.

# READERS' PROBLEMS.



"The Wireless World" Supplies a Free Service of Technical Information.

The Service is subject to the rules of the Department which are printed below; these must be strictly enforced, in the interest of readers themselves. A selection of queries of general interest is dealt with below, in some cases at greater length than would be possible in a letter.

### Multiple Battery Cables.

Is there any reason why a commercial five-way battery cable should not be used for connecting up the "New Kilo-Mag Four"? I believe that the use of these cables in highly sensitive receivers is sometimes responsible for instability.

T. C. A.

As all the circuits of this set are isolated by means of decoupling resistances and condensers, it is impossible that any interaction should take place between the various battery leads, and consequently there is no risk in using this form of connecting cable.

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### "Record III." Transformers.

Will you please tell me if it would be permissible to wind the primary and neutralising sections of the "Record III" medium-wave H.F. transformer over the secondary winding, instead of underneath it? Of course, these coils would be carried on ebonite spacing strips placed over each rib of the former.

J. R. S.

From the point of view of electrical efficiency, it is quite immaterial which form of construction is adopted; that illustrated in the descriptive article offers the advantage that the fragile primary windings are protected from harm by the secondary. Needless to say, the spacing

between the coils should be exactly as described, and the single-turn neutralising coil should be carried on extensions of the spacing strips.

o o o o

### Larger Condensers Permissible.

Would it be permissible to use variable condensers of 0.0005 mfd. for tuning the secondary and H.F. transformer circuits of the "Wireless World Kit Set"? I already have spare condensers of this capacity, and should like to use them if there is no serious objection.

N. H. C.

Tuning condensers of 0.0005 mfd. capacity can most certainly be used throughout in this receiver, provided that they have not exceptionally high minimum value. It should be pointed out, however, that tuning will be slightly more difficult, as the angular displacement of the vanes corresponding to a given wavelength change will be less than when the specified capacity is used. Of course, this slight disadvantage could be overcome by redesigning the coils, but this course would entail some reduction in sensitivity, and is not recommended.

With condenser values as specified, it will be found that the three dials run in step reasonably closely over the tuning scale; this will not hold good if alterations are made.

o o o o

### L.F. Potentiometers.

I am using an anode potentiometer for controlling the volume of my four-valve set (H.F. amplifier and anode bend detector, followed by resistance- and transformer-coupled L.F. stages). I am told that the same effect can be obtained by using a "grid potentiometer." Will you explain how this device is connected, and also say if it is superior to the method at present in use.

V. D. S.

These two methods of volume control are shown diagrammatically in Fig. 1. The anode potentiometer which you are already using appears in sketch (a).

As you will see from diagram (b), grid potentiometer control is effected by replacing the usual fixed grid leak by a high resistance (of the value normally chosen for working in association with the coupling condenser). A sliding con-

tact on this resistance is connected to the grid of the first L.F. amplifier in such a way that any desired proportion of the total signal voltage existing across the leak may be applied. This method has no advantage over the other scheme, except in the matter of cost, and often in convenience of wiring. A high-resistance potentiometer of the grid leak type is readily obtainable, and is quite inexpensive, while one's choice in the matter of suitable resistances for the anode circuit is somewhat restricted, and the majority of components having sufficient current-carrying capacity are considerably more expensive.

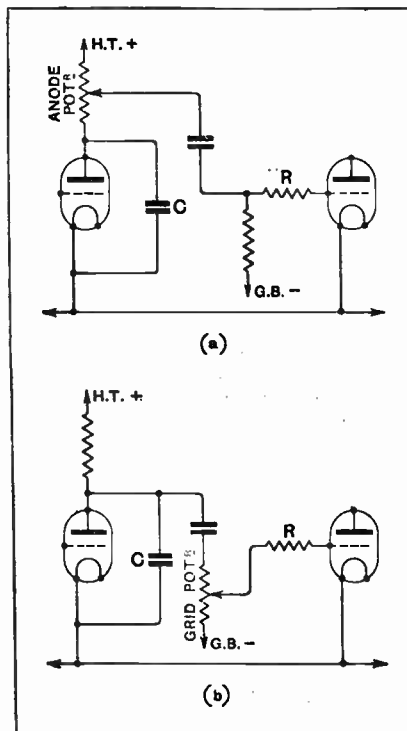


Fig. 1.—Two methods of post-detection volume control, whereby input from the detector to the L.F. amplifier may be regulated. In each diagram (c) represents the detector anode by-pass condenser, and R the conventional H.F. stopping resistance.

### RULES.

- (1.) Only one question (which must deal with a single specific point) can be answered. Letters must be concisely worded and headed "Information Department."
- (2.) Queries must be written on one side of the paper, and diagrams drawn on a separate sheet. A self-addressed stamped envelope must be enclosed for postal reply.
- (3.) Designs or circuit diagrams for complete receivers cannot be given; under present-day conditions justice cannot be done to questions of this kind in the course of a letter.
- (4.) Practical wiring plans cannot be supplied or considered.
- (5.) Designs for components such as L.F. chokes, power transformers, etc., cannot be supplied.
- (6.) Queries arising from the construction or operation of receivers must be confined to construction sets described in "The Wireless World" or to standard manufacturers' receivers.

Readers desiring information on matters beyond the scope of the Information Department are invited to submit suggestions regarding subjects to be treated in future articles or paragraphs.

**Adjusting Detector Bias.**

*My set is on the lines of the original "Everyman Four," but with a screen-grid H.F. amplifier. Is there a simple method of setting detector-grid bias other than the usual procedure of making this adjustment when listening to actual signals? I am aware of the fact that this can be done by inserting a meter in the anode circuit and balancing out the steady D.C. current, but should imagine that this is rather difficult.* E. H. W.

We agree that the balancing method is not too easy to apply, but very much doubt if it is possible to improve—from the strictly practical point of view—upon the usual procedure. If adjustments of bias are carefully made when listening to really weak incoming signals, it is generally possible to find the best setting without much trouble.

**250,000 Times Amplification!**

*Do you consider that it would be practicable to set up two H.F. stages similar to those included in the "Record III." receiver? If you think that it would be possible to construct such a set satisfactorily, I should build it in a standard "Wireless World" four-compartment cabinet, mounting the aerial tuning coils and their condenser in the base of the compartment.* C. L.

By observing extreme care at every point—particularly with regard to screening and decoupling—it would be possible to build a "2-H.F." set with something approaching the stage amplification of the receiver in question; but unless you have had considerable experience we should be doing you a disservice by recommending that you should proceed with your plan.

that a rather unusual (but by no means unknown) type of open circuit in the windings has developed, and that this manifests itself when the current passing reaches a certain fairly critical value. A fault of this kind would not be revealed by the usual tests, and we suggest that you should attempt to locate the defective component by temporarily inserting phones or loud speaker in the anode circuit of the first L.F. valve in place of the transformer primary. If, with this connection, the trouble persists, it can be assumed that the first stage transformer is at fault; if, on the other hand, the set works well, it is probable that the other is to blame.

Of course, you must not lose sight of the fact that the loud speaker or the output choke (or transformer, if one is used) may also cause a similar trouble.

o o o o

**"Designing an Eliminator."**

*With reference to the article under the above heading, which appeared in your issue for October 2nd, will you please tell me if the centre-tapped double 0.1 mfd. condenser mentioned need be of any special form, or will it be satisfactory to use two ordinary condensers connected in series, taking the negative supply lead from the junction between them? I refer, of course, to the arrangement shown in Fig. 1 (c) of the article.* W. H.

Any good condensers, with the usual commercial tolerance as to their precise values, will do for this purpose; they are connected in the manner you state.

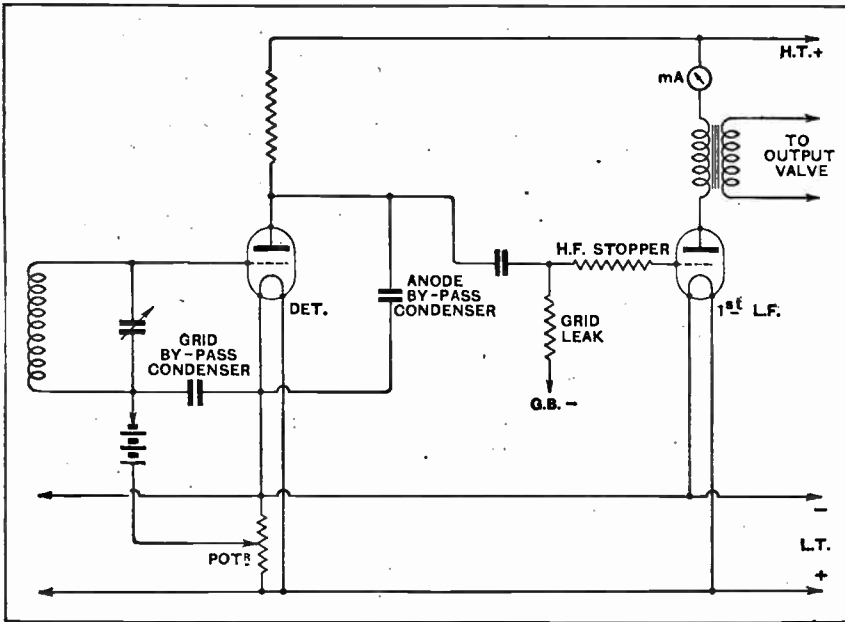


Fig. 2.—Converting a first-stage L.F. amplifying valve into a valve voltmeter: a simple method of making an accurate adjustment of detector grid bias.

A satisfactory way of making a comparative measurement of the rectified output from the detector is shown in Fig. 2; this is readily applicable to your own set, and requires no other apparatus beyond a fairly sensitive milliammeter, which is inserted in series with the anode circuit of the first L.F. amplifier. The procedure is to convert this valve into an L.F. signal rectifier by approximately doubling its negative grid bias, and, while listening to a signal of constant amplitude (such as a tuning note) to adjust grid bias until the milliammeter reading is at maximum.

Although a detector potentiometer is not usually considered as necessary when a valve of comparatively low impedance is used, we certainly think it should be included when one is attempting to make a really accurate adjustment, and accordingly this feature is shown in our diagram.

**A Faulty Transformer Primary.**

*My set (detector followed by two transformer-coupled L.F. stages) works reasonably well, provided that the H.T. pressure is not increased beyond 60 volts. As soon as an attempt is made to apply sufficient voltage for good quality and adequate volume, violent crackling noises are heard in the loud speaker, and signals sometimes fade away altogether. Can you suggest what is wrong? From replies to other correspondents, I suspect that one of the transformer primaries has developed a fault, but the usual "phone and battery" test seems to suggest that everything is in order.* N. P. R.

We think that you are correct in assuming that one of the transformer primaries is responsible for the trouble; it seems

**FOREIGN BROADCAST GUIDE.**

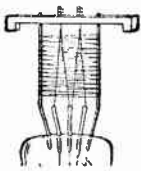
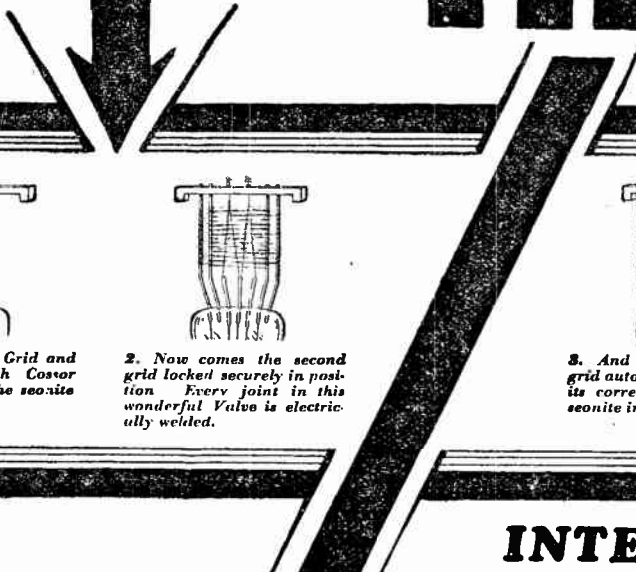
**KOVNO**  
(Lithuania).

Geographical position: 54° 55' 00" N.  
23° 56' 00" E.  
Approximate air line from London: 1,015 miles.  
Wavelength: 1935 m. Frequency: 155 kc.  
Power: 7 kw.  
Time: Central European (60 minutes in advance of G.M.T.).

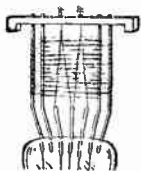
**Standard Daily Transmissions.**  
G.M.T. 11.00 and 17.00 weather and news; 18.30 and 20.00 concerts. Usually closes down at 21.00.  
Dance music 20.00—21.15 (Sats. only).  
Male announcer. Call: *Allo! Allo! Lietuoss Kaunas*, with, at times, French translation: *Ici Poste de Radiotéléphonie de Kovno*.  
Opens transmission by playing a gramophone record.  
**Interval Signals:** a stroke on a gong.  
Closes down with a few bars of the Lithuanian National Anthem.

Under the heading "Foreign Broadcast Guide," we are arranging to publish a series of panels in this form, giving details regarding foreign broadcast transmissions.

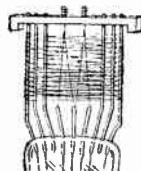
# THAT'S THAT!



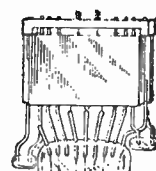
1. This is the first Grid and the double length Coszor filament. Note the seaonite bridge piece.



2. Now comes the second grid locked securely in position. Every joint in this wonderful Valve is electrically welded.



3. And this shows the third grid automatically spaced at its correct distance by the seaonite insulator.



4. Finally, the Anode completes the assembly and interlocks the whole unit immovable and rigid.

## INTERLOCKED for safety—for rigidity and for long life!

The wonderful *NEW* Coszor Pentode is the most powerful L.F. Valve you can use—it gives enormous volume—equal to the output of two ordinary valves. And because it uses the exclusive Coszor system of Interlocked Construction it has exceptional strength. Its elements are rigidly braced together—proof against shocks, noises and breakage. No other Pentode Valve has this unique system of Interlocked Construction.



### In two types:

Coszor 230 P.T. (2 volts, .3 amp.) and 415 P.T. (4 volts, .15 amp.) Amplification Factor 40. Impedance 20,000 Anode Volts 100-180.

Price - - - **25/-**  
(either type)

# The NEW COSSOR PENTODE

The only Pentode Valve with Interlocked Construction



A. C. Coszor Ltd., Highbury Grove, London, N.5.

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### DEPOSIT SYSTEM.

Readers who hesitate to send money to unknown persons may deal in perfect safety by availing themselves of our Deposit System. If the money be deposited with "The Wireless World," both parties are advised of its receipt.

The time allowed for decision is three days, counting from receipt of goods, after which period, if buyer decides not to retain goods, they must be returned to sender. If a sale is effected, buyer instructs us to remit amount to seller, but if not, seller instructs us to return amount to depositor. Carriage is paid by the buyer, but in the event of no sale, and subject to there being no different arrangement between buyer and seller, each pays carriage one way. The seller takes the risk of loss or damage in transit, for which we take no responsibility. For all transactions up to £10, a deposit fee of 1/- is charged; on transactions over £10 and under £50, the fee is 2/6; over £50, 5/-. All deposit matters are dealt with at Dorset House, Tudor Street, London, E.C.4, and cheques and money orders should be made payable to Iliffe & Sons Limited.

### THE SALE OF HOME-CONSTRUCTED UNLICENSED APPARATUS.

#### A Service to our Readers.

We have made an arrangement with the Patentees whereby readers who wish to dispose of a home-constructed receiver not licensed under the patents made use of, can license the set by means of the Deposit System referred to above.

The person desiring to sell, in sending us particulars for his advertisement, will in every case make use of a Box No., and should add to the price which he requires the amount of royalty customarily paid by manufacturers.

If the purchaser is satisfied with his purchase, the sum realised will be forwarded to the seller, less the amount due in respect of royalties, which amount will be paid by "The Wireless World" to the owners of the patents concerned, and a certificate will be handed on to the purchaser of the set.

**SPECIAL NOTE.**—Readers who reply to advertisements and receive no answer to their enquiries are requested to regard the silence as an indication that the goods advertised have already been disposed of. Advertisers often receive so many enquiries that it is quite impossible to reply to each one by post.



## ALL WIRELESS WORLD COILS

1930 EVERYMAN FOUR	47/6 set
KIT SET, Coils with Switches	45/- set
NEW KILOMAG.	45/- set
RECORD III	45/- set
FOREIGN LISTENERS 4 B.B.C.	30/- set
METAL CABINETS	5XX 37/6 set
5 1/2" DRUM DIALS with Escutcheons	38/6 to 48/6
WAVE TRAP, Litz Wire	5/6 to 10/6 each

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2, 3, & 4, Athelstane Mews,  
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A greater measure of success, a greater field of usefulness supplying such H.T. and L.T. energy as required, in a constant and unaltering form. Type 12C. H.T. 120 v. at 15 m. amp. Type 16C.H. 150 v. at 25 m. amp. Combined units from £5-12-6 (complete).

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THE TULSEMERE MFG. CO., 1-7, Dalton Street, West Norwood, S.E.27. Telephone: Streatham 6731.

"THERE IS A WHOLE OF DIFFERENCE"

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THE ORIGINATORS OF RADIO PART EXCHANGE

Phone: Paddington 8828 (3 lines).

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OPEN TILL 7 P.M. SAT. 1 P.M.



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Get particulars of the Kabilok Cabinet specified for this new Mullard set. Full details and splendid selection of cabinets for sets, speakers and Radio-Gramophones are illustrated in the KABILOK CATALOGUE.

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**W. & T. LOCK LTD.**  
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LONDON: 11, Red Lion Square, W.C.1.

## RECEIVERS FOR SALE.

**SCOTT SESSIONS and Co.**, Great Britain's Radio Doctors.—Read advertisement under Miscellaneous [026]

**3-VALVE** All-wave Receiver, latest type, powerful perfect; £4.-V. Taylor, 57, Studley Rd., Stockwell, London. [027]

**RECEIVERS** for Sale.—Portable 5-valve, suit case type, complete, as new, perfect; £9/17/6.—Taylor, 57, Studley Rd., Stockwell, London. [032]

**BURNDEPT** 7-valve Superhet, 1926-27, £15; Burndept Ethogrand 5-valve, £15; Burndept Ethophone IV, £7; Marconi amplifier for V2, 35/-.—James Scott and Co., Radio Engineers, Dunfermline. [032]

**PORTABLE** Wireless Set; £8.—Greatrex, 34, St. George's Rd., Golders Green, London. [064]

**6-VALVE** McMichael Superhet, complete with special frame aerial, valves, coils 15 to 2,000 metres, air batteries; must sell, £11, or nearest offer.—Pearson, 1, The Crescent, Anson Estate, Manchester. [691]

**MARCONI** 4-valve Set, model 41, complete (except batteries); 2 L.T. accumulators, Celestion loudspeaker, splendid condition; £9/10.—Box 3635, c/o The Wireless World. [692]

**50** 5-valve Portable 14 guinea Sets for 9 guinea straight from factory to you, suit case type, Ever-ready H.T. battery, English accumulator, Mullard or Cosor valves, ionolites paid, set complete in case equal to any 14 guinea set on the market; satisfactory guaranteed or money returned.—G. Hodgson, 53, Windsor House, Victoria St., Westminster, S.W.1. [692]

**BURNDEPT** Screened Four, 3 months used, perfect complete with valves; 17 guineas, cost £30.—Mortlock, 52, Northampton Av., Farnham Rd., Slough. [685]

**LODESTONES**, minus cabinet, otherwise complete new Osram valves, Ferranti push-pull, best pair only, £8; or £6 without valves.—Box 3626, c/o The Wireless World. [677]

**4-VALVE** Set, S.G. det., 2 L.F., last two in parallel 30 stations on moving coil; demonstration at evening after 7; price, complete set, £10 or near. Perry, 9a, Eliot Bank, Forest Hill. [688]

**BURNDEPT** S.G. Portable, magnificent performer, new; exchange approved, "Wireless World" receiver or parts, superhet, preferred; or sell 12 guinea.—Chamier, 25, Harrington Gardens, S.W.7. [687]

**2-VALVE**, receives London, 5GB Daventry, 2 foreign stations, loose-coupled coil holder, including valves, accumulators, 4 Igraic coils and Mullard 11.1 unit; £10.—Hayman, 30, High St., Sutton, Surrey. [687]

**G.E.C.** 1930 Osram Music Magnet, complete in case; opened; £7/10, sent, c.o.d., if required.—Box 5536, c/o The Wireless World. [687]

**SIMMONDS BROS.**—Receivers constructed to your own or any published design; also repairs, reconstructions, and modernisations at moderate charges; best materials and workmanship guaranteed; numerous testimonials; quotations free.—Address: Shireland Rd., Smethwick. [588]

**SCIENTIFIC DEVELOPMENT Co.**, 51, Fishergate, Preston. [588]

**WE Offer You the Following Inducements to Purchase Your New Receiver or Other Apparatus From Us.**

**FIRSTLY.**—Unbiased advice. The principal of the firm has twenty years' professional wireless experience, having been at the Government Experiment Stations in 1910. He has been manager for the Sterling Telephone Co., radio expert to the G.E.C., a Chairman of the Technical Committee of the National Association of Radio Manufacturers. His advice has saved our clients many thousands of pounds, for everybody knows, there is no hobby on which more money is wasted on useless apparatus by the uninitiated.

**SECONDLY.**—We take your old apparatus in part exchange for new, as we have means of disposal of much that the ordinary man finds it difficult impossible to sell; send us a list of your old apparatus or better still send us the apparatus, and state your new requirement; we will then make you offer for your goods, and if you do not approve, which is unlikely, we will return the parcel, carriage paid.

**IF** You are in Doubt as to the Make of Receiver or Other Apparatus you should Purchase, write to us and we will advise you; we have no leaning toward any particular maker, and will tell you the particular instrument you should buy for your purpose.

**SCIENTIFIC DEVELOPMENT Co.**, 51, Fishergate, Preston. Tel.: 1364. [026]

**NEW** 6-valve All Electric A.C. Receiver, complete with A.C. valves, in beautiful walnut cabinet, controls, 30 stations, bargain, £18; H.T. eliminator 110v. A.C., new, bargain, 30/-; suit 4-valve; ditto, no suit 4-8 valves, £3, worth £10.—Box 3646, c/o The Wireless World. [692]

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ALL Mains Receivers.—I specialise in this type of work and have an exceptionally fine range of all types receivers and radiograms from three to six valves; A.C. or D.C.

OVERSEAS Readers.—Why not have a reliable short wave receiver that really will bring in stations from all over the world at good L.S. strength? I can recommend the R.S.G.B. Four, designed by the Radio Society of Great Britain; price, complete with valves, £110, 10s.

SCREENED Grid Five.—This unique instrument was greatly admired at Olympia and many orders booked. I can now again accept orders for delivery from December 1st. Why not enquire about this instrument set? There is nothing to compare with it at its double the price.

REPAIRS and Reconstructions.—I am always pleased to quote for work of this kind, and many types receivers can be brought right up to date at moderate cost.

W. SMURTHWAITE, A.M.I.R.E., 15a, Onslow Gardens, Wallington, Surrey. Phone: Wallington 1982. Works, Belmont Rd., Wallington. [6956]

EMILIAEL Super Screened Four Portable, almost new. 25 stations guaranteed, demonstration, £6/10; Phillips 3-valve all mains set, 200-210v., absolutely new, £17.10.—Coppin, Sylva Court, Putney Heath. [6926]

MARCONI Model 61, 6 valves, 3 S.G. det. and 2 L.T. stages, frame aerial, extremely powerful and sensitive. "The Wireless World," September, 1929, writes: "Expensive but of superlative performance; perfect condition; cost £60, accept £25, bargain."—Box 8, c/o The Wireless World. [6969]

EVERYMAN Four Cabinet, with all panel components fixed, coils, screen, Gambrell neutronics and various small condensers; also Marconi Ideal £5; Blue Spot 66K, with chassis, 30/-; nearest; seen after 6 p.m.—B, 70, Chelverton Rd., Putney. [6943]

ALCYON 5-valve Portable, 1929 demonstration model, guaranteed to give excellent reception anywhere in England or Wales, complete with new H.T. batteries and large capacity Exide accumulator; cost guineas, what offers?—The Presbytery, St. Winifred, Welshpool, Mont. [6936]

VALVE Factory Made Elstree Six, complete with valves and coils, in solid mahogany cabinet, in perfect condition; £10, cost £45.—C. Payne, 26, Earl's Courtway. [6922]

ATFEST Wave Switching 2-valve, mahogany cabinet, complete, £2/10; Amplion speaker, 15/-; accumulator, 10/-; Exide H.T. accumulators, 120 volts, lot, £5; after 6-114, Worple Rd., Wimbledon. [6921]

Secures Ferranti-Marconi 1929 Amplifier. Components include Reinartz detector, P.M.6D, A.P.F.5, L.610, A.P.F.5C, 2 P.625s (push pull), O.P.M.I.C. post, Bellini terminals, etc.; takes 60 m.a. at 250 v., used as grammo radio for demonstration.—Heard evening at 7, Whitechurch Gardens, Edgware. [6919]

J.S. Receiver, 1924 type, complete with 4 Mullard valves, new Lucas 6-volt accumulator, head phones, 500 ohm loud-speaker; £10.—Apply, 57, Watney Rd., Putney. [6918]

MOOSE Any Set or Kit, and get free after sales service; testimonials from titled gentry, etc.—Write now, Radio, 447, Fulham Palace Rd., S.W.16. [6916]

BATTERIES.

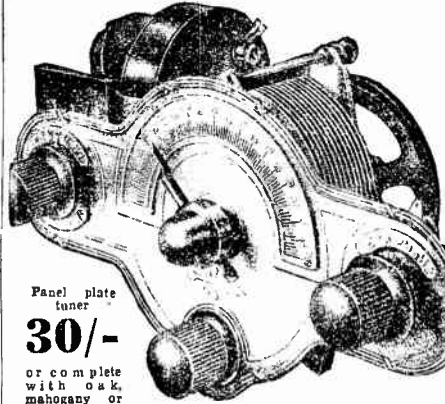
D.E.S. Accumulator Hire and Maintenance Service (5 mile radius).—98, Cherry Orchard Rd., Croydon. [6374]

H.T. H.T. Replacements.—Sacs (capped or uncapped), highest grade, No. 1, 10d. per doz.; No. 9, 9d. per doz.—See below.

NCS.—Best quality (wired), No. 1, 8d. per doz.; No. 2, 9d. per doz.; orders valued 5/- carriage otherwise 6d. for postage.—British Battery Co., London Rd., Watford, Herts. [0258]

H.T. H.T. Batteries.—Parts per dozen, jars, No. 1, 2 1/4 x 1 1/2 square, 1/3; No. 2, 1 1/6; zincs, No. 1, 1/3; No. 2, 11d.; sacs, No. 1, 1/2 dozen; No. 2, terminals, 8d., 10d.; dozen cells (18 volts), complete with bands and electrolyte, No. 1, 4/1; No. 2, post 9d.; high efficiency, long life, self charging, small; send 6d. for sample unit; illustrated list free, carriage free orders 10/-; write for free wireless bargains; trade supplied.—W. Taylor, 57, Ley Rd., Stockwell, London. [0039]

WHAT A TUNER!



Panel plate tuner

30/-

or complete with oak mahogany or walnut panel, 18" x 8 1/2", 35..

A boon to every constructor.

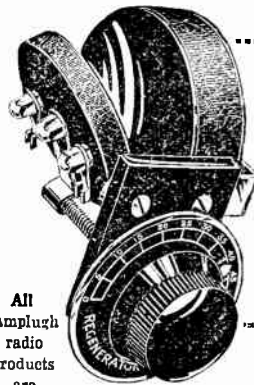
See its handsome appearance, matched only by its perfect efficiency and high-class construction, and THEN realise in brief what it is—a COMPLETE tuner, covering all B.B.C. local and high-power wave-bands, that gives any set constructor the actual basis of a first-class receiver. For it embodies a Coil-unit, a Slow Motion Straight Line Condenser, specially matched with the coil-unit, giving exceptionally fine adjustment, a Push-pull Switch for local and high-power stations, and a Push-pull Battery Switch for "On" and "Off." NOW, isn't that just what you want?

LAMPLUGH

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Write to us for all your radio requirements, Sets, Speakers, Radio Gramophones. Popular sets: two-valve 14.2.8, three-valve, £5.7.8



QUALITY AERIAL TUNER.

Ideal for set builders, covers entire band of wavelengths. One hole fixing. Supplied with a pointer on the Reaction Control and an embossed indicator dial, price

12/6

EACH.

All Lamplugh radio products are guaranteed for twelve months.

M.B.

Batteries.—Contd.

PENTODE Users.—Write for details of new size self-charging wet battery; 20,000 milliamps, 6d. per volt; illustrated catalogue giving data, post free.—J. Taylor, 57, Studley Rd., Stockwell, London. [0273]

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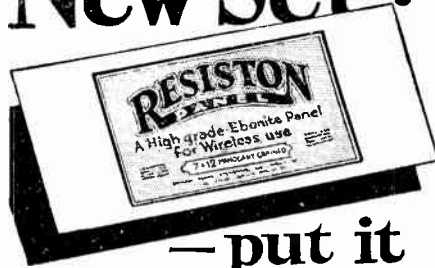
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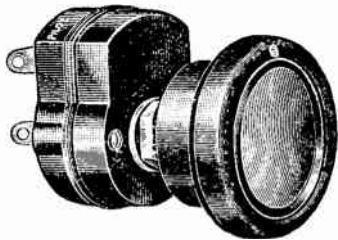
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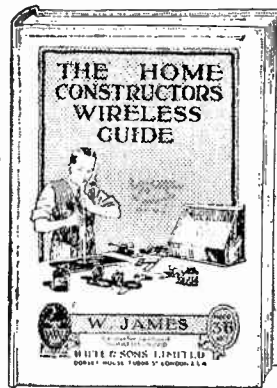
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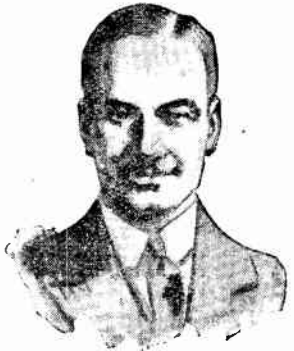
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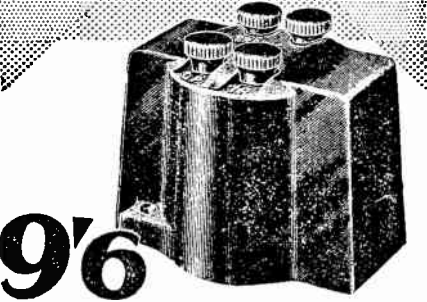
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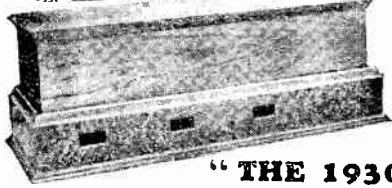
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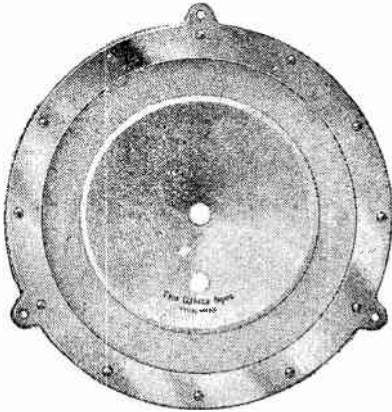
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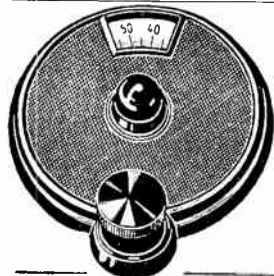


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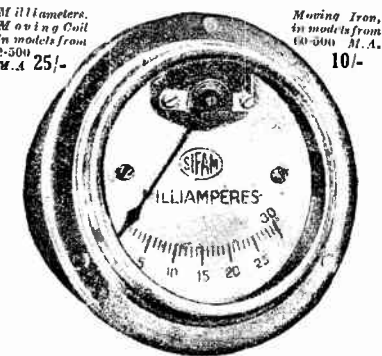
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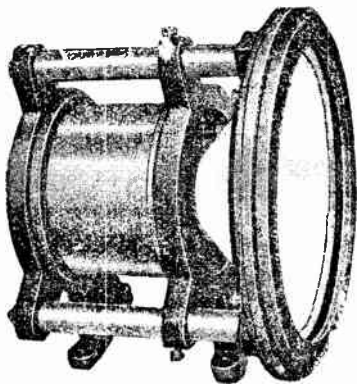
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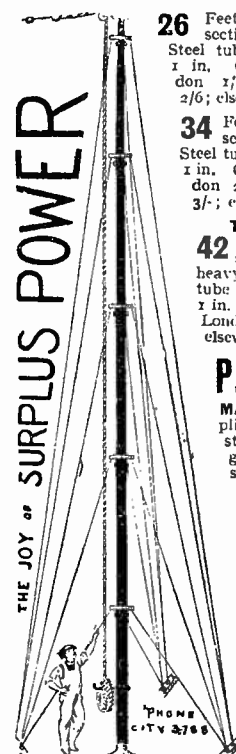
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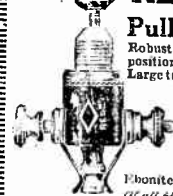
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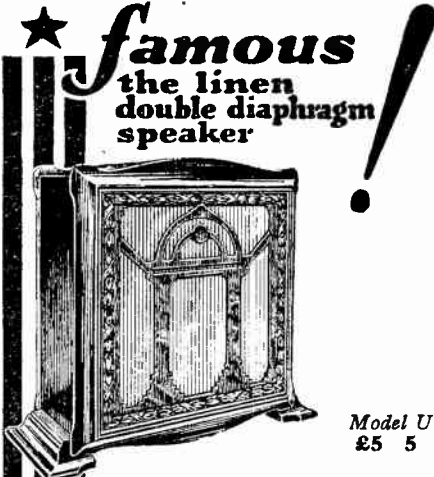
RPLUS.—Geophone 0.0005 sq. law geared variable with dial, 6/6; Burton 0.0005 S.L.F., 3/-; Detex dial, 2/-; P.M.256, new, 10/6; D.E.5A, 3/6; H.610, 3/6; Philips A409, 2/6; 30/- lot, post free: am accumulator, C.L.6, as new, 10/6, and carriage. Ryland Rd., Edingston, Birmingham. [6893]

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WE have recently had two of the chassis models on test, and can say right away that we consider the results impressive. The design of the "Air Chrome" is a complete break-away from the conventional. There is no suspicion of drumminess. Indeed, the response is distinctly clean cut, although it must be mentioned that there is ample continuance. In fact in this regard the "Air Chrome" has qualities that have hitherto been almost peculiar to the moving coil class. Bass notes come through excellently, while the harmonic range is so well embraced that high notes retain their individuality. Speech is crisp and natural.

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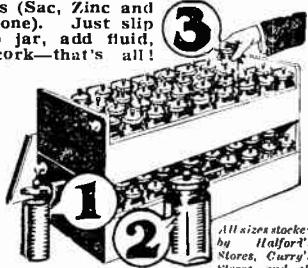
The battery will then register its original voltage. Think what this means to you!

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**OUR Old Apparatus Taken in Part Payment** for Latest Type; see our advert. in column "Receivers for Sale."—Scientific Development Co., 51, Gergate, Preston. [0229]

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**Radio or Gramophone Manufacturers**.—The proprietors of British Patent Specification No. 312,130 (Improved Electrical Gramophone Pick-up) invite enquiries with view to sale or manufacture under licence.—357B, c/o *The Wireless World*. [6853]

**PATENT AGENTS.**

**Patents and Trade Marks**, British and foreign.—Gee and Co. (H. T. P. Gee, Member R.S.G.B. and I.R.P.), 51-52, Chancery Lane, London, W.C.2. ne: Holborn 1525. [0001]

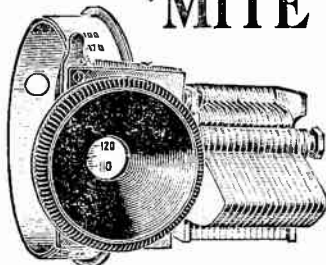
**NG'S PATENT AGENCY, Ltd.**, 146a, Queen Victoria St., E.C.4.—Free advice and handbook on patenting inventions and registering trade marks by letter agent with 43 years' experience. [0002]

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**DRUM DIAL**

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**Supplied for RIGHT or LEFT HAND Operation**

State which arrangement is required when ordering.

Cat. No.	Cap.	Price.
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W. 202	.0003	11/-
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**WILKINS & WRIGHT LTD**

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**FERRANTI Moving Coil Voltmeter**, output choke.—55, Toston Drive, Wollaton Park, Nottingham. [6915]

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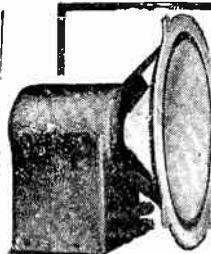
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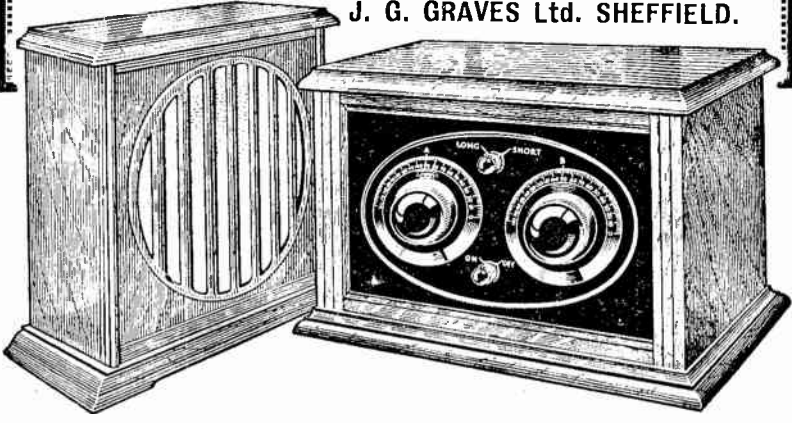


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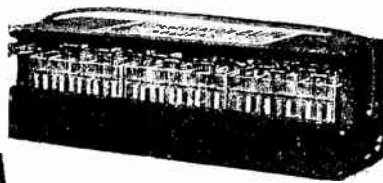
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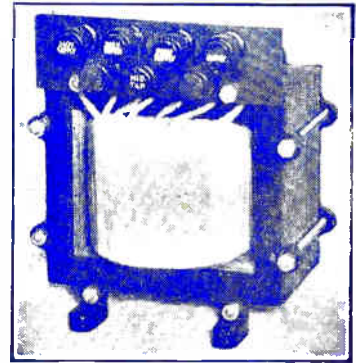
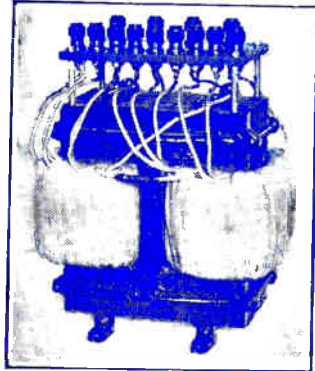
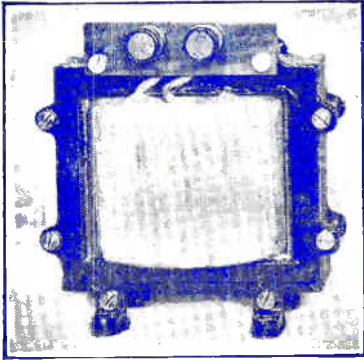
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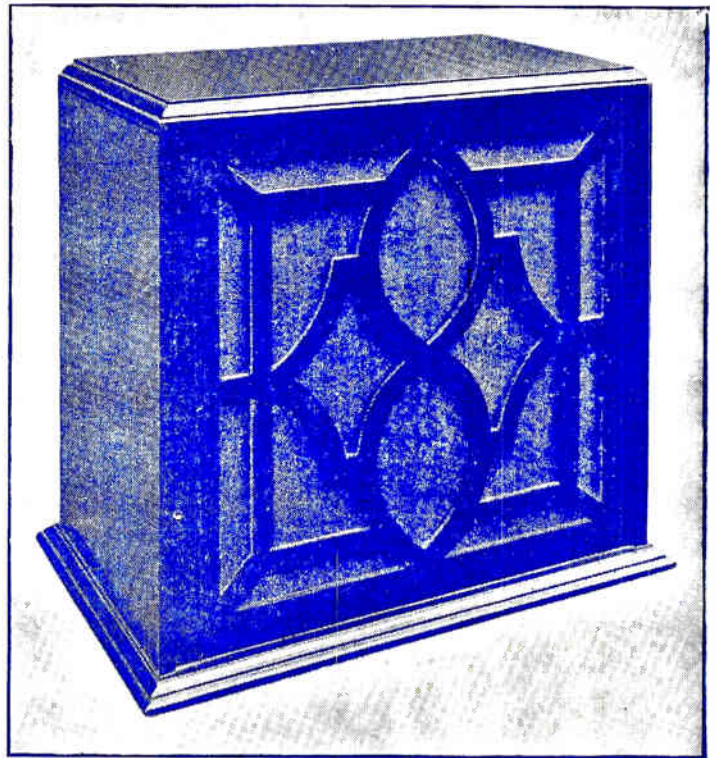
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