OLYMPIA SHOW COMPETITION—Winning Apparatus Described.

The Wireless World

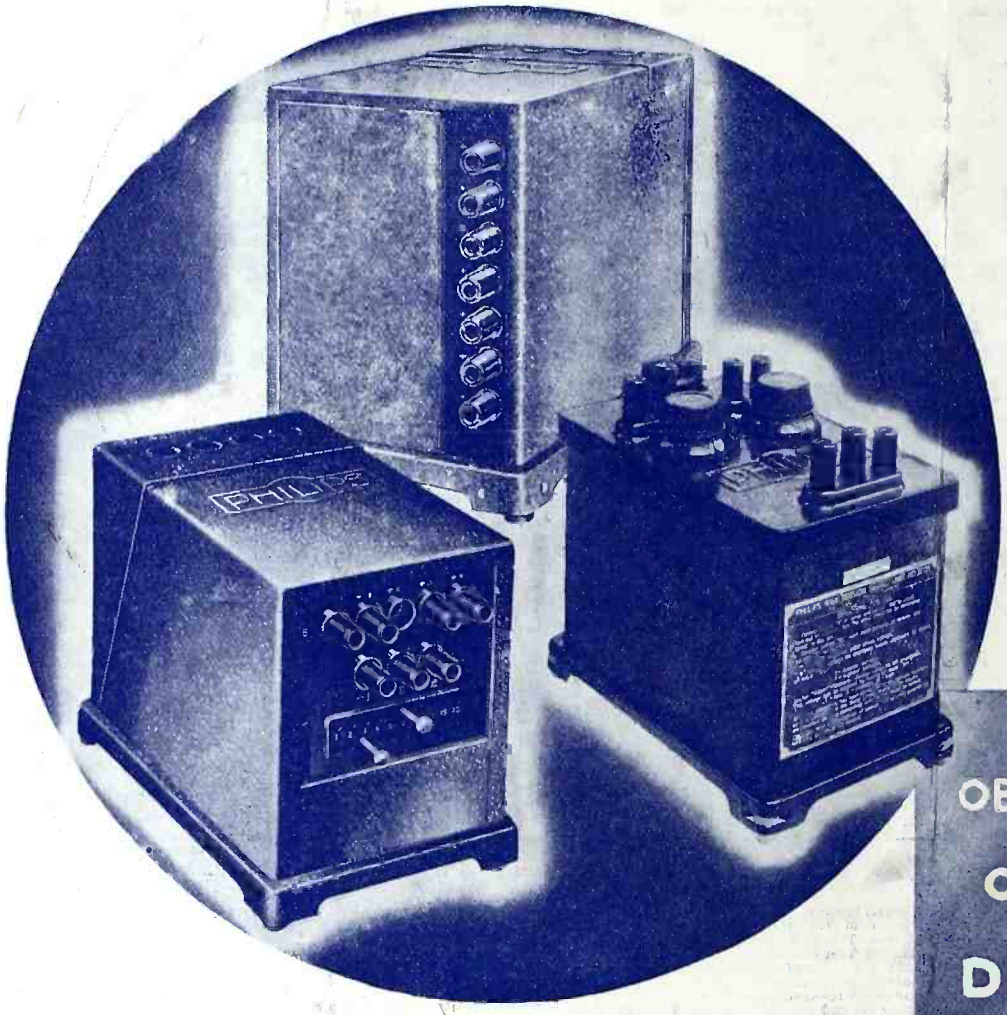
AND RADIO REVIEW

4D

The Paper for Every Wireless Amateur

Wednesday, November 12th, 1930.

No. 585. Vol. XXVII. No. 20



OBTAINABLE ON 10/- DEPOSIT

BATTERY ELIMINATORS FOR A.C. & D.C. MAINS

Battery eliminators do away with all the trouble caused by H.T. Batteries. They ensure an absolutely constant H.T. supply and faultless reception. Their initial outlay is their last expense, for the cost of running is practically negligible. Philips Battery Eliminators are made for both A.C. and D.C. mains and are absolutely reliable.

Type 3005 for D.C. mains - Price **£3.17.6.**
Type 3002 for A.C. mains - Price **£5.10.0.**
Type 3009 for A.C. mains - Price **£5.15.0.**
Or on easy hire purchase terms for 10/- deposit.

PHILIPS BATTERY ELIMINATORS

Made by the manufacturers of the famous Philips Argenta lamps, all-electric radio receivers, commercial and industrial fittings and neon signs.

To PHILIPS LAMPS LTD., Philips House, 145, Charing Cross Road, London, W.C.2.

Please send me an illustrated catalogue of Philips receivers and battery eliminators.

Name .....

Address .....

.....

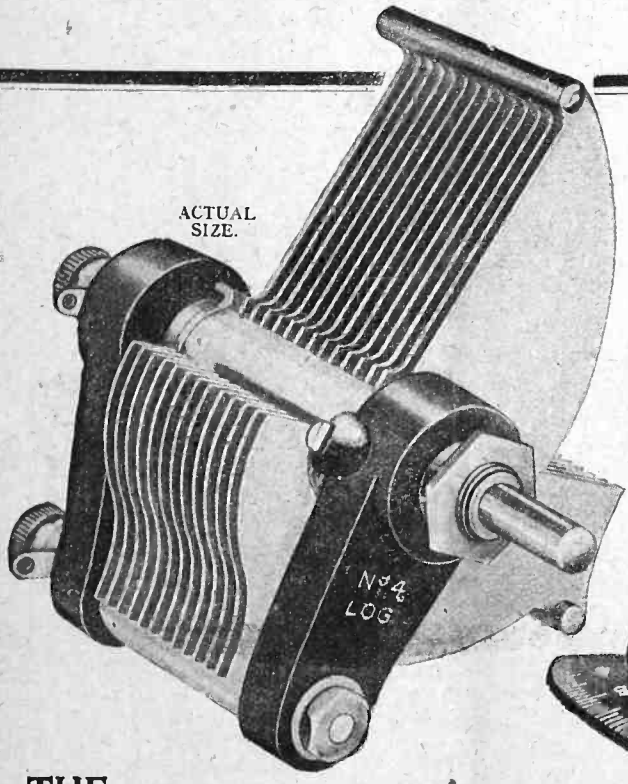
W.A.W.

PHILIPS LAMPS LTD., PHILIPS HOUSE, 145, CHARING CROSS ROAD, LONDON, W.C.2.

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

COMPACT... STRONG... ACCURATE...

2 New ORMOND CONDENSERS for Modern Radio

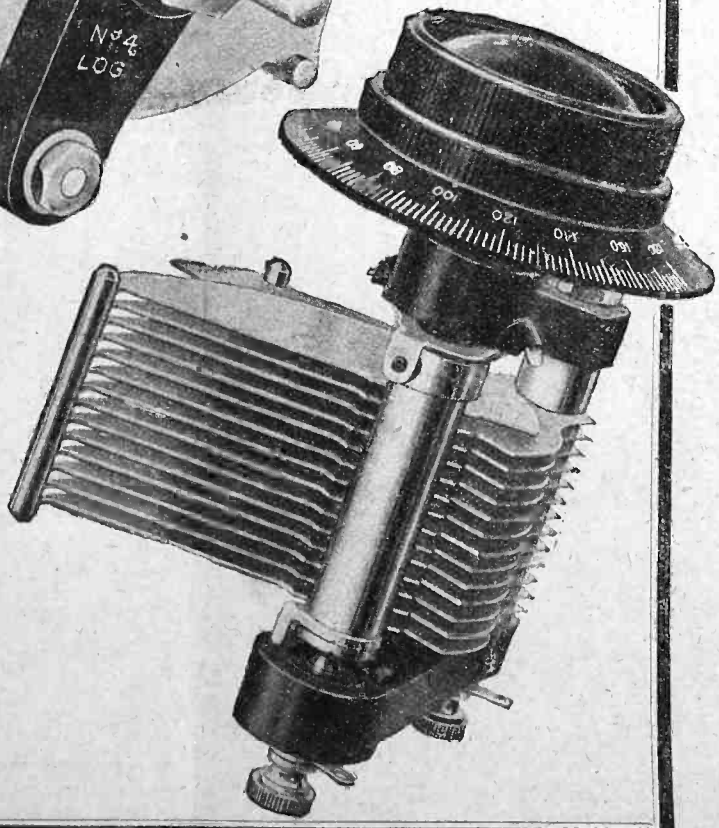


THE ORMOND No. 4 LOG CONDENSER

Designed to follow the Logarithmic Law, it has such value that it will be found very suitable for use under average conditions in the modern receiver. The vanes are of aluminium, firmly secured to slotted spindles. The condenser ends are of best quality bakelite, with the greatest possible reduction in size.

This condenser is not supplied with dial.

Capacity		Price
·00025		4/-
·00035	„	4/-
·0005	„	4/-



THE ORMOND No. 4 LOG SLOW MOTION CONDENSER

Direct drive is obtained by means of a beautifully finished 2½ inch diameter bakelite dial engraved 0 to 180 degrees. Slow motion ratio approximately 9 to 1 is incorporated in the condenser and is controlled by means of the upper small knob.

Complete with 2½ inch dial and slow motion control knob.

Capacity		Price
·00025		6/-
·00035	„	6/-
·0005	„	6/-

SOMETHING quite new in condenser design. Rigid, robust and amazingly efficient, these new Ormond Condensers of skeleton construction have proved a great advance, both in convenience and efficiency. Most attractive appearance and beautiful finish.

A condenser which can be relied upon to give the maximum performance and the maximum satisfaction always. They are wonderful value.

ENGINEERING ORMOND COMPANY LTD

Registered *Trade Mark.*

THE
ORMOND ENGINEERING
COMPANY, LIMITED,
ORMOND HOUSE,
ROSEBERY AVENUE, LONDON, E.C.1.
'Phone: Clerkenwell 5334/5/6 and 9344/5/6.
Telegrams: "Ormondengi, Smith."

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

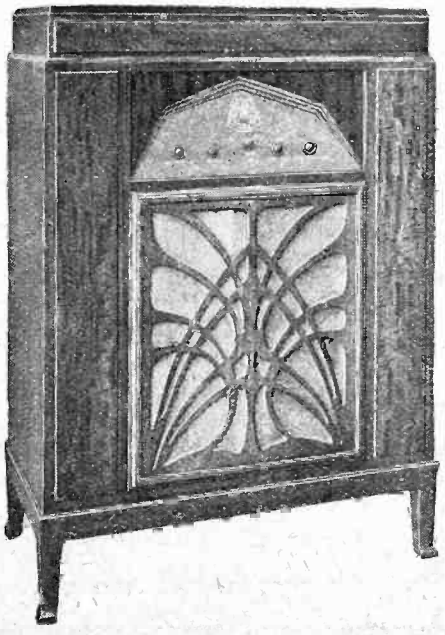
VOTED The FINEST:—— RADIO GRAMOPHONE AT OLYMPIA

Awarded 1ST place in "THE WIRELESS WORLD" Competition

THE

R.G.D.

REALITY



THE R.G.D. DE LUXE ALL ELECTRIC RADIO GRAMOPHONE.

2 Screened Grid Stages.

BAND PASS FILTER.

Super Selective.

SINGLE KNOB TUNING.

FADER FROM RADIO TO RECORD.

ABSOLUTE

THE public were able to say that this instrument gives the very best that both radio and gramophone can give as the instrument "Ideal for quality." Its radio side is so powerful that given favourable atmospheric conditions over 30 stations can be received with ample volume. The quality of reproduction from distant stations is equal to that of local stations. All Mains operated, with exclusive cabinet design,

IN OAK, £80 MAHOGANY, £85

Send for illustrated catalogue and literature.

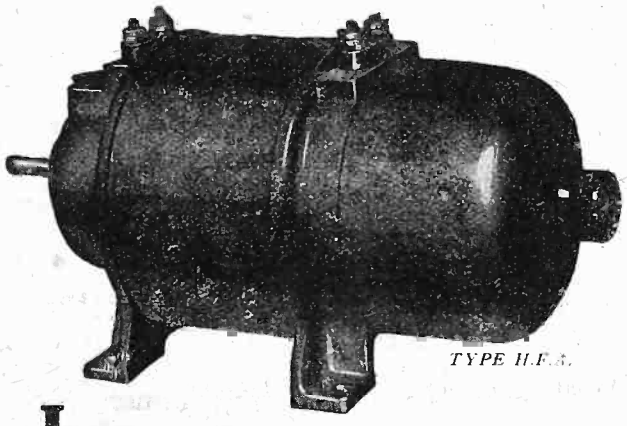
(Agencies VACANT)

London Agents: THE RADIO ELECTRIC STORES
164, CHARING CROSS ROAD, LONDON, W.C.2

THE RADIO GRAMOPHONE DEVELOPMENT Co.,
72, Moor Street, BIRMINGHAM.

RELIABILITY in D·C to A·C MACHINES

YOUR power supply problems can be simply and efficiently solved by one or other of the M–L Machines. Write for your free copy of "The Book of the M–L Rotary Transformer," which deals with all machines of our manufacture.



TYPE H.F.A.

M-L ROTARY TRANSFORMERS

Types H.E.A and H.F.A. deliver an A.C. output at 110v. or 230v., 50 cycles when connected to D.C. supply mains. Machines supplied to run from any voltage; country house lighting plant or D.C. plants on private yachts. H.E.A. type, 40 watt, £13. H.F.A. type, 85 watt, £17. Recommended and used by Philips Radio, Marconiphone, Burndept, Kolster–Brandes, M.P.A., etc., etc.

M-L ANTI-INTERFERENCE UNIT

For use with M–L Rotary Transformers. Price £2.

THE M-L MAGNETO SYND. LTD., Radio Department, COVENTRY.

Telephone: 5001.

Contractors to the Air Ministry, the B.B.C., the G.P.O., Marconiphone, The Gramophone Co., Ltd., etc., etc.

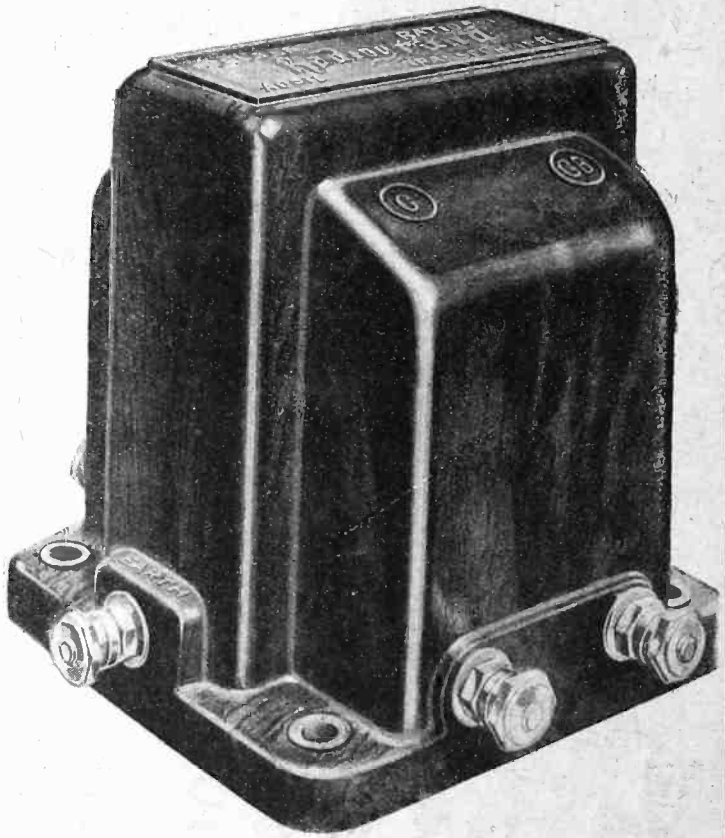
ROTARY TRANSFORMER SPECIALISTS

Godbolds

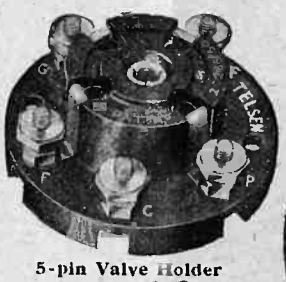
 Advertisements for "The Wireless World" are only accepted from firms we believe to be thoroughly reliable.

100% EFFICIENCY & RELIABILITY IN TELSEN COMPONENTS

Performance is built into them . . . The design is right . . . The workmanship . . . Superb! The materials . . . the best. They are constructed for the enthusiast who is appreciative of and determined to get the finest radio reproduction. Every component is made to function perfectly . . . individually and collectively. Try them . . . Modernise your old set . . . or insist on Telsen Components for your 1931 Receiver, and get 100% efficiency.



TELSEN H.F. CHOKES. Designed to cover the whole wave-band range from 18 to 4,000 metres, extremely low self-capacity, shrouded in Genuine Bakelite. Inductance 150,000 henries. Resistance 400 ohms. Price **2/6** each.

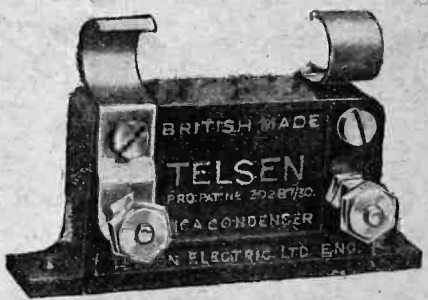


5-pin Valve Holder
PRICE **1/3**

TELSEN FIVE-PIN VALVE HOLDER. Pro. Pat. No. 20286/30. Genuine Bakelite Mouldings fitted with Nickel Silver shock-absorbing spring contacts. Price **1/3** each.

TELSEN VALVE HOLDERS. Low capacity, self-locating, supplied with patent soldering tags and hexagon terminal nuts. Price **1/-**

4-pin Valve Holder
PRICE **1/-**



TELSEN FIXED (MICA) CONDENSERS. Shrouded in Genuine Bakelite, made in capacities up to ·002 mfd. Pro. Pat. No. 20287/30. ·0003 supplied complete with Patent Grid Leak Clips to facilitate series or parallel connection. Can be mounted upright or flat. Tested on 500 volts. Price **1/-** each.

Telsen "Radiogrand" Transformer, new model, shrouded in Genuine Bakelite, with new windings and core, fitted with earth terminal. Made in ratios 3—1 and 5—1. Price **12/6** each.

Telsen "Ace" Transformer, the ideal model for all Portable Sets, and where space is limited. Made in ratios 3—1 and 5—1. Price **8/6** each.

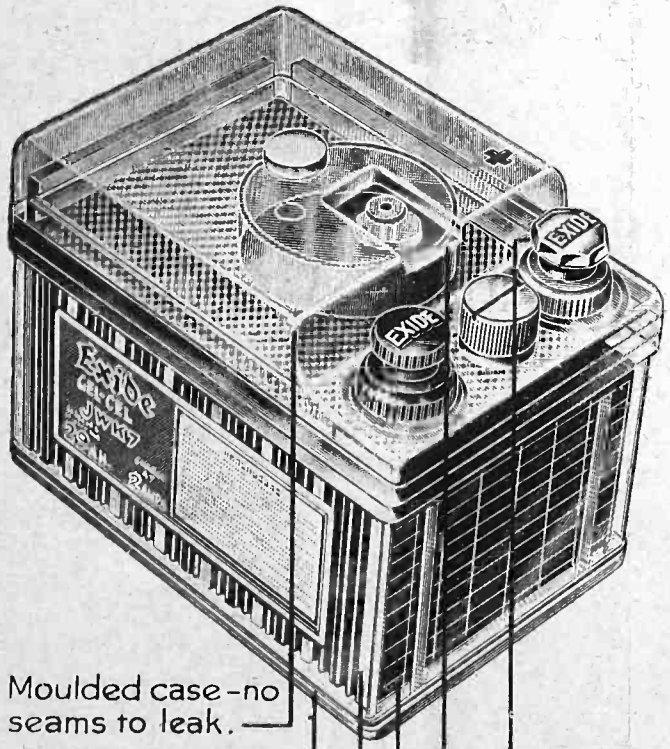
Telsen 7—1 Super Ratio "Radiogrand" Transformer, giving enormous amplification with perfect reproduction, shrouded in Genuine Bakelite, with new windings and core, fitted with earth terminal. Price **17/6** each.

TELSEN
COMPONENTS

Advt. of Telsen Electric Co. Ltd., Birmingham

Mention of "The Wireless World," when writing to advertisers, will ensure prompt attention. A8

Voted—the best battery in Wireless World public Ballot



AGAIN an Exide Battery has won first place in the "Wireless World" Olympia Ballot. Every year an Exide Battery wins this distinction. This now-famous Ballot is voted in by the more advanced wireless experimenters—men who know what to look for in a battery. In the Exide Gel-cel—the new jelly acid battery—they have seen advantages never before available in a low tension battery for portables. Examine them yourself and when next you need a battery for a portable set you will insist on an Exide Gel-cel.

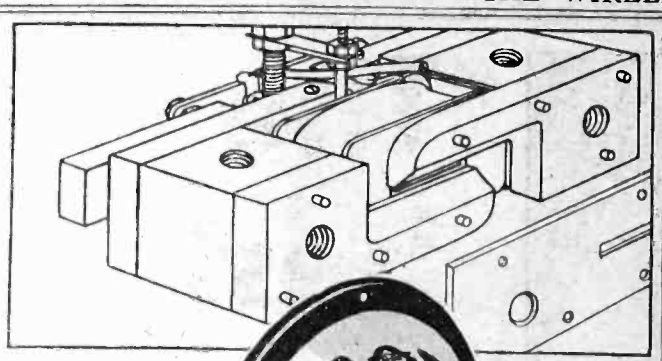
Exide GEL-CEL

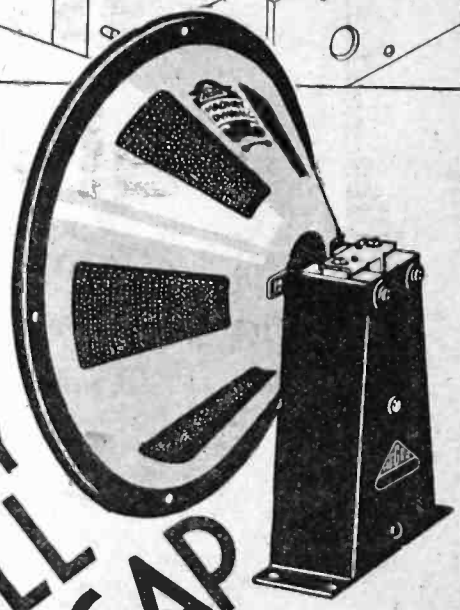
There is a size to suit every set. Prices range from 13/-

From Exide Service Stations or any reputable dealer. Exide Service Stations give service on *every* make of battery

Exide Batteries, Clifton Junction, near Manchester. Branches at London, Manchester, Birmingham, Bristol and Glasgow

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





THE VERY SMALL AIR GAP

• • • • •

THE special design of the magnet system in the new Hegra Magnet Dynamic Speaker enables a very small uniform air gap to be employed. This, together with pole shoes specially shaped to give a compensated field, ensures uniformity of armature response. At the same time, it is impossible for the armature to come into contact with the pole-pieces.

This Hegra Speaker therefore handles, without distortion or overloading, an input up to 4 watts, which makes it the equal of a moving coil instrument, yet without the necessity for separately energising the field windings.

It is particularly suitable for use with gramophone pick-ups and P.A. systems as well as for ordinary receivers.

This Speaker is fitted with a triple lead giving impedance values suitable for any type of output valve—a very important feature.

The Hegra Magnet-Dynamic Speaker Chassis complete £2-16-0
In handsome Walnut Cabinet £5- 0-0

This and other Hegra Speakers are obtainable from all reputable dealers.

EDINBURGH RADIO EXHIBITION, STAND No. 7.

HEGRA

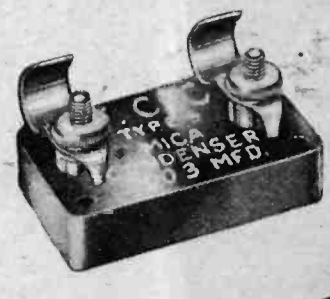
M.C.18

LITTLE STORIES OF GREAT MOMENTS

"I dare not do it!"

When a young shepherd boy, bitten by a mad dog, was brought to him for inoculation, Louis Pasteur, the great French scientist, was tormented by indecision. Should he put his life's work to the test? Would it save—or end—the boy's life? He decided, the boy was saved, and long years spent in doing one thing and doing it well, were rewarded with success.

It is this same spirit of "doing one thing and doing it well" which has, for years, been behind all T.C.C. endeavour. That is why T.C.C. have never made anything but Condensers, and why T.C.C. Condensers are unmatched—for accuracy and dependability.

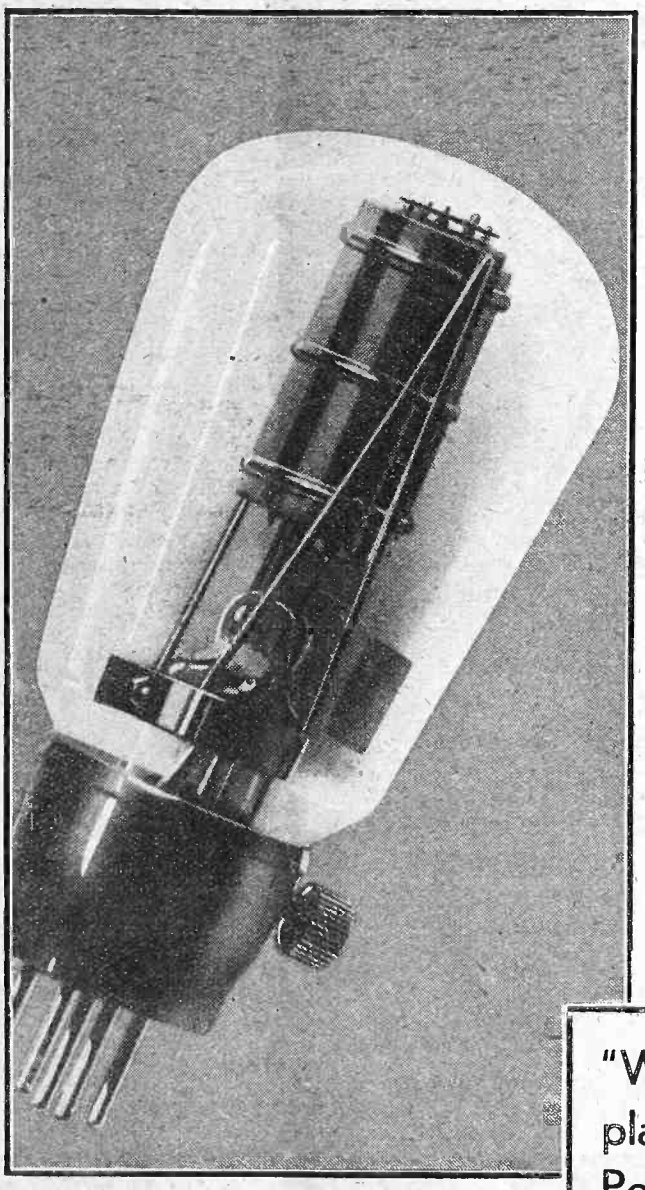


The T.C.C. .0003 mfd. Flat type Mica Condenser is shown here. Price 1/3.

T.C.C. CONDENSERS

TELEGRAPH CONDENSER CO., LTD., N. ACTON, W.3.

6588



"The best valve at the Show"

"Wireless World" readers place the Mazda A.C. Pen **FIRST** in the class for Valves in the Olympia Show Competition!

THE AMAZING

MAZDA A.C.PEN

PRICE 27/6

Here is striking evidence of the excellence of the Mazda A.C.Pen—and to the value it offers! "Wireless World" readers—the most critical public—placed this Valve FIRST in the class for valves (section 6) in the Olympia Show Competition. There could be no better testimony than this to our slogan "The finest range of valves the world has ever known."

V.91

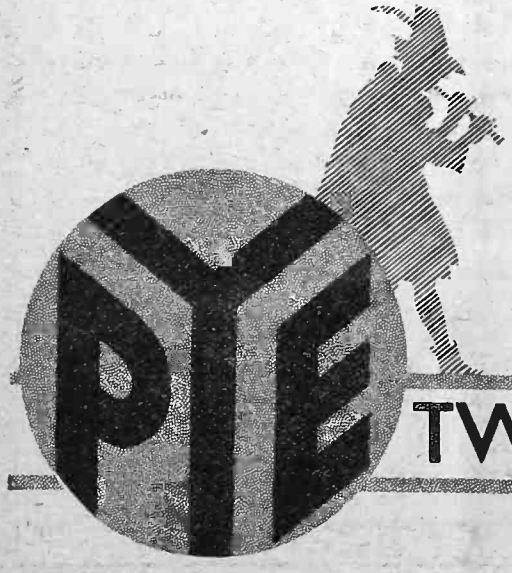
THE EDISON SWAN ELECTRIC CO., LTD.
Incorporating the Wiring Supplies Lighting Engineering, Refrigeration and Radio Business of the British Thomson-Houston Co. Ltd.
Radio Division
1a Newman Street, Oxford Street, W.1
Showrooms in all the Principal Towns

EDISWAN

TRIUMPHANT AT OLYMPIA

IRRESISTIBLE PREDOMINANT

First in the Wireless World Ballot . . . First in public estimation! . . . There has never been anything in Radio to compare with the Pye TWINTRIPLE Portables. New in technique, new in presentation, new in performance. Completely portable and completely self-contained (Battery model or All-Electric models) . . . altering and widening the whole outlook of radio reception, the Pye TWINTRIPLE Portables have created the greatest public demand in the history of radio.

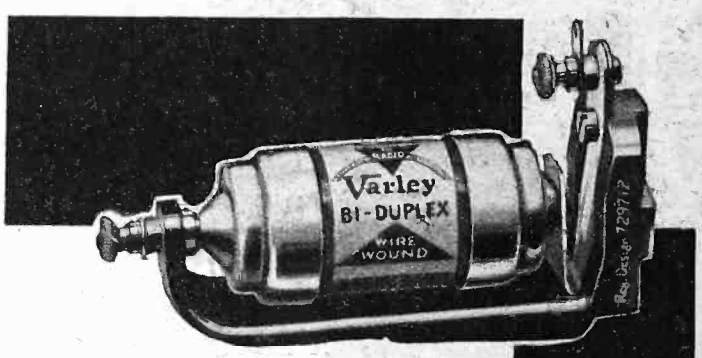


TWINTRIPLE PORTABLES

Pye Radio Ltd., Sales Organisation, Paris House, Oxford Circus, W.1.

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

ADAPTABLE FOR ANY SET



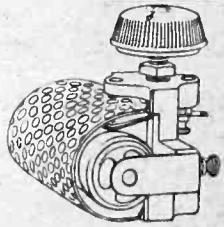
Accurate, constant in value, silent in use and free from breakdown—use Varley Bi-duplex Wire-wound Anode Resistances wherever you need a fixed resistance for radio purposes.

Their special "Universal Holder" allows them to be fixed either vertically or horizontally, making them adaptable for *any* set. And they are guaranteed accurate to within 5%.

Varley Components are the outcome of more than 30 years' experience. The famous Varley Bi-duplex Winding is giving to tens of thousands of listeners a quality of radio that would otherwise be unobtainable.

Complete range from 5,000 ohms to 500,000 ohms. Prices 4/6 to 17/6 (including Universal Holder).

Write for Section B & C of the Varley Catalogue.



VARLEY POWER POTENTIOMETER.

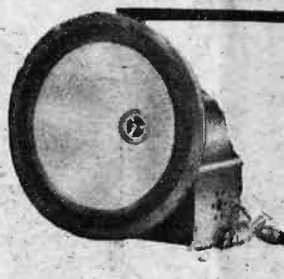
Ideal for use as voltage regulator in H.T. eliminators. Wire-wound. Spring loaded contact arm. Carries up to 20 watts.

Complete range, 9/6 to 11/6.

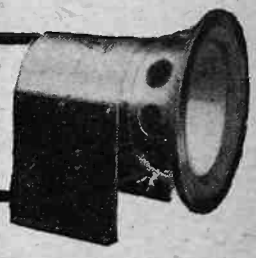
For RADIO
OLIVER PELL MANUFACTURE
Varley

Advertisement of Oliver Pell Control Ltd., Kingsway House, 103, Kingsway, London, W.C.2. Telephone: Holborn 5303.

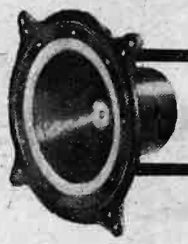
Perfect reproduction now costs less



SENIOR R.K. (For A.C. Mains Field Excitation). Fitted with 10" corrugated cone, with moving coil having an impedance of 10-15 ohms at 50/4000 cycles. Price £10 10s. Also supplied complete with Oak cabinet £20. Mahogany cabinet £24 10s. Walnut cabinet £25 10s. Also supplied without rectifier.



JUNIOR R.K. Fitted with 6" corrugated Cone, with moving coil having an impedance of 10-15 ohms at 50/4000 cycles. Price £4 15s. This model is not supplied complete with cabinet.



PERMANENT MAGNET R.K. Fitted with 8" Corrugated Cone. Price £6 15s. Also supplied complete with Oak cabinet £16 16s. Mahogany cabinet £21. Walnut cabinet £22.

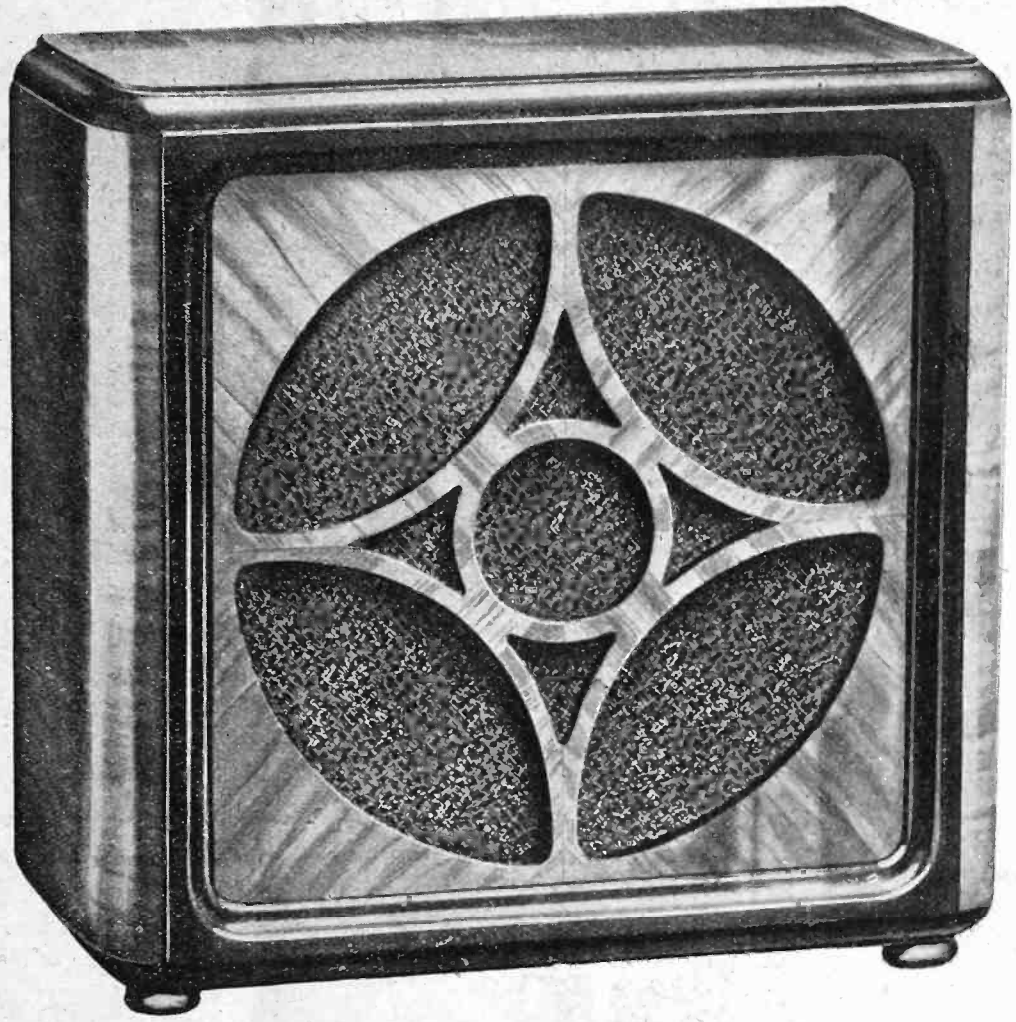
The wonderful R.K. reproducers have stood the test of four years and still remain in unchallenged supremacy. They are without doubt the finest reproducers ever built. We agree that R.K.'s cost a little more than some other loud speakers, but the results are so far superior as to make the additional cost seem absurdly inadequate. Our unique hire purchase facilities are at your disposal, so that you can possess and use one of these remarkably fine speakers on payment of only a small deposit.

RK
REPRODUCERS

ASSOCIATED ELECTRICAL INDUSTRIES LTD
AEI

THE EDISON SWAN ELECTRIC CO. LTD.,
Incorporating the Wiring Supplies, Lighting Engineering, Refrigeration and Radio Business of the British Thomson-Houston Co., Ltd.
Radio Division,
1a, Newman Street, Oxford Street, W.1
Showrooms in all the Principal Towns

EDISWAN W. 109



BLUE SPOT 29R

Blue Spot Speakers are in a class all by themselves—Blue Spot Speakers are the best in the world. 29R is the best of the Blue Spot Speakers . . . Put two and two together, what follows? . . . Yes, quite right, 29R *is* the best in the world. **£6-6-0**

Blue Spot
TRADE MARK

THE BRITISH BLUE SPOT COMPANY LTD.

BLUE SPOT HOUSE, 94/96 ROSOMAN STREET, ROSEBERY AVENUE, LONDON, E.C.1

'Phone: CLERKENWELL 3570. 'Grams: "BLUOSPOT, SMITH, LONDON."

Distributors for Northern England, Scotland and North Wales: H. C. RAWSON (Sheffield and London), LTD., 100 London Road, Sheffield; 22 St. Mary's Parsonage, Manchester; 183 George Street, Glasgow.

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

How to bring in Foreign Stations

READ WHAT "THE WIRELESS TRADER" AND "THE MUSIC SELLER" SAY ABOUT

THE GAM-BRELL A.C. ALL-ELECTRIC THREE

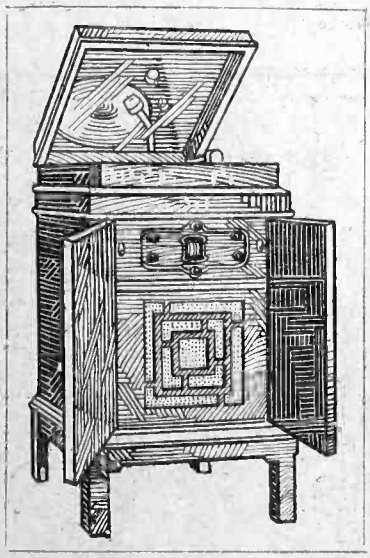
"The Wireless Trader" says:—

". . . . . 11 miles from Brookman's Park, using an inside roof aerial . . . it was possible to limit the spread of both the London Regional and National stations to 3 degrees on a 100 scale and still obtain them at good volume. This, of course, represents extremely good selectivity and sensitivity."

London National	261 Metres
Toulouse (France)	255 ,,
Midland Regional	479 ,,
Langenberg (Germany)	473 ,,

Königs Wusterhausen, Radio-Paris, Daventry National

ALL CLEAR OF EACH OTHER



THE GAM-BRELL RADIO NOVOGRAM

In addition to having most modern type of valves and circuit, giving long range, volume and maximum output, this instrument is fitted with Garrard electric gramophone motor with automatic stop. B.T.H. pick-up. One-at-a-time needle cup. Highest class electro dynamic loudspeaker. Volume control on both radio and gramophone. The famous Novotone is, of course, incorporated, and the result when reproducing records is "amazing realism."

This is the Receiver tested and reported upon by "The Wireless Trader" and "The Music Seller."

Nothing has been spared in order to make Gam-brell All-electric Receivers the most perfect and ideal musical instruments obtainable.

Every possible refinement is incorporated, with the result that each model is "outstanding" of its type.

THE GAM-BRELL ALL-ELECTRIC THREE
D.C. £24 - 0 - 0 *A.C.* £26 - 15 - 0

THE GAM-BRELL BUCKINGHAM MODEL
D.C. £37 - 0 - 0 *A.C.* £45 - 0 - 0

THE GAM-BRELL RADIO NOVOGRAM
D.C. 62 *Guineas.* *A.C.* 70 *Guineas.*

Send for Descriptive Folder, "R.W."

Demonstrations Arranged without any obligation

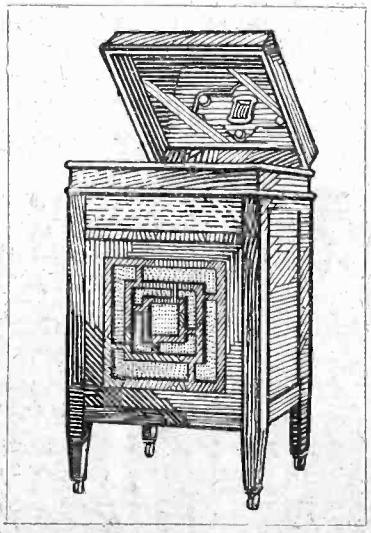
"The Music Seller" says:—

"Gambrell Radio Ltd. have fitted every refinement to this Receiver and the results have repaid the trouble taken in this respect."

"Hair-line selectivity is arrived at by an additional tuning device . . . This greatly assists in reducing interference."

"With a little care and practice in tuning, some forty stations are to be received at good strength."

RECEIVED AT GOOD STRENGTH



THE GAM-BRELL BUCKINGHAM MODEL

The new Gam-brell receiver was designed to meet the need for an All-electric receiving set incorporating its own highest class moving coil loudspeaker, yet occupying but little floor space.

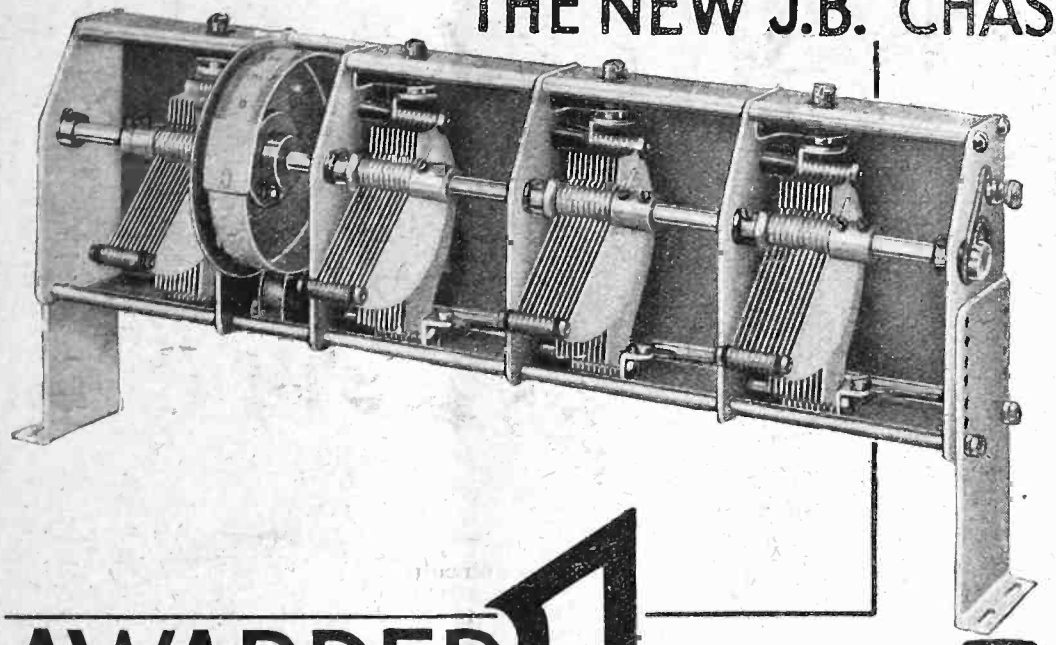
Selectivity is of the highest order, tuning is simple as a calibrated card is supplied giving wavelengths. Changes of programmes are assured without using an aerial, but with one, numerous Continental and British stations are perfectly received. Can be moved from room to room, as cabinet is fitted with easy running castors.

GAMBRELL is the name to know—for All-electric RADIO

GAMBRELL RADIO LTD., 6, Buckingham Street, Strand, London, W.C.2.

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

THE NEW J.B. "CHASSIMOUNT"



Chosen by the Public as the outstanding exhibit in Class 7, the New J.P. "Chassimount" has proved one of this season's biggest successes.

AWARDED 1st place by the public in "Wireless World" Olympia Competition

The natural outcome of J.B. precision and J.B. experience, the J.B. "Chassimount" Screened Gang Condenser is the newest and most effective method of one-dial control. Its single knob will tune from two to six circuits *accurately*.

The J.B. "Chassimount" is not merely a number of condensers ganged together. It is built and designed as a unit, and each stage is adequately screened.

J.B. Variable Condensers are Precision Condensers in the truest sense. Freedom from stray capacities and H.F. losses is achieved by cutting away all surplus materials. At the same time their rigid construction ensures calibration which will never vary.

J.B. "CHASSIMOUNT" GANG CONDENSERS.

Type D4 (illustrated above) 4 stage ·0005 with Drum Drive. Price 42/6.

2 stage	·0005	26/6
3 stage	·0005	35/-
5 stage	·0005	50/-
6 stage	·0005	57/6

Also available without Drum Drive:

2 stage	·0005	15/-
3 stage	·0005	23/6
4 stage	·0005	31/-
5 stage	·0005	38/6
6 stage	·0005	46/-

·0001 Trimmer fitted in each stage. Adjusted once only—no alteration during tuning.

PRECISION INSTRUMENTS

Advertisement of Jackson Bros., 72, St. Thomas' Street, London, S.E.1. Telephone: Hop 1837.

The Wireless World AND RADIO REVIEW

(18th Year of Publication)

No. 585. WEDNESDAY, NOVEMBER 12TH, 1930. VOL. XXVII. No. 20.

Editor: HUGH S. POCOCK. Assistant Editor: F. H. HAYNES.

Editorial Offices: 116-117, FLEET STREET, LONDON, E.C.4. Editorial Telephone: City 9472 (5 lines).

Advertising and Publishing Offices: DORSET HOUSE, TUDOR STREET, LONDON, E.C.4.

Telephone: City 9852 (25 lines). Telegrams: "Ethaworld, Fleet, London."

COVENTRY: Hertford St. BIRMINGHAM: Guildhall Bldgs., Navigation St. MANCHESTER: 260, Deansgate. GLASGOW: 101, St. Vincent St., C.2.

Telegrams: "Cyclist, Coventry." Telephone: 5210 Coventry. Telegrams: "Autocar, Birmingham." Telephone: 2970 and 2971 Midland. Telegrams: "Iliffe, Manchester." Telephone: 8970 (25 lines). Telegrams: "Iliffe, Glasgow." Telephone: Central 0857.

PUBLISHED WEEKLY. ENTERED AS SECOND CLASS MATTER AT NEW YORK, N.Y.

Subscription Rates: Home, £1 1s. 6d.; Canada, £1 1s. 6d.; other countries abroad, £1 3s. 10d. per annum.

Editorial Comment

A Maximum Royalty.

WE have on several occasions remarked that the old royalty of 12s. 6d. a valve stage, which British manufacturers have paid on their receivers until the comparatively recent reduction, had the effect of influencing receiver design in the direction of limiting the number of valves. Manufacturers strained to get the utmost out of the minimum number of valves, and this very often resulted in seriously handicapping the designer of a set who, if he had had a free hand, would have produced a better set if an extra valve or so had been permissible.

American sets have not paid royalties in proportion to the number of valves, and this is probably one of the reasons why nearly all the better class American sets employ many more valves than our own and are credited with being on the whole more selective than any but the most modern of British sets.

Now that agreement has been reached on the subject of licensing under the patents owned by Marconi's, the Gramophone Company, and Standard Telephones, as announced in our issue last week, and the royalty is to be substantially less than formerly, the question arises as to whether it would not be to the benefit of all concerned if a maximum royalty were fixed so that any receiver employing valves in excess of, say, four stages, would not be called upon to pay a proportionately increasing royalty. Such an arrangement would, in our opinion, stimulate the production of sets of more valve stages, and the designer would have a free hand in the choice of circuit, irrespective of the number of valve stages.

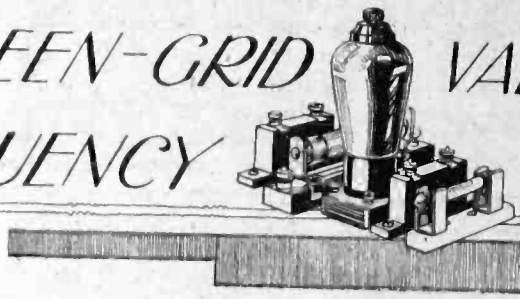
It seems fairly certain that better sets would result from such a policy, whilst the cost of sets employing more valves might not be seriously enhanced, because, to some extent, elaborate screening and other points which are a costly item in manufacture would be minimised where the aim was no longer to get the last ounce out of every valve stage.

Gramophone Broadcasts.

WE believe that the recent experiment of the B.B.C. in transmitting an all-gramophone record concert met with wide approval. One is prompted to enquire why these transmissions, which must obviously be somewhat inferior to direct broadcasts, should be so well received. First, we think that the gramophone record concert had the advantage that every item was short—limited to the length of a record—so that listeners had plenty of variety, and, secondly, the items were by first-class performers representing a fund of talent which could not possibly have been gathered together in the flesh for one evening's performance. If there is any lesson to be learned from the experiment it would seem to be that the public appreciates brevity as a change in broadcast subject matter.

In This Issue

SCREEN-GRID VALVE AS LOW-FREQUENCY AMPLIFIER



Obtaining Stage Gains of 200 and Over.

By D. McDONALD, B.Sc.,

Of the Engineering Laboratory, B.T.H. Co., Rugby.

THIS article describes what the author believes is a new method of connecting a screen-grid valve for audio-frequency amplification, enabling a stage gain of over 200 to be obtained. Before describing the method, it will be well to run over the elementary principles of resistance-capacity amplification.

The maximum amplification that can be realised with a triode is, for the case of resistance-capacity coupling, considerably less than the amplification factor of the valve, and for transformer coupling may actually reach the full magnification factor, and even pass it at the secondary resonance. If R_1 is the effective anode load resistance, R_a the A.C. resistance of the valve, μ the magnification factor, and m the effective stage amplification, then for resistance-capacity coupling we have $m = \mu \frac{R_1}{R_1 + R_a}$.

The term R_1 is called the effective anode resistance because it is composed of the actual anode resistance and the grid resistance of the following valve in parallel. Fig. 1(a) shows the valve V_1 resistance-coupled to V_2; R is the anode resistance, and R_G the grid resistance. The equivalent circuit for alternating signals is shown in Fig. 1(b). The resistances R and R_G are in parallel, since the H.T. positive and H.T. negative should be at the same A.C. potential, the battery providing no effective resistance.

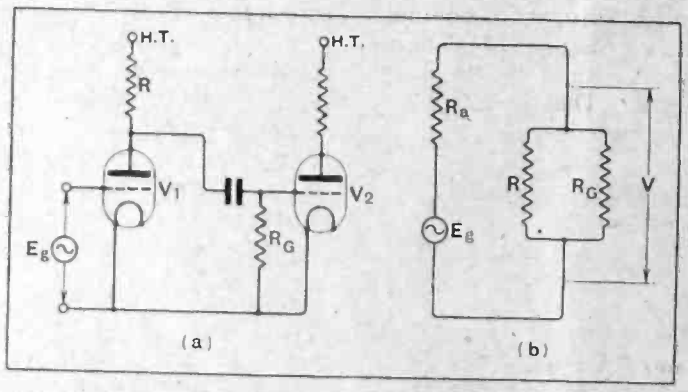


Fig. 1.—Circuit of a conventional resistance-capacity coupled L.F. stage (a). The equivalent circuit with the valve as a fictitious alternator is shown in (b).

The stage gain is: $m = \frac{V}{E_g} = \mu \frac{R_1}{R_1 + R_a}$, where $R_1 = \frac{R R_G}{R + R_G}$. This formula does not take into account the effect of the succeeding valve in shunting the resistance R_G with its own input impedance, which is never infinite. It always consists of a resistance term and a capacity term. The resistance may be positive or negative, depending on whether the valve anode load is capacitative or inductive. The chief trouble, however, arises with the capacity term. Obviously, if this capacity is large enough, it will effectively shunt R_G, at the higher frequencies, and hence lower the magnification. Roughly, this capacity is equal to the anode-grid capacity of the valve multiplied by the effective amplification of that valve. Even for small valves this capacity may be several hundred micro-microfarads, and this, in some cases, definitely limits the value of R_G to a rather low value.

For screen-grid valves, if we assume perfect screening of the anode in the valve, it can be considered as a constant current generator. That is, for a given signal on the control grid a definite fixed alternating current flows in the anode circuit. This is true only if the anode voltage is above the screen-grid voltage; this latter point is important. It can readily be seen that if the above conditions are fulfilled, any value of resistance can be placed in the anode circuit, and there will be developed across this resistance a voltage equal to the product of that resistance and the alternating current.

This can be represented by Fig. 2, if g is the mutual conductance of the screen-grid valve in milliamps per volt on the grid, and R R_G are as before; then a current of gE_g milliamps flows through the circuit and develops across R R_G a voltage V.

And $V = \frac{gE_g}{1{,}000} \times \frac{R R_G}{R + R_G}$ volts $= \frac{gE_g R_1}{1{,}000}$. Hence $m = \frac{V}{E_g} = \frac{g R_1}{1{,}000}$

Thus, we reach the conclusion that the magnification for resistance-capacity-coupled screen-grid valves is dependent only on the mutual conductance and the anode-load resistance, so long as we have perfect screening of the anode and so long as the anode voltage is greater than that of the screen grid. No screen-grid valve has a perfectly screened anode, and it will be shown later that the loss of magnification due to imperfect screening may be considerable.

Screen-Grid Valve as Low-frequency Amplifier.—Now, if the anode voltage can be kept above that of the screen grid, very large magnifications can be obtained. For instance, if we have $R_1 = 500{,}000$ ohms, $g = 0.5$ mA./volt, $m = \frac{R_1 g}{1{,}000} = 250$. It can readily be seen that the slope is a maximum for high anode current, and diminishes as this is reduced. In other words, the curve of anode current against control grid voltage—keeping the screen-grid voltage constant—curves round at the foot, and tends to a straight line farther up. Of course, the valve for this purpose should be worked on the straight portion.

This will be made clear by referring to the curves for an A.C./S.G. valve shown in Fig. 5. These show the variation in anode current when the control grid volts are varied, keeping the anode voltage constant. The slope of these curves at any point gives the value of g, which is seen to decrease very much for very low values of anode current, no matter what may be the anode voltage or grid voltage.

Here we have a limitation, because to pass a reasonably high anode current through, say, 500,000 ohms would require an enormous anode voltage. The figure of merit for a valve for this work would be the value of g for a very low anode current. The chief difficulty encountered when running screen-grid valves resistance-capacity-coupled with high anode resistances is as follows:—If the valve bias is adjusted to give the correct anode current, which gives a suitable anode voltage, any other adjustment may easily throw the anode volts up or down to the screen-grid volts. Changing the valve would probably do this also. An example will make this point clear. If $R = 300{,}000$ ohms, and anode current $= 1$ mA., with H.T. volts $= 450$ and screen-grid volts $= 60$, then anode volts $= 450 - 300 = 150$. This would operate satisfactorily. Suppose now a new valve is substituted which with the same grid voltages gives 1.4 mA., then anode volts $= 450 - 420 = 30$. This valve would distort hopelessly under these conditions.

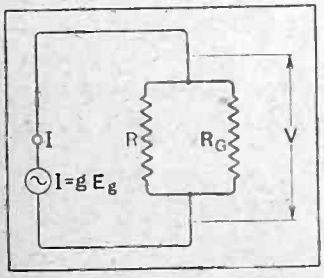


Fig. 2.—The screen-grid valve may be considered a constant current generator if the anode voltage is maintained above that on the screening grid. The amplification of a screen-grid resistance-coupled L.F. stage depends almost entirely upon mutual conductance and anode load resistance.

A Compensating Device.

Obviously, some kind of compensating device must be used to keep the anode voltage considerably higher than the screen-grid voltage. One method of doing this is shown in Fig. 3. This employs a large trailing resistance R_T, through which the anode current passes and creates a negative bias voltage several times too great for the valve. This voltage is reduced with respect to the grid by a battery as shown, which is of such a value that the grid voltage becomes normal. The condenser merely by-passes the alternating currents. It can be seen that, if the valve is changed, any change in anode current, however small, causes a relatively large change in bias voltage, which, to some extent, tends to bring the anode current to the normal value. This method operates satisfactorily, and is used at present in one commercial, direct-coupled amplifier, with this difference, that the battery is replaced by a positive voltage obtained from a potentiometer. The objection to this method is that it is clumsy and rather expensive.

IT is well known that there is a serious limitation in the stage gain possible with L.F. resistance coupling using three-electrode valves. This is due to the input impedance which results from an appreciable internal anode-grid capacity. In this article a method of detection and low-frequency amplification is given, using the screen-grid valve which has negligible input impedance. Stage gains of over 200 are shown to be possible, and an ingenious automatic compensating device to keep the screen voltage below that of the anode is described.

Automatic Screen-grid Compensation.

The author has devised a method of compensation which is cheap and simple and practically fool-proof.[1] This consists in deriving the screen-grid voltage direct through a high resistance from the anode, as shown in Fig. 4, fixing the voltage of the screen to earth by a condenser as shown. As this screen-grid resistance effectively shunts the anode resistance, it should be made at least twice as large. This connection, in effect, makes the screen-grid valve as simple to use as a triode, as we need now only supply one H.T. voltage, while amplifications of the order of 200 can be obtained.

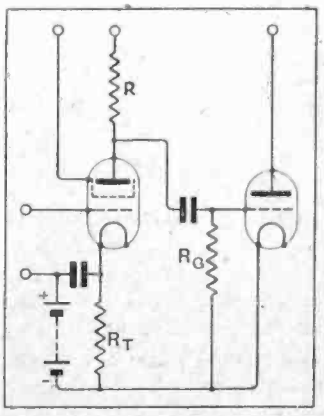


Fig. 3.—A trailing resistance R_T in association with a grid battery tends to keep the anode current constant, which in turn prevents the anode voltage from decreasing to a figure below that of the screening grid.

The action of the valve with this connection may seem rather complex at first. In fact, it would be rather difficult to calculate the running conditions, as even when the complete performance curves of the valve are known, including the screen-grid current values, it necessitates a trial and error method of arriving at the screen-grid voltage. However, the working is easy to visualise. First, we have the screen-grid and anode current passing through the anode resistance and causing a certain voltage drop therein. Then from the anode the screen-grid current causes a further drop in R_g. The latter drop constitutes the working voltage difference between the anode and the screen grid. When the signal comes on, the screen-grid voltage does not fluctuate, being practically at earth

[1] Pat. application No. 15334/30.

Screen-Grid Valve as Low-frequency Amplifier.—potential for alternating currents, due to C offering little impedance compared with R_g. However, the anode voltage does fluctuate, and the voltage difference mentioned above should be greater than the peak value of the voltage swing.

It will be found that for large voltage outputs, say, of the order of 100 volts, R_g should be of the order of 0.5 to 1 megohm; indeed, it is inadvisable to go below these values, as this resistance effectively shunts the anode resistance for alternating signals. In any case, the value of R_g does not seem at all critical. This method also provides a convenient and cheap method of supplying screen-grid voltage, and if a value of R_g is chosen sufficiently high, say, 0.5 megohm, it seems that the connection would also hold for high-frequency amplification, although this has not been tried out.

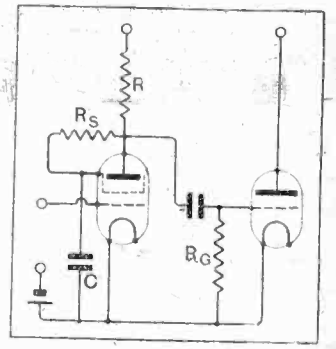


Fig. 4.—Automatic screening-grid compensation can be arranged by feeding the screen and anode through R_s and R respectively.

The value of the condenser C should bear the same relation to R_g as the coupling condenser to the value of R_G. That is, its impedance at, say, 50 cycles per second, should be reasonably small compared with R_g.

It may be thought at first that, in the case of a valve taking negative screen-grid current, the screen volts would rise above the anode volts. This, however, will not occur, as negative screen-grid current arises from secondary emission from the screen grid, and no emission will occur unless the anode voltage is above that of the screen grid. In connection with this it might be advantageous to shunt the condenser C with a resistance. This would ensure a greater voltage difference between the screen grid and the anode.

The amplification which could be obtained from screen-grid valves by the above method was measured at various anode voltages, and with various values of R, R_g, and R_G, the frequency being 500 cycles per second. These are shown in Tables I and II. Table I is for a Mazda A.C./S.G. valve. It will be noticed that, by changing the anode voltage from 450 to 570, the value of the stage gain is nearly doubled. This is probably due to the value of *g* increasing. The value of *g* at the low anode currents used is very much smaller than the rated *g*.

TABLE I. E_B = Battery volts.

E_B.	E_G.	R.	R_g.	R_G.	*m*.
450	−1.5	0.5×10^6	3×10^6	3×10^6	127
570	−1.5	0.5×10^6	3×10^6	3×10^6	210
570	−1.5	0.5×10^6	1×10^6	1×10^6	187
570	−1.5	1×10^6	1×10^6	1×10^6	156
570	−1.5	0.25×10^6	1×10^6	1×10^6	103
500	−1.5	0.2×10^6	0.5×10^6	0.5×10^6	84
450	−1.5	0.2×10^6	0.5×10^6	0.5×10^6	77
400	−1.5	0.2×10^6	0.5×10^6	0.5×10^6	70
350	−1.5	0.2×10^6	0.5×10^6	0.5×10^6	64
300	−1.5	0.2×10^6	0.5×10^6	0.5×10^6	57

Table II shows the results for a Mazda 215 S.G. valve, and Table III the effect of frequency on the amplification, the slight fall off at the higher frequencies being due to the input capacity of the thermionic meter used to measure the volts across R_G. This latter effect, and the grid current, and leakage current in certain valves, limit the value of R_G to less than 1 megohm for power valves. Also, 0.5 megohm should be considered the maximum for R. Even with these limitations, this method can be put to good use, and if the anode voltage is kept sufficiently above the screen grid, by suitable values of R and R_g, a voltage swing of 100 can be obtained across R_G.

The value of the magnification obtained for the 215 S.G. valve was calculated from the measured slope at the operating conditions. This was about 20 per cent. higher than the actual value. The reason for this was put down to the assumption that the valve anode current was unaffected by anode voltage, when the latter was above the screen-grid voltage, i.e., that the valve was perfectly screened. Actually, in every screen-grid valve the curves show a slight variation in anode current with anode volts. Of course, the effect of this would be to decrease the amplification.

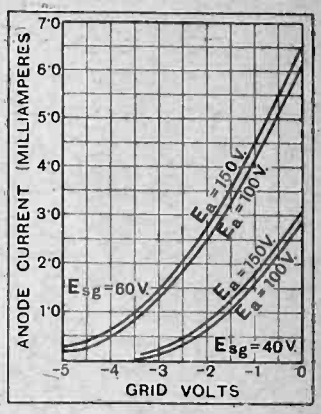


Fig. 5.—Grid volts/anode current curves of an AC/SG valve.

TABLE II.

E_B.	E_G.	R.	R_g.	R_G.	*m*.
450	−1.5	0.5×10^6	1×10^6	1×10^6	93
360	−1.5	0.5×10^6	1×10^6	1×10^6	78
270	−1.5	0.5×10^6	1×10^6	1×10^6	63
180	−1.5	0.5×10^6	1×10^6	1×10^6	45

TABLE III.

Cycles.	E_B.	R.	R_g.	R_G.	*m*.
50	450	0.5×10^6	1×10^6	1×10^6	90
250	450	0.5×10^6	1×10^6	1×10^6	93
500	450	0.5×10^6	1×10^6	1×10^6	93
1,000	450	0.5×10^6	1×10^6	1×10^6	93
3,000	450	0.5×10^6	1×10^6	1×10^6	92
6,000	450	0.5×10^6	1×10^6	1×10^6	84
8,000	450	0.5×10^6	1×10^6	1×10^6	77

The screen-grid valve used in this manner makes an excellent detector, and no trouble was experienced in loading up a Mazda P.P.3/425 power valve with a grid swing of approximately 100 volts straight from the detector, resistance-capacity-coupled. No reaction was used, as the station was local. Another advantage of using the screen-grid valve in this position is that it imposes very little load on the tuned grid current when used as an anode bend detector, hence tuning can be made much more efficient and sharper.

A Photo-Electric Model de Luxe.

By D'ORSAY BELL, M.A.

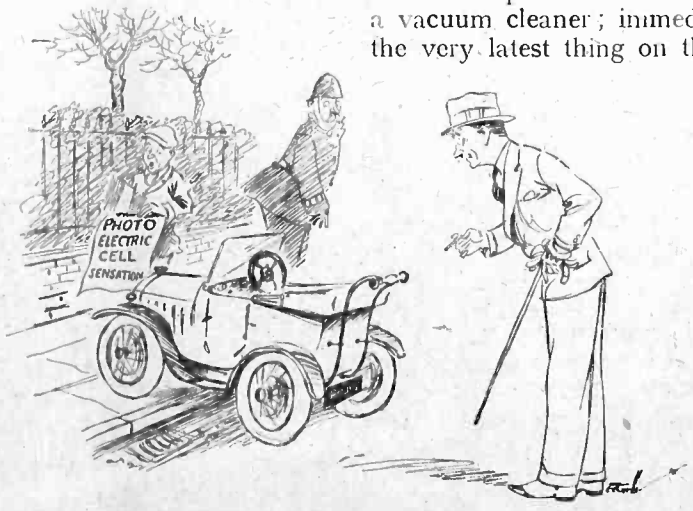
Note.—When this article was submitted to us, we wrote to our contributor to enquire whether it was intended as a serious scientific contribution or as an elaborate jest. The reply is given below.—Ed.

To the Editor of "The Wireless World."

Dear Sir.—I was glad to receive your enquiry, as it gives me an opportunity to state definitely the lines on which this article—like all my numerous other articles—was written. So far as statements as to Wireless and allied subjects are concerned, these are all based on serious scientific announcements. In suggesting future developments I may allow myself to give rein to my imagination—as I may do also in incidental remarks which are in no way connected with Wireless; but apart from these easily identified points I am always ready to give chapter and verse for anything I say in my articles. I hope you will publish this letter, because 99 per cent. of the value of these articles would disappear if their readers imagined they were mere fiction.

Yours faithfully, D'ORSAY BELL.

IN a previous article[1] I said that the photoelectric cell was beginning to be used for about as many purposes as the Austin Seven. Since writing those words I have been more and more impressed with the excellence of this comparison. The very next day, a few hours after meeting a Baby Austin tootling along with two large milk churns sitting pompously side by side, I was told that a new use had been found for the photoelectric cell—it is being carried round from house to house by officials of electricity companies to test the accuracy of their meters by an ingenious stroboscopic method. A few days later, after dodging, on my way, two Austin Sevens masquerading as (a) a motor fire-escape (or perhaps it was only a window-cleaner's gadget) and (b) as a chimney-sweep, complete with paraphernalia, I saw a journal which described how photoelectric cells are now being used to weigh paper in the process of manufacture (the weight is proportional to the opaqueness, and to measure this is, of course, child's play to the photoelectric cell),



"—I noticed a Baby Austin with a perambulator handle at the back for lifting it up over the doorstep—"

and how they are also being used to watch over the level of liquids, especially in high-pressure plants.

During the next week I noticed a Baby Austin with a perambulator handle at the back for lifting it up over the doorstep into the hall—where, I imagine, it acts as a vacuum cleaner; immediately after that, I read that the very latest thing on the German State Railways is an automatic train control system in which a pulsating beam of light is sent out vertically from the cab of the engine and reflected back on to a photo-sensitive cell in the cab by mirrors erected overhead at suitable points on the track; these mirrors may be manipulated like ordinary signals, and in addition the cab installation may have a speedometer device incorporated so that the train is automatically pulled up if it passes a mirror at an excessive speed.

The New Model.

These are just a few examples, chosen at random, of the multifarious new uses for photoelectric cells. Many other uses were mentioned in my previous article—and of course the best known use of all is in connection with commercial facsimile telegraphy, television, and above

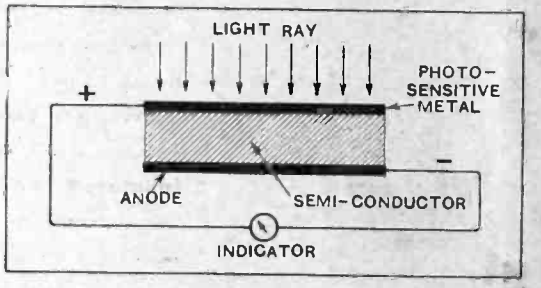
[1] *The Wireless World*, 29th January, 1930.

The 1931 "Super" Cell.—

all, the talkies. And now comes quite a sensational announcement—the discovery of an entirely new design of photoelectric cell, claiming enormous advantages over the usual kind.

In terms of the Austin Seven, it is as though the 1931 model had the following specification features: Speed on top gear, 1 to 300 m.p.h.; petrol consumption, 250 m.p.g.; can be folded up and packed behind the umbrella stand. That this is hardly at all an exaggerated way of regarding the claims of the new cell is indicated by the following fact—the inventor (a serious scientific worker writing in a highbrow scientific journal[2]) distinctly implies his belief that with a little improvement his invention will be useful for the direct conversion of the sun's energy into electrical energy. In fact, the baby car specification suggested above—which you thought rather far-fetched—may very shortly be regarded as old-fashioned; the modern specification may contain such phrases as "daylight performance 100 m.p.h., moonlight performance 70 m.p.h., emergency (glow-worm) performance 25 m.p.h."

The idea at the bottom of this new invention is quite a simple one. In all photoelectric cells the action depends on the fact that a ray of light, falling on a metallic surface (usually potassium), supplies certain electrons inside the metal with enough additional energy to enable them to emerge from the surface and buzz off to the anode across the intervening space—generally a vacuum or a rarefied gas. Now these electrons, when they emerge, are not so full of energy as they might be, because they have had a struggle to get past the surface of the metal; and the severity of the struggle depends on what is called the "contact potential" between the surface and what is touching it (the vacuum or the rarefied gas, in the ordinary cell). It has been realised for some time that the contact potential between a metal and a semi-conductor, such as copper oxide, silver iodide, etc., is far less than the contact potential between a metal and a gas or a vacuum; but hitherto no practical use has been made of this fact. Now Herr B. Lange has made very practical use of it.



Diagrammatic representation of Herr B. Lange's photo-electric cell, for which enormous advantages are claimed.

Shorter Journeys for Electrons.

Full details have not yet been published, but the general idea is as follows. Instead of having a rarefied gas, Lange squeezes up against it a layer of semi-conductor; on the other side of this layer he presses his anode—as shown in the diagrammatic representation on this page.

The first result of this arrangement is that, instead of having a metal-to-vacuum or metal-to-gas surface for the electron to penetrate, he has a metal-to-semi-conductor surface with its low contact potential; the second result is that, instead of leaving quite a large distance for the electrons to traverse before reaching the anode, he can reduce the distance to microscopic dimensions by making his semi-conductor layer very thin indeed—in fact, he makes it so thin that it is only a molecule or two thick.

Efficiency Already Increased Ten Times.

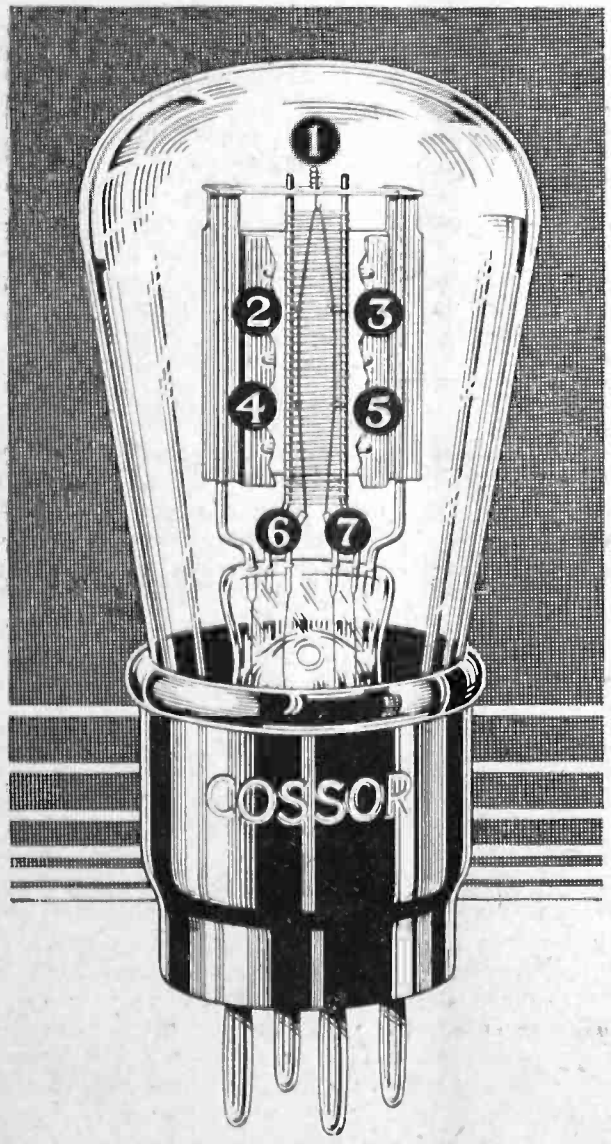
The first fact ensures that for a given amount of light energy the photoelectrons emerge with far greater energy than in the older type of cell; or, alternatively, that they emerge with the same energy as in the older type, in response to an amount of light energy far too small to have any effect on the older type. Incidentally, this means that the new cell is sensitive to rays in the infra-red part of the spectrum; it will respond to waves ten times longer than the ordinary average cell will respond to.

The second fact ensures that the cell has practically no inertia or "lag," and will therefore reproduce very high frequencies perfectly—an important point for sound-films. Also, that its internal resistance is very small; a consequence of this is that no permanent "polarising" voltage is needed with this cell as it is with the ordinary type—the electrons have such a short distance to travel to reach the anode that they need no guiding voltage to steer them.

A point of importance is that whereas, in the ordinary photo-electric cell with vacuum or rarefied gas, the ray of light passes through the vacuum or gas, falls on the sensitive surface, and ejects the electrons from that same surface, in the new cell the light has to fall on the *outside* of the sensitive metal plate, and yet the electrons have to emerge from the *inside* surface next to the semi-conductor and the anode plate. This seems to imply that the photo-sensitive metal plate must be very thin. Nothing, however, is said about this, but the inventor states definitely that he has already obtained efficiencies ten times greater than those given by the older type of cell, so that this point does not seem to present any difficulty. By suitable choice of the semi-conductor, it is apparently possible to produce a kind of resonance effect between the atoms of the latter and the electrons, with the result that sensitivity can be very greatly increased for a particular part of the spectrum. No doubt this property of the new cell would be made use of in any attempt to convert the energy in sunlight into electrical energy. Herr Lange's paper is stated to be only a "preliminary communication"; further news from him will be awaited with considerable interest.

[2] The *Physikalische Zeitschrift* of 1st February, 1930.

Seven point suspension *definitely prevents* microphonic noises



—by eliminating filament vibration

Microphonic noises in a Receiving Set are usually traceable to the Detector Valve. Nine times out of ten the cause is filament vibration. Look at the illustration alongside. This shows the internal construction of the new Cossor Detector Valve. See how the filament is held—not only top and bottom—but also by four insulated hooks spaced at intervals throughout its length. The purpose of these hooks is to damp out any tendency for filament vibration. Therefore by using this "steep slope" Cossor Detector Valve in your Receiver the possibility of microphonic noises is definitely eliminated and you are assured of greater volume with absolute tonal purity.

We have just issued a novel, circular Station Chart which gives identification details of nearly 50 stations and space is provided for entering your own dial readings. Price 2d. each they are obtainable from any Wireless Shop. In case of difficulty write us, enclose 2d. stamp and head your letter "Station Chart W.W."

Cossor 210 DET., 2 volts, .1 amp. Impedance 13,000. Amplification Factor 15. Mutual Conductance 1.15 m.a./v. Normal working Anode Voltage 90-150. *Price* **8/6**

THE NEW COSSOR DETECTOR VALVE

DEFINITELY FREE FROM MICROPHONIC NOISES

6567

CURRENT TOPICS

Events of the Week in Brief Review.

DID YOU HEAR THE BUZZ?

Radio-Strasbourg P.T.T., which gave its inaugural transmission yesterday (November 11th), sends out an identification signal consisting of a deep buzz sounded for five seconds with five-second intervals. The power is 12 kilowatts, and the wavelength 345.2 metres.

o o o o

BRITISH RAILWAYS, PLEASE NOTE.

The legend, "Radio," now appears on certain of the coaches on the Warsaw-Lodz railway, indicating that travellers should choose these if they wish to enjoy broadcast reception. The charge is ninepence per pair of headphones.

The man who saw "Radio" on a British railway coach is receiving optical treatment.

o o o o

WAVE-SHARING IN AMERICA.

Mexico's highest powered broadcasting station has begun operations on a wavelength of 385 metres. The station is situated in Mexico City, writes our Washington correspondent, and employs the call-sign XEW. Actually the wavelength is shared by CKY, Winnipeg, and by a number of low-power American stations, but no interference has been reported.

o o o o

WHERE TO FIND THE "RADIOS."

New York leads other American States in the number of wireless sets within its borders, the estimated total being 1,752,000. Next comes California with approximately 1,470,000. These figures have been evolved by the Department of Commerce after a rough survey of the 1930 Census forms, in which, for the first time in U.S. history, citizens were required to answer the question: Have you a radio?

The grand total of receivers in the United States is estimated at 13,478,600.

o o o o

RECORDS, OLD AND NEW.

Pre-war gramophone records in which all frequencies under about 400 cycles, and all above 1,200, were lacking, provided a striking contrast when compared with modern electrically recorded specimens during the lecture-demonstration given by Mr. J. H. A. Whitehouse (of the Gramophone Co., Ltd.) at Portland Hall, Regent Street Polytechnic, on Wednesday last, November 5th. Mr. Whitehouse's lecture, which dealt entertainingly with the progress of sound reproduction, was one of a series on "Science in Everyday Life" which are being delivered in the coming weeks on behalf of King Edward's Hospital Fund for London. The complete programme can be obtained at the Polytechnic or on application to the Secretary, at 7, Walbrook, E.C.4.

o o o o

GERMAN LICENCE FIGURES

On October 1st German licensed listeners numbered 3,241,725, as compared with 2,843,569 at the corresponding period last year.

o o o o

A RADIO BANQUET.

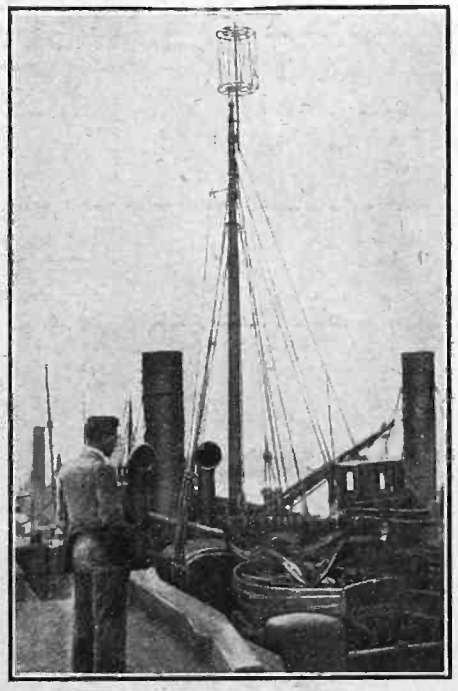
One of the strangest banquets ever held took place on Saturday, November 8th, when 11,000 employees of the H. J. Heinz Company, distributed all over the world, sat down at exactly the same moment to exactly the same menu to listen to exactly the same speeches.

President Hoover was one of the speakers, and others included Mr. Howard Heinz, president of the company, and Sir Henry Worth Thornton, head of Canadian National Railways.

In America the main banquet was held at Pittsburgh, while other banquets were held in London, Manchester, Liverpool, Bristol, Leeds, Hull, Birmingham, Edinburgh, and Glasgow, the London banquet being held at the Heinz headquarters at Harlesden. Other feasts took place simultaneously in cities in Canada, Australia, France, Germany, Spain, and Belgium.

All the gatherings were linked up by wireless, the speeches being broadcast from the Pittsburgh short-wave station, on 48 and 25.4 metres.

In London and the other European centres the land lines were connected to a Marconiphone installation. In London alone some six or seven hundred people were present.



CAGE AERIALS AT SEA. Owners of small single-masted ships are showing a preference for aerials occupying a minimum amount of space. This recent photograph of the trawler "Ardrossan" shows the Ashton cage aerial in use.

o o o o

THE POWERS THAT BE.

According to a German statistician, the total energy radiated by the broadcasting stations of the Fatherland amounts to 535 kilowatts. Other countries listed are: Britain, 470 kW.; Russia, 222 kW.; Sweden, 120 kW.; Czecho-Slovakia, 107 kW.; and France, 64 kW.

o o o o

OPTIMIST.

Having advocated stringent regulations for the suppression of all electrical apparatus causing interference with radio reception, a Paris wireless journal has received a letter from a reader which runs as follows:—

"Should your campaign prove successful, we shall no doubt soon read in the Press that M. ——, possessor of a crystal set, has obtained a legal injunction shutting down a 30,000-kilowatt generating station!"

o o o o

ANOTHER 50 KW. STATION FOR U.S.

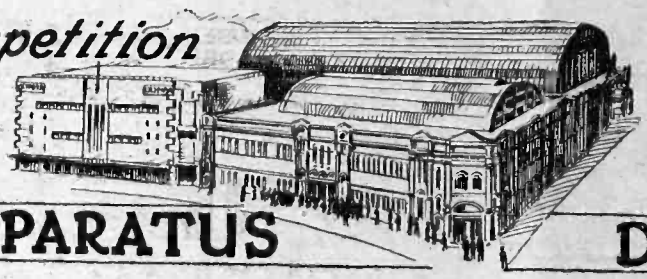
The Columbia Broadcasting System will shortly rebuild station WABC, Wayne Township, Passaic County, N.J., installing a 50 kw. transmitter. Authority for the power increase has been granted by the Board of Public Utility Commissioners of New Jersey, which has assumed jurisdiction over inter-State radio.

o o o o

CATHOLIC RADIO CONGRESS.

Despite the presence of two cardinals and several bishops, the "Wireless Catholic Congress" which was held in Paris on November 4th, 5th, and 6th was not purely religious in scope, writes our Paris correspondent. Radio apparatus and gramophones were on view, and the discussions dealt with the programme side of the organisation of listeners. Members of the Congress visited "Radio Paris" and other stations.

Our Show Competition



WINNING APPARATUS DESCRIBED

IN the following pages we illustrate and describe the apparatus which, in the voting competition arranged by "The Wireless World" in connection with the Olympia Radio Show, gained first place in the total of votes cast by our readers in each of the various classes into which we divided the Olympia Show exhibits as a whole. It will be recollected that readers were asked to vote, first for what they considered to be the outstanding single exhibit at the Show, and, in addition, to make their choice of apparatus in each of seven classes into which the exhibits at Olympia as a whole were divided. The classes were:—(1) Receivers of all types, either mains or battery operated. (2) Radio Gramophones. (3) Batteries of all kinds, including accumulators for both high tension and low tension. (4) Mains supply units, both D.C. and A.C. (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.

As already announced, the Pye "Twinlriple" A.C. receiver was voted the outstanding single exhibit, and the following apparatus gained first positions in the various classes:—(1) Pye "Twintriple" A.C. receiver. (2) R.G.D. Radio Gramophone de Luxe. (3) Exide "Gel-Cel." (4) Clarke's "Atlas" combined eliminator and trickle charger, model A.C.188. (5) Ferranti Magno-Dynamic Speaker. (6) Mazda A/C Pen. (7) Jackson Bros. "Chassimount" condenser. An announcement has already been made of the names of the readers of "The Wireless World" who have won the prizes in the ballot for their forecasts of the popular vote.

Pye Twintriple A.C. Receiver

AS so much attention has been devoted to the self-contained or portable type of receiver in this country, it is surprising that the average set of this class should embody so few features of real technical interest. Most of the designs are empirical, and although results are generally good enough, it is hardly an exaggeration to say that such sensitivity as they possess is largely due to incidental or intentional reaction effects. Those responsible for these sets seem to have been satisfied to copy an arrangement known to work tolerably well, and then to assert their individuality by devising fancy fretwork to cover the loud speaker diaphragm.

This state of affairs was bound to change, and for some time there have been indications that manufacturers are taking the "portable" more seriously. At any rate, the new Pye sets are illustrative of an important technical advance, and the self-contained A.C. "transportable," which forms the subject of this descriptive article, is interesting in every way—with regard to its circuit arrangement, its constructional details and its performance.

As shown in the accompanying circuit diagram, four indirectly heated A.C. valves are used. The

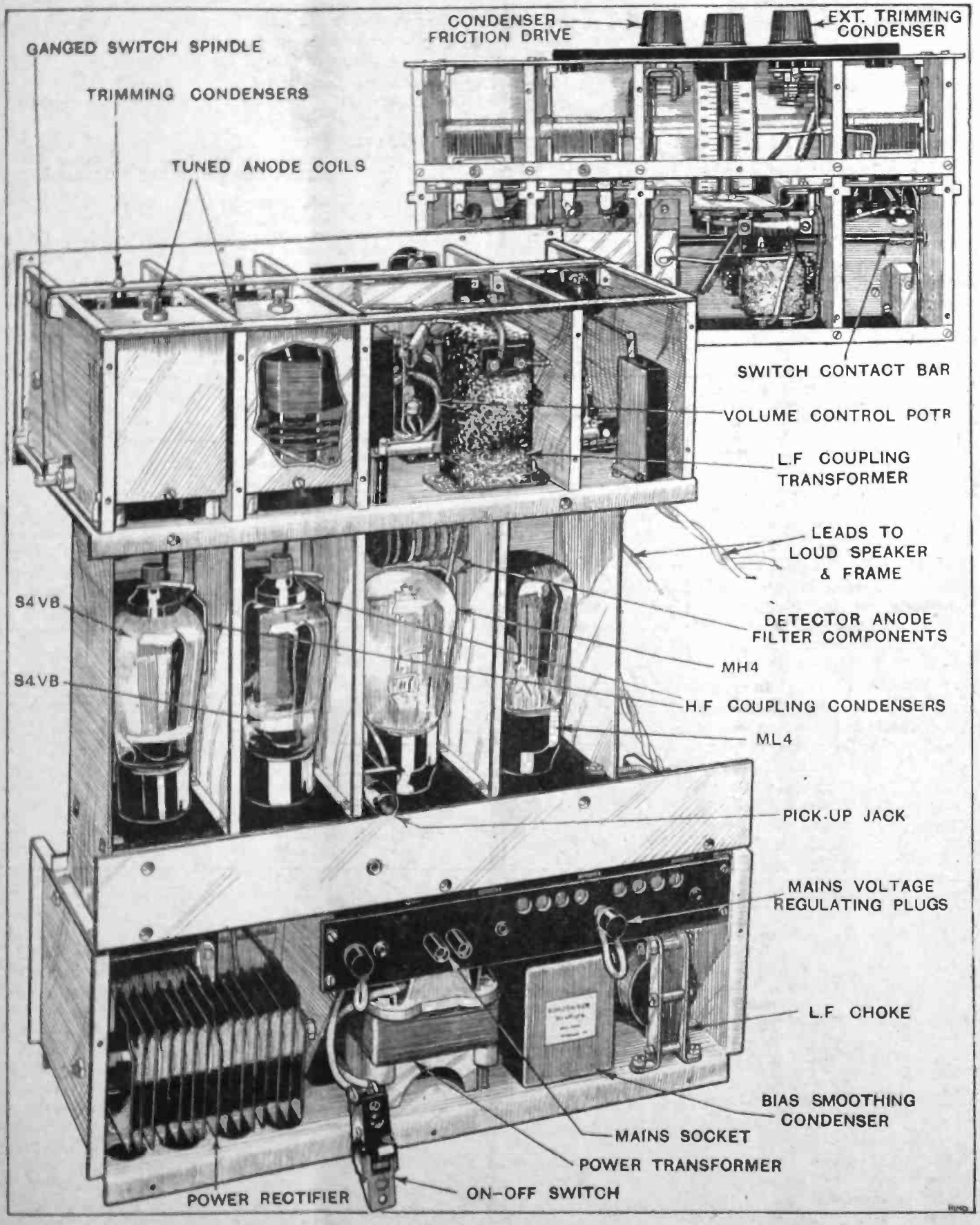
The Pye receiver.

H.F. amplifiers are linked by simple tuned-anode couplings and are followed by a power grid detector, with a filter to separate H.F. and L.F. components in its anode circuit. This valve is coupled to the L.F. stage through a directly connected transformer having a high permeability core. A choke filter output for the loud speaker is included.

All three tuning condensers are controlled by a single knob, and are fitted with trimmers; that for the frame aerial circuit is operated by an external knob, but the remaining two are fixed at the works and do not need any subsequent adjustment.

Volume regulation is effected by variation of the grid bias voltage applied to the first H.F. valve, and the operation of this control may also be regarded as a form of reaction adjustment.

Power supply is through a Westinghouse metal rectifier connected in a voltage-doubling circuit, the smoothed output being applied across a potentiometer, from which suitable operating voltages for both grid and plate circuits are taken. Decoupling resistances and by-pass condensers are connected at every point where harmful interaction is likely to arise. A special tapped choke is used for smoothing, and is so arranged that A.C. potentials developed across it are balanced out.



The receiver chassis, with top and back cover plates removed. Above: plan view of the tuner unit.

A 33

Pye "Twintriple" A.C. Receiver.—

In order not to distract attention from essentials, a few details have been omitted from the circuit diagram. Wave-range switching is effected by joining each set of long- and short-wave inductances (including those of the frame) in series, and connecting short-circuiting switches —which are, of course, linked mechanically—across each of the long-wave sections. To prevent disturbances of the ganged tuning system when changing over, special balancing condensers are connected between the tuned-anode coil junctions and earth. Other features not shown include a gramophone pick-up jack in the detector grid circuit and a combined plug socket and switch to allow of the use of an external loud speaker, either in conjunction with, or instead of, that already included in the set.

The aluminium chassis is built up as three units: receiver proper, shielded valve compartments, and power supply unit. This metal chassis, of which the general construction is shown in the accompanying illustration, is beautifully made; die-cast metal plates are used to divide up each of the "H.F." compartments and, in addition, there are sealed rectangular metal boxes for each of the tuned-anode coil assemblies.

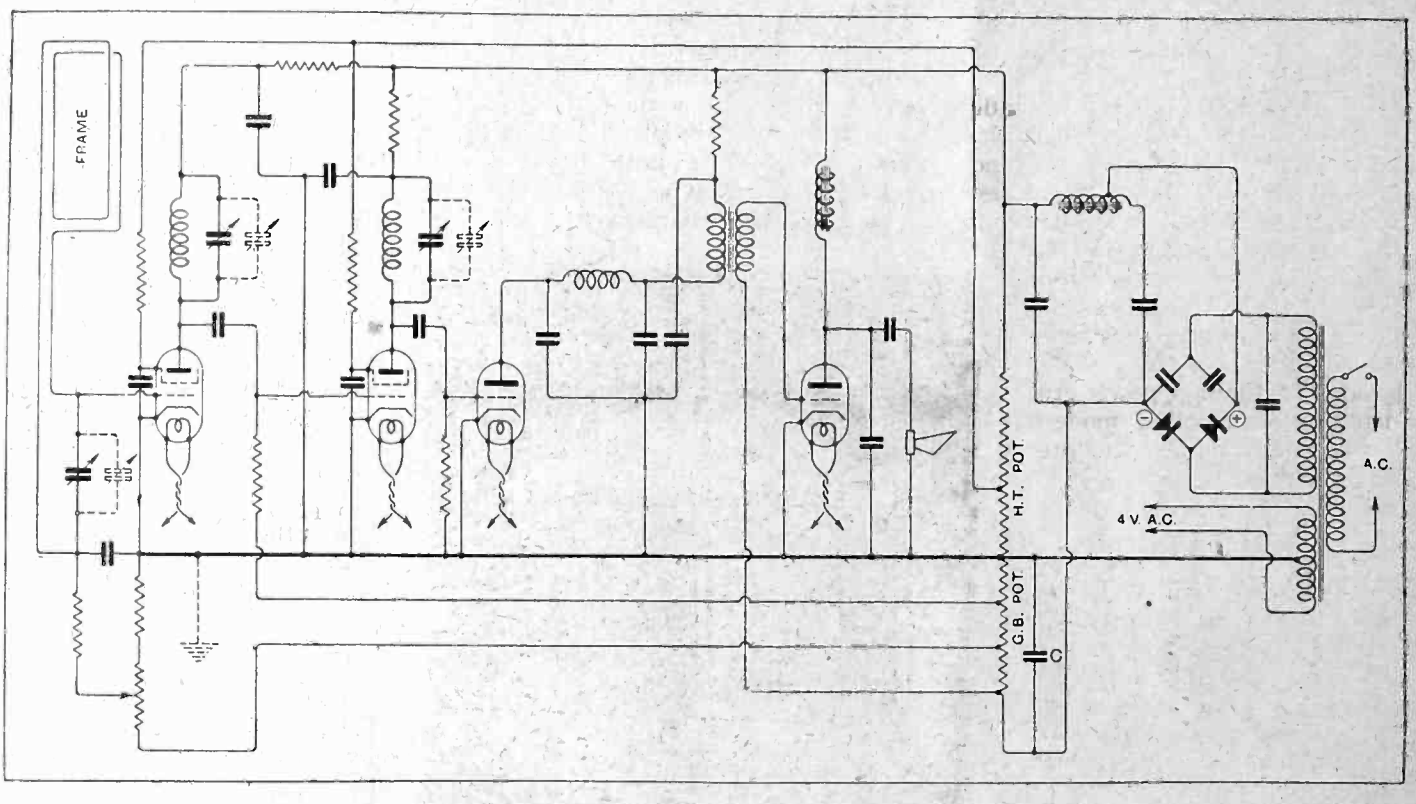
The sensitivity of the receiver is altogether exceptional, and, in spite of the fact that the pick-up of comparatively small frames is relied upon (there is no external aerial connection), real long-range reception is definitely assured even under comparatively poor conditions. Continental stations can not only be heard, but their programmes can be appreciated. Background noise is well below the average level for such a sensitive set, and there is a complete absence of A.C. hum, due probably to the special smoothing circuit.

Quality of reproduction must not be judged by the usual "portable" standard, as, in an A.C. receiver, ample power is available. In this respect, the set makes an extremely good showing, and the special "Celestion" loud speaker seems to suit its characteristics admirably. There is a slight resonance round about 400 cycles, but uniformity of response over the upper middle register is particularly well maintained.

Selectivity is considerably above the average standard, even for a "2-H.F." set, and, at seven miles distance from the twin London stations the two transmissions may not only be separated easily, but other stations on intermediate wavelengths may be received without interference.

The complete set weighs about 35 lb., and is compact enough to be moved from room to room; it is fitted with convenient hand grips for this purpose. Operation could hardly be simpler, as the trimming condenser does not need continuous adjustment, and the main tuning dial is directly calibrated in wavelengths.

Internal construction is unexceptionable, and there is no evidence whatsoever of skimped work; the set seems to have been built without regard to cost, and could not be considered dear if it were priced at considerably more than 28 guineas. The makers are Pye Radio, Ltd., Radio Works, Cambridge.



Circuit diagram, simplified by omission of certain features discussed in the text. An electrolytic condenser (C) is used for smoothing the bias voltage supply.

R.G.D. Radiogramophone De Luxe

THE popularity of the radio gramophone is due primarily to the wide range and variety of entertainment provided by a single compact unit of furniture. Nearly all designers have taken advantage of the facilities offered by the self-contained cabinet form of construction to fit moving-coil loud speakers and suitably matched power amplifiers. In most cases, therefore, quality and volume of reproduction leave little to be desired. Generally speaking, however, the radio side has been allowed to take a position of subsidiary importance to the gramophone side, and in most cases only local station radio reception is catered for.

In the R.G.D. Type S6 radio gramophone the entertainment value of foreign-station reception has not been overlooked, and in this respect the radio section is not inferior to the best receivers designed exclusively for long-range reception. Further, range has not been achieved by sacrificing quality, for the circuit includes band-pass tuning, power-grid detection, and other modern developments designed to preserve quality in the H.F. stages.

The Circuit.

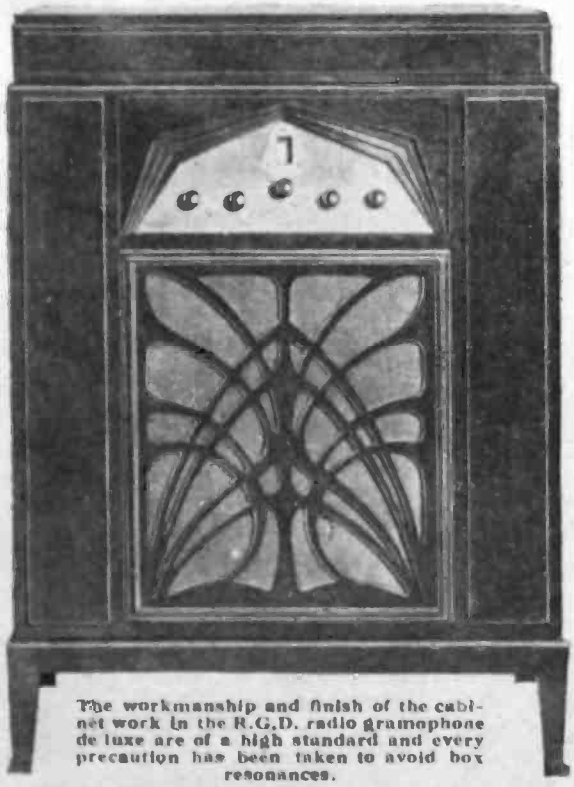
Briefly, the circuit is constituted as follows:—Two H.F. stages employing AC/SG valves, and coupled by parallel-fed tuned grid circuits, are preceded by a capacity-coupled band-pass filter which may be excited either by an external aerial or by the energy picked up on the perforated metal screen forming part of the ventilated back panel of the cabinet.

The screen-grid potential for both H.F. valves is supplied from a common variable potentiometer, both grids being provided with decoupling resistances and by-pass condensers. The potential variation available not only serves as a pre-detector volume control, but is also sufficient to permit oscillation in the H.F. stages, and the control is therefore marked "Reaction" on the front panel.

The detector is resistance-coupled to the first L.F. stage, and the anode voltage and circuit constants are so adjusted that the AC/HL valve functions as a "power-grid" rectifier with zero grid bias.

Volume Control.

Following the detector is a simple but effective volume control which controls both radio and gramophone. This takes the form of a centre-tapped potentiometer, with the centre point earthed. Volume increases as the slider is moved outwards in either direction from the zero position, and a quiet fade-out from radio to gramophone, or *vice versa*, is, therefore, possible. The pick-up is a new type R.G.D. with a good overall characteristic and low damping and record wear.



The workmanship and finish of the cabinet work in the R.G.D. radio gramophone de luxe are of a high standard and every precaution has been taken to avoid box resonances.

An AC/HL is used in the first L.F. stage, and is coupled to the output stage through a Ferranti AF5 transformer.

Two AC/P$_1$ valves in parallel supply the "Rola" moving-coil loud speaker through a 12:1 ratio transformer. Series resistances are included in the grid circuit of each valve.

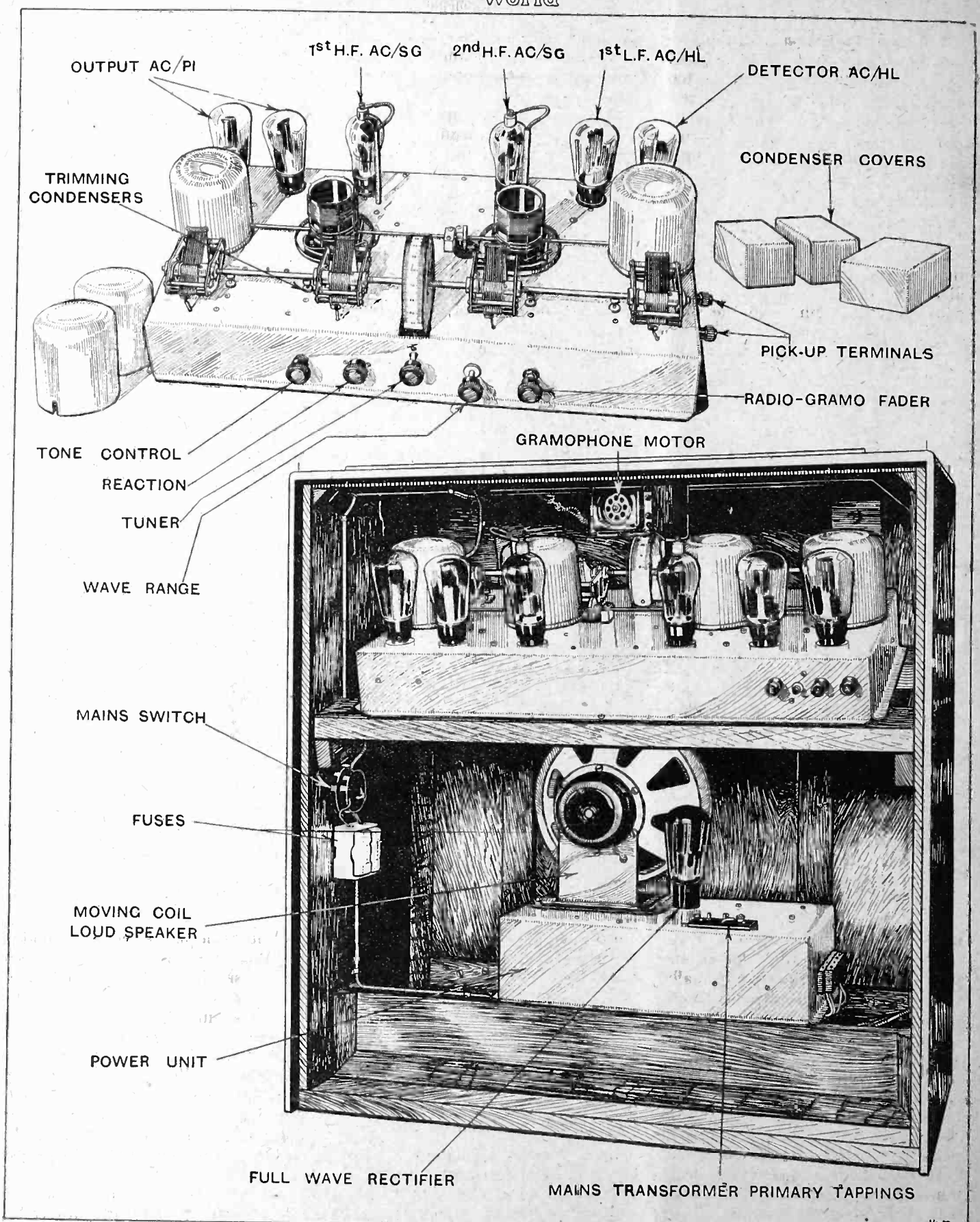
A Bayliss mains transformer of massive construction is the nucleus of the power supply unit. There are three separate filament heater windings, one for the first four stages of the receiver, another for the two power valves, and a third for the rectifier. The latter is a type D.W. 30 full-wave valve, the output from which is smoothed by a double filter. The choke in the second stage of the smoothing circuit is provided by the field winding of the loud speaker, which is energised by the total anode current of the set. Grid bias is provided by separate resistances in series with the cathodes of the valves in each stage.

The circuit is divided structurally into two units—the receiver-amplifier, which occupies the top half of the cabinet immediately behind the control panel, and the loud speaker and power unit, which is mounted behind the ornamental grille at the bottom of the cabinet. Connections between the two units are neatly executed in lead-covered wire in conjunction with shrouded power-type terminal blocks. The porcelain fuse-holders are also of the power type, and are placed in an accessible position on the inside of the cabinet.

Screening.

The layout of the receiver-amplifier unit gives a clean external appearance. The only components which appear on the outside of the heavy leaded iron chassis are the condensers, coil units, and valves. The coils and condensers are provided with individual screening boxes, but the valves, which are placed in an accessible position along the back of the chassis, have only their anode leads screened in small-diameter vertical tubes. The condensers and coil switches are linked by rods running parallel with the front panel, and the single tuning dial is illuminated.

The power chassis is also constructed of heavy gauge leaded iron, and contains the mains transformer and smoothing circuits and the out-



Layout of components in the receiver unit of the R.G.D. Type S.6 A.C. radio gramophone and inside view of cabinet with rear panel removed.

R.G.D. Radio Gramophone De Luxe.—put transformer to the loud speaker. The loud speaker is mounted on top of the case, together with the rectifying valve and the terminal panel for adjusting the primary of the mains transformer to the supply voltage.

Cabinet Design.

The cabinet is of exceptionally massive construction, and is entirely free from resonances. Actually, the thickness of wood is nowhere less than ¾in., and the sides are as much as 1⅛in. The loud speaker fret is also made unusually thick to prevent vibration. A recessed joint round the edge of the lid is a refinement which effectually keeps in all mechanical noise emanating from surface scratch.

The receiver unit is tilted, and the control spindles pass at right angles through the sloping control panel. The latter is of solid bronze, so that its rich colour is not likely to deteriorate with time. From left to right the controls are as follows:—"Tone" (high and low), "Reaction" (s.g., potential variation on both H.F. valves), "Tuner" (friction drum drive to the four gang condensers), "Wave Range" (short and long), and, on the extreme right, "Volume," for changing silently from radio to gramophone reproduction.

We have had an opportunity of handling the instrument under working conditions, and the performance is fully in keeping with the circuit specification. The radio side is extraordinarily lively, and after dark no difficulty should be experienced in tuning in at least thirty stations with an outside aerial, or twelve stations when using the metal grille at the back of the cabinet. The band-pass filter functions admirably, and there is a precipitous cut-off at each side of the useful frequency band. It was specially noted also that no change in quality takes place as the condenser is moved into or out of tune with a station, even when making full use of reaction with the small internal aerial. This is convincing proof that there is no cutting of side bands.

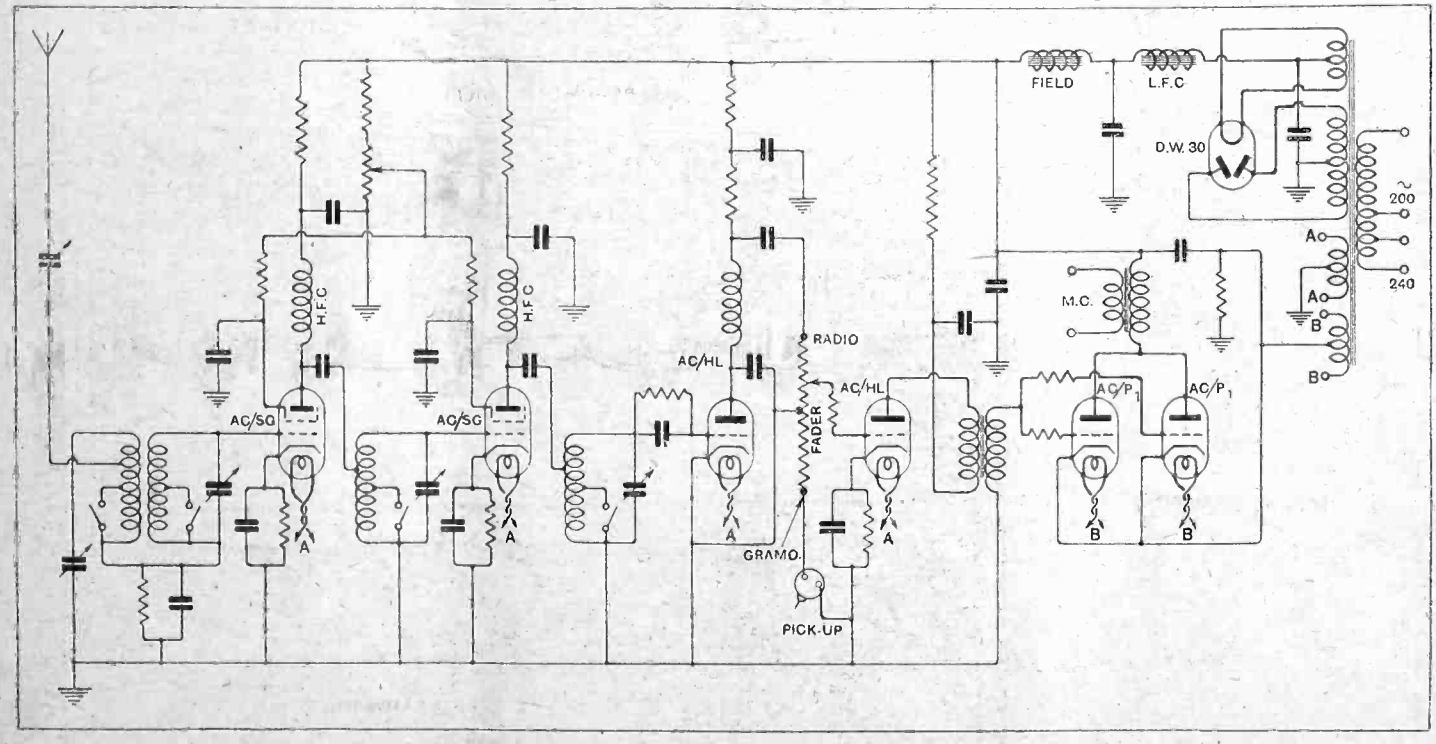
Volume and Tone Control.

The volume available is more than sufficient for most domestic requirements, and the instrument is easily capable of supplying dance music, etc., for hotels and restaurants. The quality of reproduction also gives no opportunity for criticism. There is no evidence of booming in the lower register, and the high-note reproduction is excellent. Both speech and music come through in a natural and effortless manner. For those who prefer the "mellow 'cello" type of quality a tone control has been fitted to suppress the upper register, but most discerning people will appreciate the excellent high-note response provided.

D.C. and A.C. Models.

A model designed for D.C. mains is also available. The valves used are the same as in the A.C. model, and the series resistance is provided with a special heat deflector which prevents an uncomfortable temperature rise in the interior of the cabinet. Since the H.T. voltage is limited with D.C. mains, provision is made for the introduction, if desired, of a bias battery for the output stage in order that the anode voltage may not be reduced by the volt drop in the usual cathode resistance.

There is also a special 50-watt super power model with two DO25 valves in push-pull in the output stage.

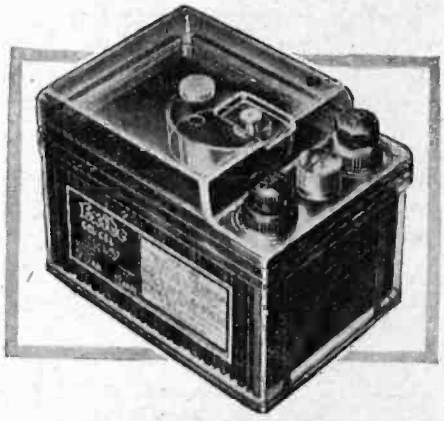


Circuit diagram of the R.G.D. radio gramophone Type S.6. A.C.

Exide Gel-Cel

USERS of portable sets realise that rarely is the accumulator entirely unspillable. The principal difficulty arises from acid spray finding its way through the vent hole and producing serious corrosion not only on the accumulator terminals and leads themselves but on metal parts in the receiver. The vital need of rendering the accumulator unspillable and spray-proof has been tackled by the Chloride Electrical Storage Co., Ltd., whose London address is 215-229, Shaftesbury Avenue, W.C.2.

This season a new battery has been introduced in which a jelly electrolyte is used which prevents spraying and avoids the free flow of the acid within the case. The use of jelly electrolyte in accumulators is not a new principle, and it will be remembered that Exide H.T. batteries were available at the start of broadcasting, optionally rendered unspillable by this method. The particular merit of the use of jelly electrolyte in a portable battery is that the acid is kept in contact with the entire surface of the plates irrespective of the position in which the battery is standing.



Exide Gel-Cel accumulator.

This form of electrolyte does not enter into the chemical reaction which takes place inside the battery, but merely serves as a means to hold the acid in the neighbourhood of the plates and thus prevent it flowing. Generous precautions are, however, taken to provide an acid lock in the top of the cell, so that gases may escape without carrying acid spray.

A special feature of the battery is its robust construction, brought about by the use of shaped celluloid pressings for top and bottom. By this means sharp corners are avoided and enormous strength with stiffness obtained. The Gel-Cel Type JWE/ measures 4¾in. × 4in. × 3¼in. and has the high ampere-hour capacity of 24, and allows a charging rate of 2 amperes. Seven positive and eight negative plates are fitted, measuring about 4in. × 1½in., thus giving a plate area greater than that customarily met with in portable-set accumulators. By the use of different screw threads on the positive and negative terminals, these cannot be interchanged, whilst one is octagonal and the other round.

Clarke's Atlas Combined Eliminator

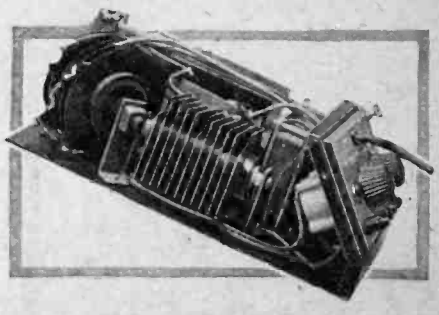
ONE never quite knows what to do when the question arises of converting an existing battery-fed set for A.C. mains operation. If it is decided to make a clean sweep and to fit indirectly heated valves, with appropriate arrangements for supplying their anode, grid, and heater circuits with suitable voltages, there is an unpleasant possibility that, due to the improved "figure of merit" of the new valves, uncontrollable instability may result unless extra screening and, perhaps, more than usually extensive "decoupling" is provided. Further, the cost of a complete conversion is considerable, and there is often a natural reluctance to replace a set of valves that may still be capable of working satisfactorily for many months.

Compactness is a feature of the Atlas combined eliminator and trickle charger.

In such circumstances, the easiest, simplest, and certainly the cheapest solution of the problem lies in the fitting of an H.T. battery eliminator for anode current supply, coupled with the use of an L.T. trickle charger, which admittedly will not "eliminate" the filament accumulator but does largely eliminate all trouble in connection with it.

There remains the grid bias battery. Opinions are divided as to the desirability of eliminating this component; if the set is to be operated by someone without technical knowledge it is certainly as well that grid potentials should be provided automatically, but, when dealing with a converted battery set, it is not often worth while to introduce this extra complication, at any rate if the user realises that the battery should be tested occasionally.

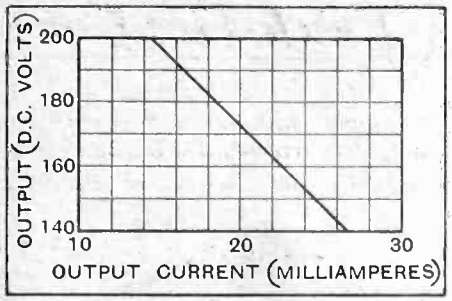
The Atlas combined eliminator is intended for meeting anode current demands of the typical domestic receiver, and also includes the necessary equipment for recharging L.T. accumulators of 2, 4, or 6 volts at about 0.5 amp.—a rate that is more than adequate, in ordinary circumstances. The apparatus is mounted in a neat and compact ventilated metal case measuring about 3½in. high, 5¼in. wide, and 10in. deep. It is designed for operation on A.C. supplies of 200-250 volts, 40-120 cycles. A Westinghouse rectifier, with a rated output (after smoothing, and allowing a reasonable figure for choke resistance) of 25 milliamps. at 150 volts is connected in the conventional



Internal arrangement of the eliminator components.

Clarke's Atlas Combined Eliminator.—"voltage doubler" circuit. Its output will change with load, and the accompanying graph shows the voltage actually existing between the "negative" and "+150" sockets for different current demands.

There are two other output sockets, through which the earlier valves are fed: the first, marked "0-100 volts," is connected to an internal potentiometer with a variable resistance element, and is intended for supplying a low output current, as, for example, that passed by an H.F. valve screening grid or a detector. The remaining output is through a series variable resistance, which, like the potentiometer element, is of the compression type. It must be remembered that, in estimating the current and voltage obtainable from the power socket, it is necessary to subtract the current drawn through the variable outputs.



Regulation curve, showing how voltage rises as the output load is reduced.

Another Westinghouse rectifier of the low-voltage type is fitted for charging the L.T. battery, which is permanently connected to both unit and receiver, and automatically goes "on charge" when the H.T. circuits are switched off.

A test of the eliminator shows that it operates quite satisfactorily in conjunction with a typical H.F.-det.-L.F. three-valve set, and that there is hardly any trace of hum. When it is connected to a receiver with two L.F. stages, care should be taken to see that the manufacturers' instructions regarding separate feeds to each valve are observed.

The unit is made by H. Clarke and Company, Ltd., Atlas Works, Old Trafford, Manchester, and costs £6 complete.

Ferranti Magno-Dynamic Loud Speaker

FOR the second year in succession a Ferranti loud speaker has recorded the greatest number of votes in the loud speaker section. This year it is the "Magno Dynamic" moving-coil unit which has so favourably impressed visitors to Olympia. This is hardly surprising, for now that the flux densities provided by permanent magnets have been brought up to the standard set by mains-energised field magnets, we are at last relieved of the complication, expense and maintenance of A.C. rectifiers and the anxieties associated with back E.M.F.s when switching off D.C. mains fields.

In designing the permanent magnet, special attention has been directed to the question of permanence, and in this connection the designers are able to draw on 40 years' experience in the manufacture of permanent magnets for electric supply meters and measuring instruments, in which permanence of calibration is of prime importance. It is, therefore, interesting to find that the steel alloy in the field magnet contains as much as 35 per cent. of cobalt, and is by no means cheap to produce. The design of the magnet has been patented, and it is magnetised in a special machine so that it is not necessary to leave a magnetising coil inside the core. The pole pieces are electro-plated to prevent the formation of rust in the air gap, which is only 0.075in. wide. With this magnet a total flux density of 13,000 lines per square centimetre is obtained, and the useful flux density in the vicinity of the moving coil is 8,000 lines per sq. in. This figure is obtained by making use of a specially designed instrument in which the movement of the search coil is limited to $\frac{3}{16}$in.

Prize-winning model permanent magnet loud speaker.

The design of the diaphragm and moving coil is similar to that of the other moving-coil loud speakers in the Ferranti range. The 90-degree diaphragm is of comparatively small diameter, and is fitted with a centring device at the apex to prevent lateral movement of the speech coil. The latter has an average impedance of 20 ohms, and for the purpose of our own tests a Ferranti type OPM3 output transformer was used. Where push-pull amplification is employed a type OPM3L transformer will provide suitable matching.

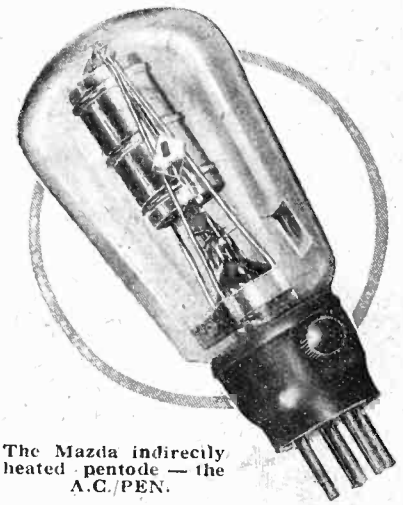
Comparison with the records of previous tests on the mains-energised "Electro-Dynamic" Ferranti loud speakers showed that the sensitivity of the permanent magnet model is only very slightly less; indeed, a direct comparison would be necessary in order to appreciate the difference. Frequency tests over a range from 50 to 6,000 cycles revealed that the response in the middle register is sensitively uniform from 200 up to 3,000 cycles. Above and below these limits the characteristic rises. The increased output down to 50 cycles is sufficient to give body to the general result without introducing objectionable "boom." It is from 4,000 cycles upwards that the response is so unusually good, and the resulting brilliance imparted to the quality is probably unequalled

Ferranti Magno-Dynamic Loud Speaker.—by any other loud speaker. With a well-designed amplifier a certain amount of hiss may be experienced, but this is easily overcome with a simple form of tone control. In fact, it is quite a new experience to have a reserve of high-frequency output with which to experiment.

The choice of a permanent magnet moving-coil loud speaker is significant, for we believe that this type is destined ultimately to displace the older type of mains-energised field magnet.

Mazda A.C./Pen Valve

THIS valve, the sole representative of the pentode class with an indirectly heated cathode, affords striking evidence of the extraordinary advance which has been made in valve design and manufacture, and well deserves the high praise bestowed upon it by readers of *The Wireless World*. When one reflects on the difficulties encountered in supporting rigidly three grids, a large anode, a hairpin heater, a



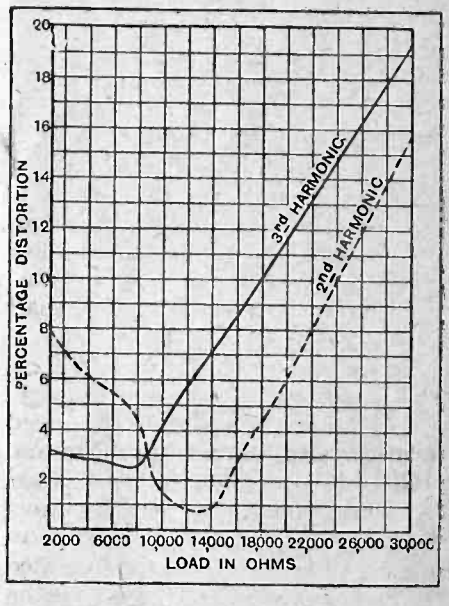
The Mazda indirectly heated pentode — the A.C./PEN.

cathode, two getter plates and a number of mica supports in such a restricted space, one realises that the factory production of such a valve is no mean achievement, and must be attributed to research over a long period. Mazda valves are made by the Associated Electrical Industries—a concern in which the research and manufacturing resources of the Metropolitan-Vickers, B.T.-H., and Edison Swan companies have been combined. It will be remembered that the Cosmos AC/G and AC/R valves made by the Metro-Vick Company in 1927 were the forerunners of a highly successful series of indirectly heated valves which are now available.

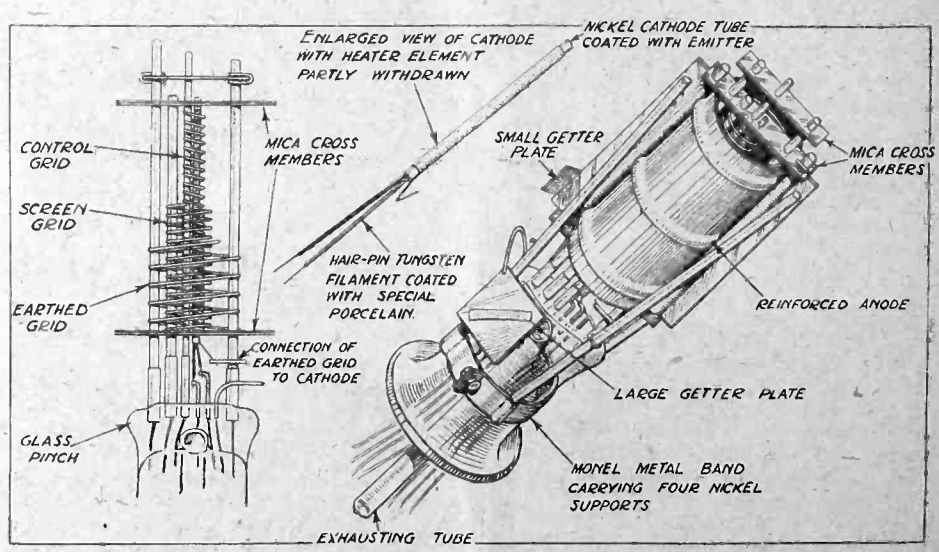
The intricate construction of the A.C./PEN can be seen from the illustration. The hairpin heater, which consumes 1 amp. at 4 volts, consists of a tungsten filament which has been dipped into a porcelain "slip." This is inserted into a nickel tube or cathode which is coated with the necessary emitter, and the whole assembly is held in position by mica locking bars. Surrounding the cathode is a control grid around which, in turn, are the screen grid and the earthed grid, all rigidly held not only by mica cross members but also by vertical supports which are embedded in the glass pinch. It is of fundamental importance in a pentode that there should be no negative resistance kink in the working characteristic due to secondary emission; this is effectively avoided by the presence of the outer grid, which is internally connected to the cathode.

The multiple-electrode structure, including a reinforced anode, is stiffened by four nickel uprights attached to a monel-metal band clamped by a bolt and nut to a waist in the lower part of the glass pinch. As the valve normally dissipates about 8 watts, longitudinal expansion of every electrode is arranged.

Under amplifying conditions, with 10 volts negative bias and maximum anode and screen voltages of 250 and 200 respectively, the A.C./PEN will deliver about 1½ watts of undistorted A.C. energy, assuming that it is worked into a load of correct value. Whilst a triode will not give audible distortion when a small deviation is made from the optimum load, a pentode will give a poor



Curves showing the percentage distortion with different speaker impedances. The optimum load is 8,000 ohms.



Showing the disposition of the three grids (left). On the right is seen the multiple-electrode structure firmly bolted to the glass pinch. Two getter plates ensure a perfect vacuum.

Mazda A.C./Pen Valve.—

account of itself unless the speaker impedance is chosen with accuracy. The accompanying curves show the percentage harmonic distortion given by the A.C./PEN when the load in the anode circuit is varied from 2,000 to 30,000 ohms.

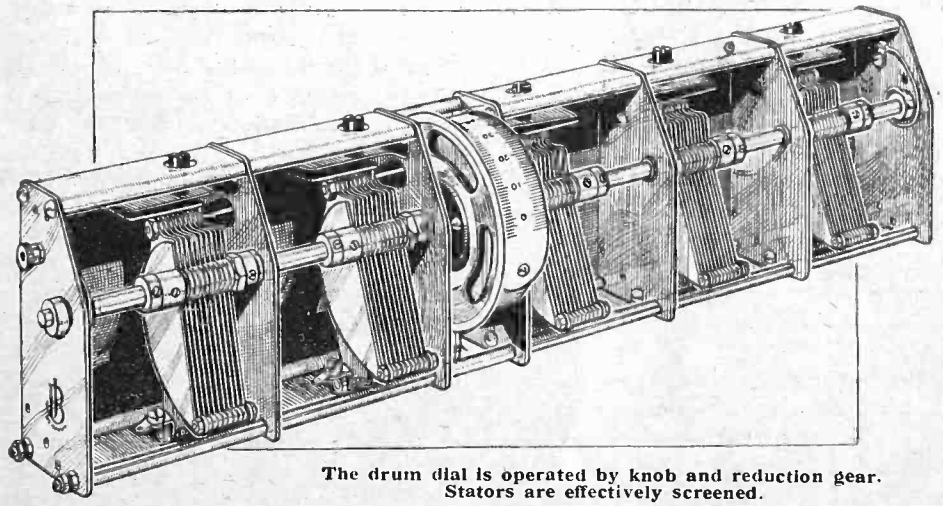
It will be seen, for instance, that a moving-iron speaker having an impedance rising to 20,000 ohms at the higher frequencies will cause a third harmonic component of nearly twelve per cent., which is very distressing to the ear, whilst with an 8,000-ohm load the distortion of both second and third harmonics is below five per cent. and is unobjectionable. With a moving-coil speaker having a special pentode speech coil the impedance of which does not vary substantially over the musical range, the A.C./PEN can be used with an ordinary one-to-one choke filter output, but with a moving-iron speaker an impedance-limiting arrangement, consisting of a condenser and resistance in series, should be used across the output device, and a tapped output choke should be employed to raise artificially the impedance of the speaker, which has probably been designed to give of its best at about 256 cycles when coupled to a 2,000-ohm triode. Not only will the A.C. pentode give a greater output per given volt grid swing than any three-electrode valve, but it will also deliver sufficient energy as a power grid detector to work a loud speaker direct without an intermediate low-frequency amplifier.

J.B. Chassimount Condenser

AT the time that the single-dial control of a multi-stage screen-grid amplifier was first introduced, difficulty was experienced in finding a condenser that could be readily gang operated. It was necessary to adopt the hollow spindle J.B. model as the most satisfactory, and to provide a steel shaft to link up the four sections.

Jackson Brothers, of 72, St. Thomas's Street, London Bridge, London, S.E.1, have quickly applied themselves to this new problem and produced a popular type of gang-operated condenser assembly incorporating two, three, four or five sections. This new gang-operated assembly made its appearance on the market shortly before the Radio Show, and is known as the "Chassimount." To conform to the popular requirement, a drum indicating dial is incorporated, though knob operation through a reduction gear is fitted in preference to thumb dial control. Passing through the centre of the drum is a ¼in. steel shaft which engages in bearings set up in the screening barriers between each section. The fixed plates take their support from the substantial aluminium barriers between the sections, and these in turn are held rigidly in position by means of four spacing bars running the entire length of the assembly. Easily removable shields clip over the individual sections and provide complete screening between successive sets of fixed plates.

When balancing between the individual tuned stages is necessary it is readily obtained by the use of the simple trimming condensers associated with each condenser section. The plates are of brass and are shaped to follow a logarithmic tuning scale. Pigtail earthing is fitted to the centre shaft.



The drum dial is operated by knob and reduction gear. Stators are effectively screened.

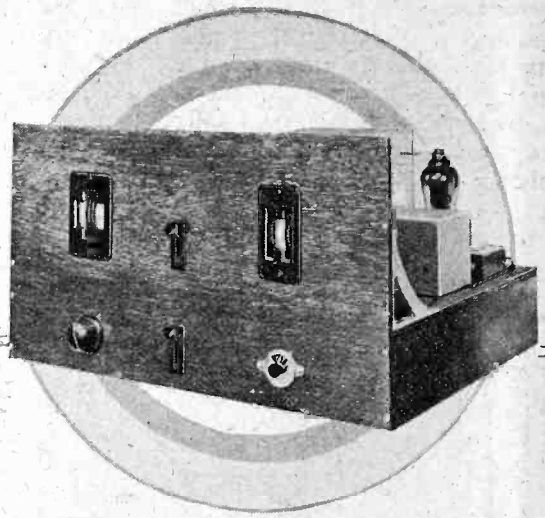
BOOKS RECEIVED.

Photocells and their Application, by V. K. Zworykin, E.E., Ph.D., and E. D. Wilson, Ph.D., of the Westinghouse Research Laboratories, comprising the History, General Theory and Mechanical features; the Methods of Preparing Photocells, Vacuum and Gas-filled Cells; the General Uses in Sound-films, Facsimile transmission, Television, etc., and predictions as to future developments. Pp. 209, with 98 illustrations and diagrams. Published by John Wiley and Sons, Inc., New York, and Chapman and Hall, Ltd., London, price 12s. 6d. net.

The Chronicle Wireless Annual (Eighth Edition), containing constructional articles on Various Types of Mains and Battery-operated Receivers, with useful information concerning Wave Traps, Volume Control, Operating the Televisor, Gramophone Amplifiers, Radio Societies, and many other wireless subjects of interest alike to the home constructor and the ordinary listener. Prepared by the *Manchester Evening Chronicle*. Pp. 191, with numerous illustrations and diagrams. Published by Allied Newspapers, Ltd., Manchester, price 1s.

Easy Lessons in Television, by R. W. Hutchinson, M.Sc. A book for non-technical readers, explaining the elementary principles of Electricity and Light and describing the Apparatus used in Television with the purpose and use of each component, and practical points to be observed in working the Televisor, synchronising the Motor and other adjustments, with a chapter on Tele-Cinematography, Tele-Talkies, Tele-Photography, etc. P. 175+vi, with 129 illustrations and diagrams. Published by the University Tutorial Press, Ltd., London, price 1s. 9d.

"The Wireless World" Band-Pass Superheterodyne



Details of Construction.

(Concluded from page 517 of previous issue.)

By A. L. M. SOWERBY, M.Sc., and H. B. DENT.

THE general layout of the receiver can be seen at once from any of the photographs. The baseboard is raised considerably, so that the decoupling components and grid-bias batteries, together with all the battery supply leads, can be run below it out of the way. This style of construction is particularly convenient when dealing with a receiver in which there is a certain amount of screening, as leads can be brought up through the bottom of the screening boxes.

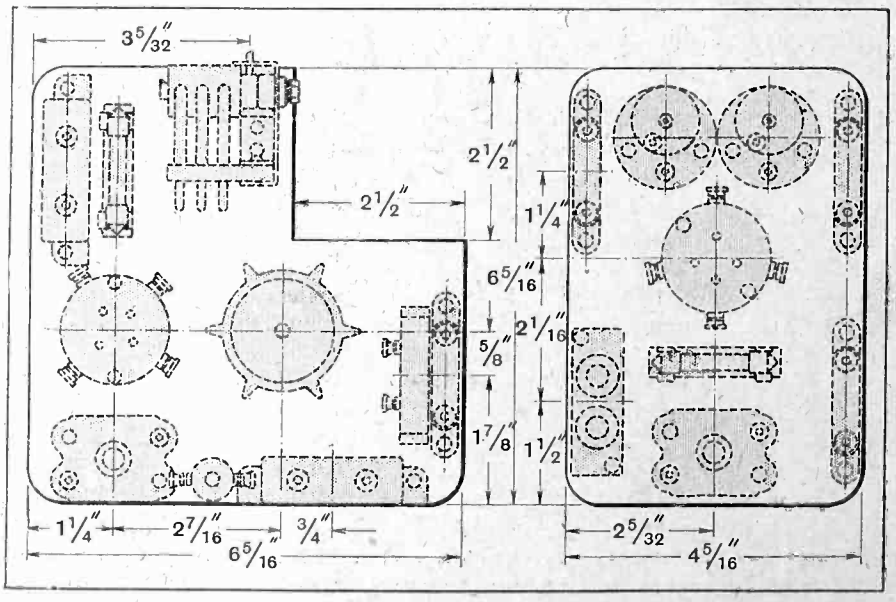
The panel has been kept short, and the components upon it symmetrically arranged, by putting the high frequency stage and the frequency-changer immediately behind the panel, with the rest of the set running back from right to left behind them. This brings input and output of the set into close juxtaposition, but thanks to a capacity screen between them and an efficient low-pass filter in the anode circuit of the second detector, no ill-effects result.

Wood has been used in place of the conventional ebonite as the material for the panel; its main advantage is cheapness. To the writer's eye it is as sightly as ebonite, but those who prefer to use the latter will find that the set works neither more nor less well as a result of substituting one for the other. For the two terminal strips, paxolin sheet has been preferred to ebonite on account of its greater mechanical strength.

Coil Details.

The first stage in the building of the receiver is the construction of the "chassis," which will naturally be done while the local dealer is getting in those components which he does not normally stock. The construction of the special coils employed in the receiver is also a task that can be embarked upon at an early stage. The two oscillator-couplers and the intermediate-frequency filter are wound on slotted formers built up from discs of $\frac{1}{8}$in. plywood, strung together on short lengths of 4 BA rod. Sixteen discs, 2in. in diameter, and ten discs $1\frac{1}{4}$in. in diameter, are needed for the whole set of coils. In winding them the ends of the wire are secured by bringing them out through holes in the larger discs, and the wire is run into each slot in turn by fixing the former in the chuck of a hand-drill and turning the handle just as fast as one dares, guiding the wire with one hand.

There are two large discs separating pick-up and reaction coils in the oscillator-couplers so that the ends of the reaction coils may be brought out between the discs without difficulty. Plate and reaction coils should be wound in the same direction, when the inside end of the plate coil goes to plate, and the outside end of the reaction coil to grid. (Actually, in the set, both go to switch.) Reversal of either of these two windings will prevent the oscillator from oscillating. The direction of winding and connecting the pick-up coil is a matter of complete indifference.

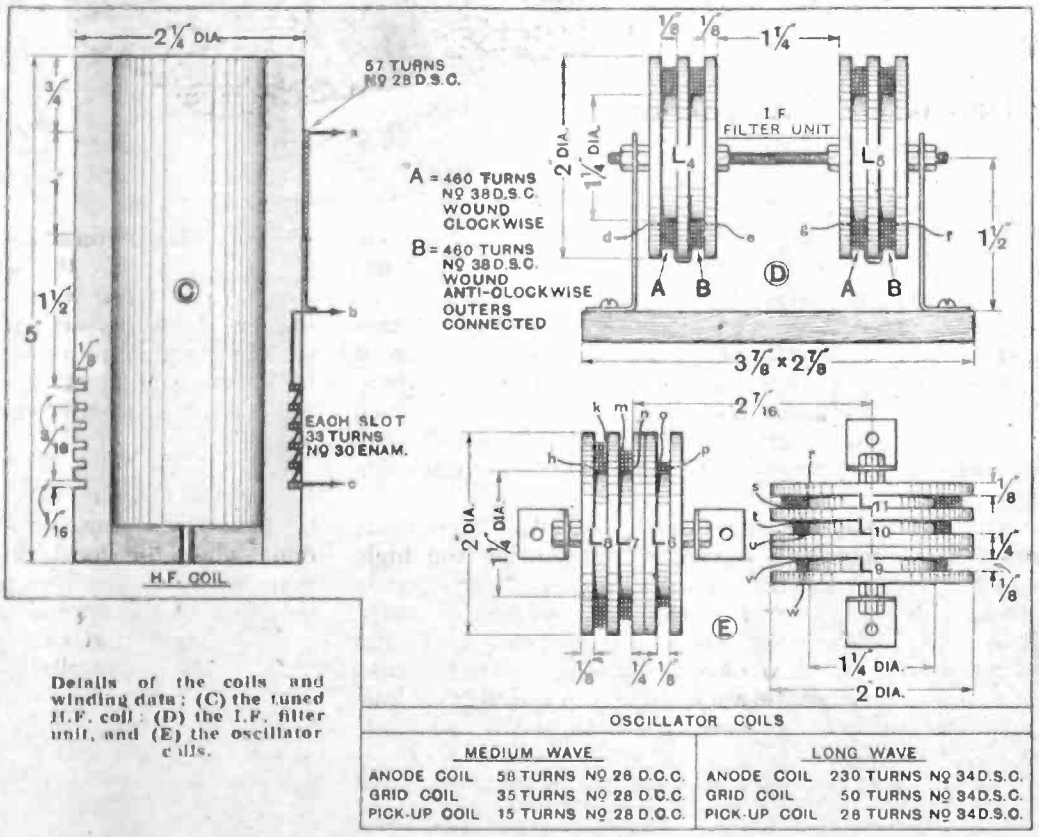


Disposition of the components in the screened units. (Left) The signal frequency H.F. stage; (right) the I.F. amplifier and second detector.

"The Wireless World" Band-Pass Superheterodyne.—

Some care must be taken in winding the I.F. filter coils, each of which has two slots with the windings connected in series. In each coil the wire is wound clockwise in one of the slots and counter-clockwise in the other; the two outer ends are then connected together, leaving the inner ends only as connections to the semi-fixed tuning condensers. A set containing wrongly-wound coils would show no visible fault, but would give no signals whatever. Coupling between the two parts of the filter is magnetic, fixed by the difference between them. Anything from 1⅛in. to 1¼in. between inner faces of the two assemblies will be found perfectly satisfactory. The filter, like the oscillator-couplers, is mounted between a pair of small brackets, to which it is clamped by nuts on the 4 BA rod that holds the whole together.

The coils wound and the various other components collected, the assembly of the set can begin in earnest. It will be well to start by mounting on the baseboard and panel all the components that are external to the two main screening boxes, with the exception of the pair of H.F. tuning condensers and the upper one of the two switches. The small box for the long-wave filter, which has been used as a precaution against direct pick-up of long-wave interference, can also be mounted in position at this stage.



Details of the coils and winding data: (C) the tuned H.F. coil: (D) the I.F. filter unit, and (E) the oscillator coils.

As soon as this is done, it will be apparent that a good deal of the wiring can be carried out at once; it is a good plan to do it before the main screening boxes are put into position.

In going over the sub-baseboard connections, it will be noticed that there is a tapped 30,000 ohms resistance; the smaller section of this does duty as decoupling resistance, the rest acting as anode resistance for the second detector. A fixed resistance and a variable potentiometer are used in series to feed the screening grid of the first valve, and criticism may be levelled at taking the supply for the other two screening grids from the junction of fixed resistance and potentiometer. Admittedly, the voltage at this point depends to a slight extent on the current drawn by the first valve, and so on the setting of the volume control; the range of variation, however, is small, and lies between 55 and 65 volts, over which range the I.F. stage-gain and detector efficiency are not audibly, though they are measurably, altered.

As is usual where switches are used, there is a certain congestion of wires round the lower switch. The fact that the switch makes a convenient anchorage for six out of the twelve wires which form the ends of the oscillator-coupler windings is, perhaps, some compensation.

The fact that a frame aerial is to be used makes it necessary to screen all circuits carrying amplified high-frequency currents with some care. This accounts for the fact that the contents of the main screening box are many and crowded. The components in this box are mounted on a small wooden baseboard, part of which is cut away to clear the tuning condenser. It is particularly to be noticed that the switch, which appears to be solely dependent on the panel for its support, is in reality mounted on a small bracket on this little base. The first stage in assembling the contents of the box is to mount and wire up as far as possible all the components, not forgetting the Graham-Farish condenser, which is the grid condenser of the detector in the three-valve arrangement. This has been slung on the wiring through sheer lack of space, but being small and light it is quite adequately supported.

When these jobs have been attended to, the screening-box can be mounted in position, with the tuning condenser through one side and with the slot for the switch registering with the slot on the panel. The baseboard with all its components is then dropped in the box, and the wires connecting it with the rest of the set soldered into position. A small iron is recommended here, as some of the joints are a little difficult of access.

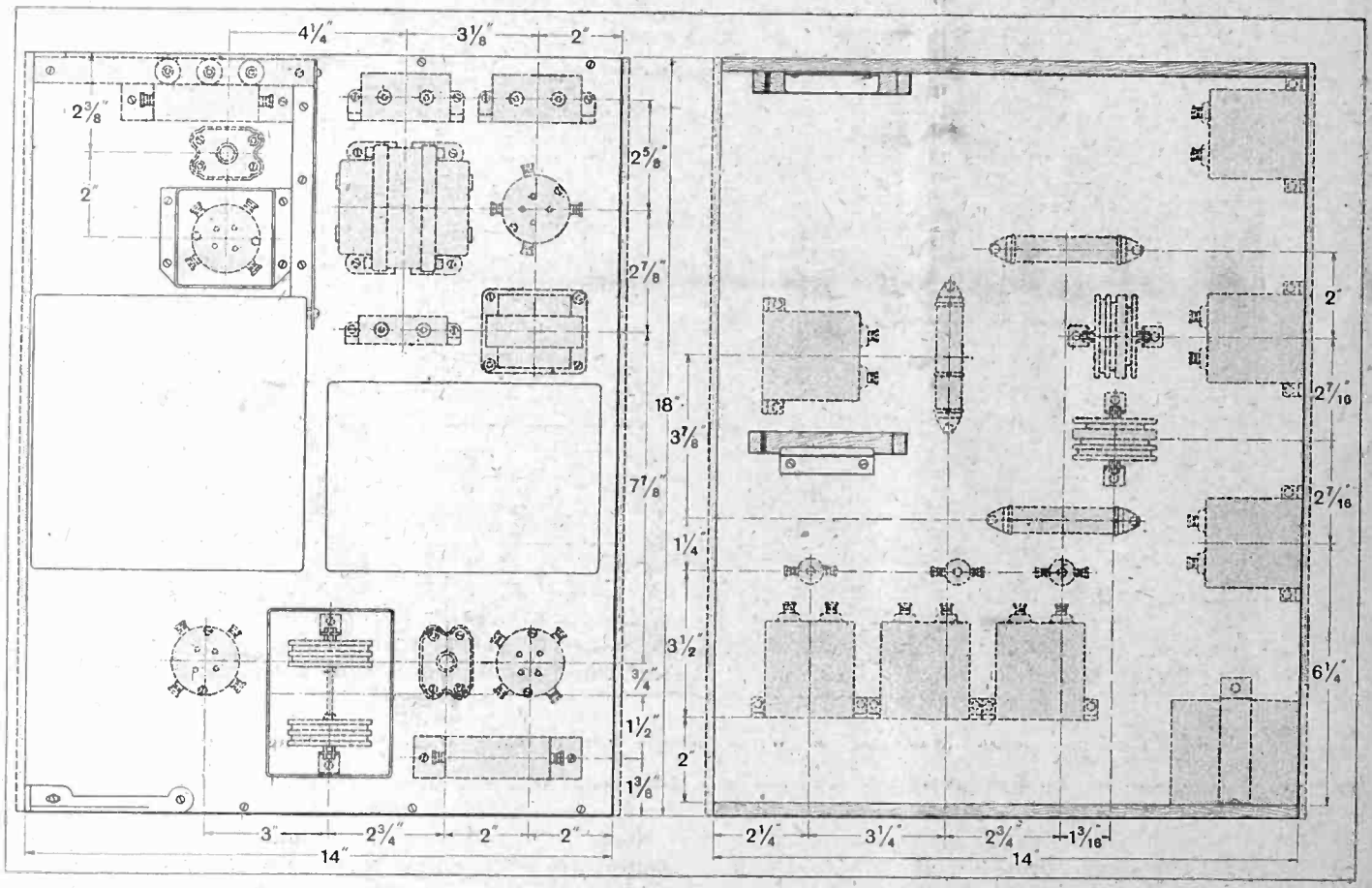
"The Wireless World" Band-Pass Superheterodyne.—

The contents of the smaller box can next be mounted on their base. As the H.F. choke used as an I.F. tuning coil is binocular, its close proximity to the screen is not harmful. The two Wearite chokes, with their associated condensers, and the condenser incorporated in the primary of the AF6 transformer, form a low-pass filter which should, theoretically, stop all but a fraction of 1 per cent. of the intermediate frequency, while passing about 75 per cent. of high audio-frequency notes of frequency 5,000 cycles per second. Whether its practical performance is as good as this is not known; at all events no signs of any I.F. currents could be detected in the loud speaker leads, while high audio notes are satisfactorily present. When the components in this compartment have been wired up as far as possible, they can be dropped into their box, and the remaining connections made. There are no special constructional difficulties here.

The last component to be fitted will probably be the screening box surrounding the H.F. valve; this was found necessary, because there was sufficient capacity coupling between the plate of the valve and the fixed plates of the frame condenser to cause instability on both wavebands.

Before putting valves into the sockets for the set's first trial it is as well to check over the wiring to make sure no mistakes have been made. As switching always makes a circuit much more difficult to follow, special attention should be paid to the wiring in this neighbourhood, where mistakes are most likely. Another possible fault is omission of the earthing connections to the various screens; without them the receiver will not be stable.

The receiver should now be ready for its first adventure in reception. The valves used for trial purposes, and selected as most suitable, were Mazda SG 215 screen-grid valves, Mazda L210 valves as oscillator and second detector, and an Osram PT240 as output valve. As has already been pointed out, the use of a pentode here is quite essential. The two triodes should be identical, or nearly so, because both have to act as grid detector preceding the transformer, one for local reception and one when all six valves are alight. The two H.T.+ terminals should be joined together, and a 160-volt battery connected. Grid bias for the oscillator should be set at $1\frac{1}{2}$ or 3 volts, and for the first detector at 3 volts; variations may be needed when the set has been got going. A centre-tapped frame aerial, if one is available, should be connected to the "Input" terminals, but if no frame is to hand a centre-tapped tuning coil may be used in place of it, a few yards of wire to act as aerial being connected to the "Input" terminal farthest from the panel. If an aerial is used it will be necessary to connect an earth-lead to the set (or to the L.T. accumulator); when using a frame, it



Layout of the components on the top and the underside of the baseboard.

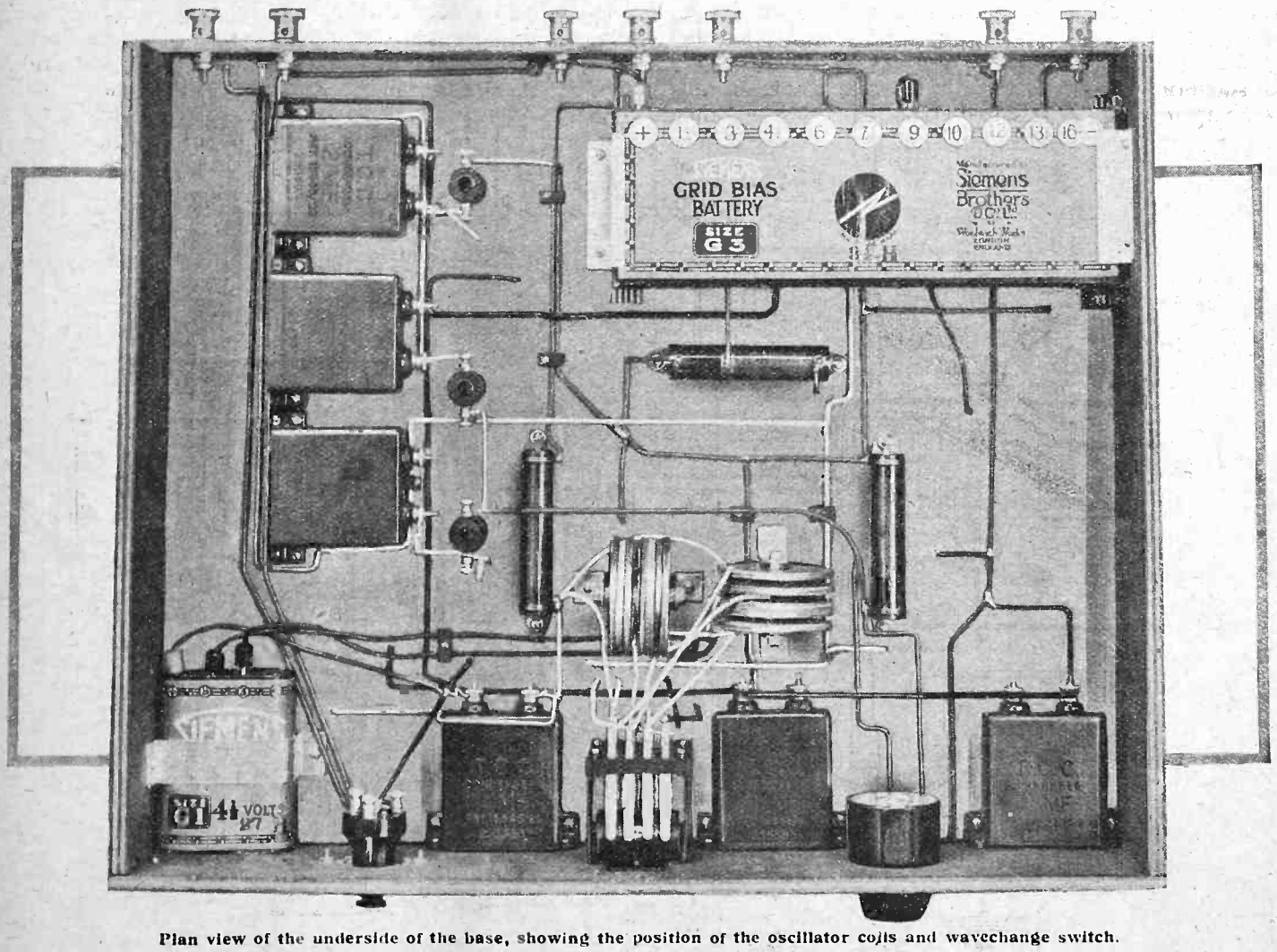
"The Wireless World" Band-Pass Superheterodyne.—

makes no difference whatever whether the set is earthed or not.

With the lower switch up (medium waves) and the upper switch down (three valves) and the volume control set at maximum, the local station should be heard on rotating the twin tuning dials on the left of the panel. With the small energy collected by a frame or tiny aerial, tuning will be found to be very much sharper than the habitual user of a full-size aerial would expect.

It may be helpful to state that in the original set the condenser across the filter primary was screwed right home, that on the secondary nearly down, and the one across the tuned anode circuit was practically not screwed down at all.

When the I.F. tuning has been set roughly with the aid of signals from the local station, something a little more distant may be tried for—Midland Regional, for example. With this station tuned in, and the volume control turned well down to keep the signal strength



Plan view of the underside of the base, showing the position of the oscillator coils and wavechange switch.

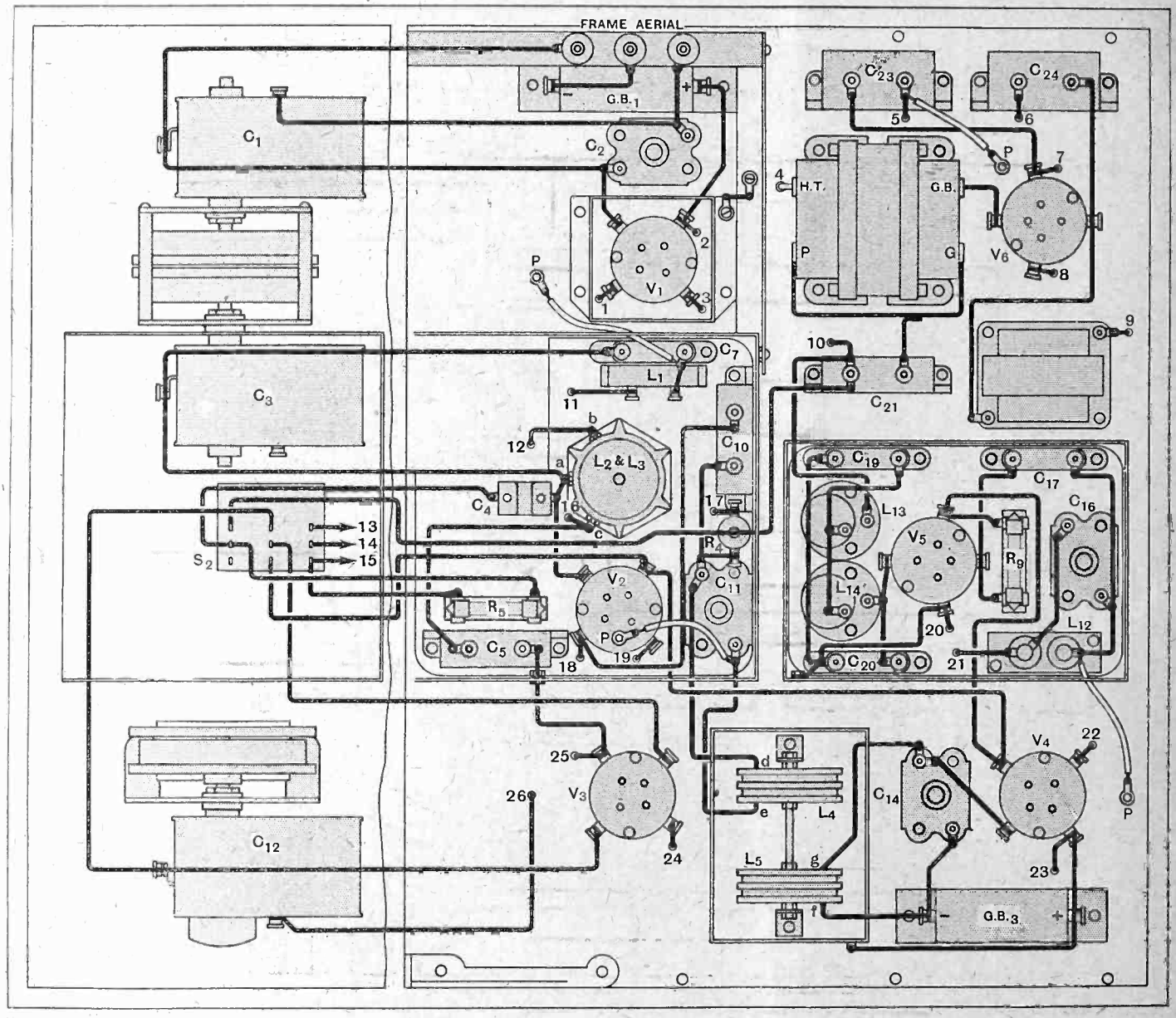
The local station is next tuned in accurately on the two dials, and the volume control slowly turned down till the signals are reduced to a faint whisper. Next, the upper switch is turned to bring in all six valves, and the oscillator dial is swung until signals are heard once more. The semi-fixed condensers controlling the intermediate-frequency tuning can now be set for maximum signals. In doing this, it is absolutely necessary that signals be kept very low by manipulation of the volume control, and, if necessary, of the frame tuning condenser, for the second detector chokes up and gives almost no output of signals if it is heavily overloaded, so that on an overwhelming signal louder music may be heard with the I.F. tuning set well away from its real best adjustment.

low, some more or less final touches may be given to the I.F. tuning condensers.

Next, the frame is turned to find the exact minimum position for 5GB, and is then set about twenty degrees from this position. By turning all the tuning condensers back by one degree, and then exploring a little with the slow-motion drive on the oscillator condenser, Langenberg should be heard. With its aid a really perfect and final setting of the three semi-fixed condensers can be achieved, for the presence of 5GB at a distance of 9 kc. away enables the width of the band passed by the I.F. filter to be correctly adjusted. If the settings are correct, it should not be possible to hear Langenberg without slight interference from 5GB, the latter station making itself heard by a kind of intermittent quacking

"The Wireless World" Band-Pass Superheterodyne.—

noise. This is the high-note modulation of 5GB, overlapping into the frequency band which we need to receive from Langenberg if we are to reproduce the higher notes that the German station transmits. When a setting of the I.F. condensers has been found, such six valves alight a station is tuned in at the bottom of the wavelength scale; the frame condenser will read higher than the H.F. condenser. The frame condenser is set to the same reading as its neighbour, and the station tuned in again by using the trimmer. Next, a station of wavelength well over 500 metres is found, and



Practical wiring plan of the components above the baseboard.

that the highest notes of music, or the consonants in speech, just break through intermittently when the set is tuned to Langenberg, their adjustment may be reckoned exactly right.

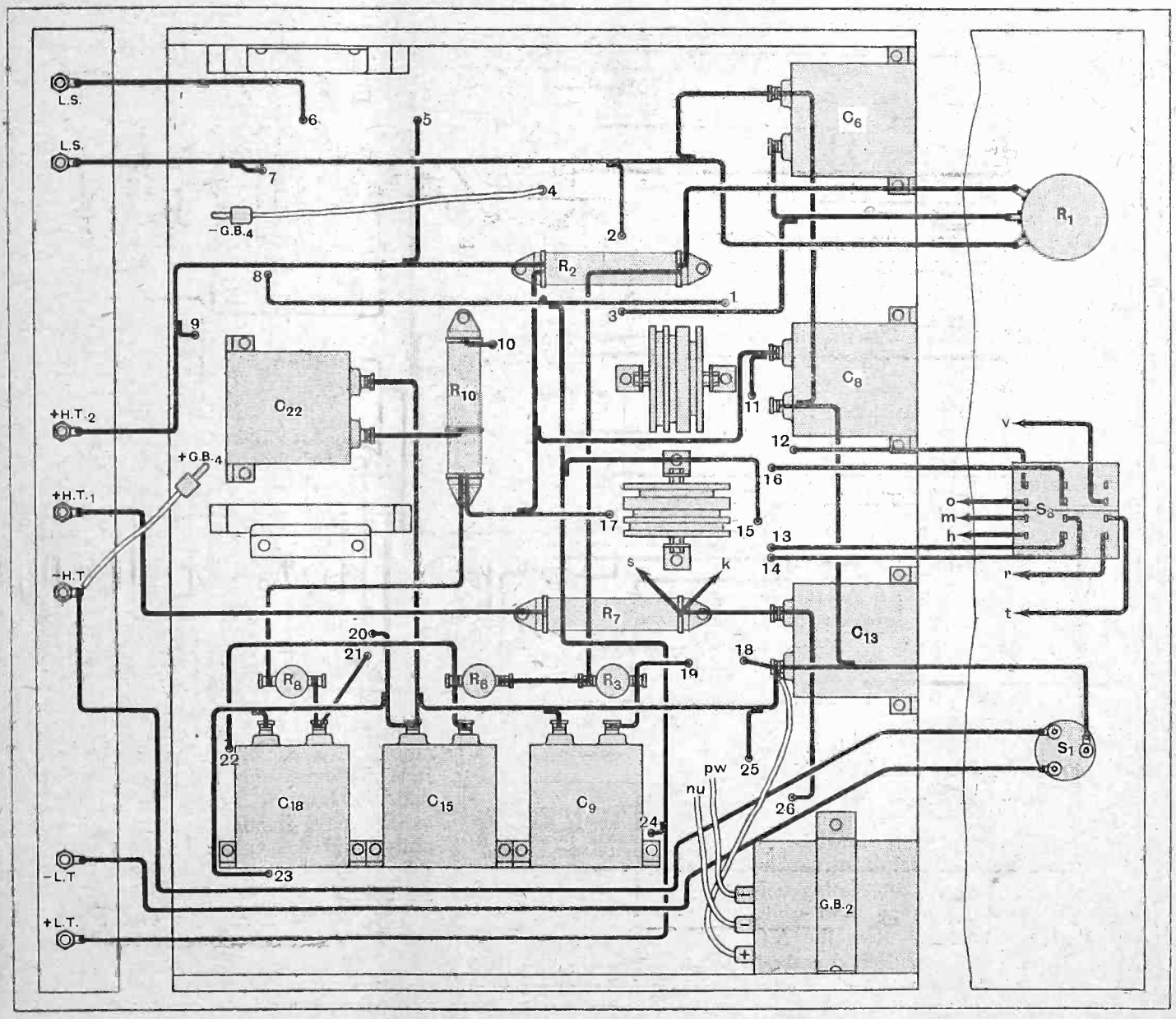
To listen to Langenberg in earnest the frame is set to the exact minimum position for 5GB, when the interference naturally stops.

The adjustment of the intermediate-frequency part of the receiver completed, nothing remains but to log stations. This attractive process will be considerably facilitated if the trimmer connected across the frame-aerial tuning condenser is brought into use. With all any difference between the readings of the two condensers is noted. Reverting to the original low-wavelength station, the H.F. condenser is set as before, but the frame condenser is set as many degrees behind or in advance of it as was required for the other station, and the trimmer is readjusted. Proceeding in this way, tuning in the two stations alternately, a setting of the trimmer is eventually found which allows one dial to be in advance of the other by the same amount at both ends of the scale. The two may now be regarded as ganged in the sense that they can be rotated together, like a single control, when searching for stations, but

"The Wireless World" Band-Pass Superheterodyne.—

independent fine adjustment for close tuning is still perfectly possible, for there is no mechanical linking.

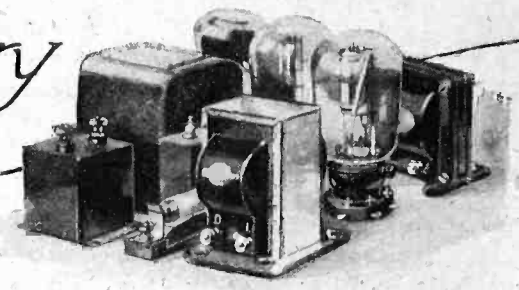
The standard of sensitivity to be expected of the receiver may be gauged from the fact that when using an 18-inch frame aerial Langenberg's lunch-time concert was found, in the heart of London, to deflect a milliammeter in the anode circuit of the second detector by about three-quarters of a milliampere. As a guide to the selectivity, it may be said that a news bulletin from Stuttgart, working on 360 metres, could quite easily be followed, even by one whose German is not too fluent, while the London Regional station was pouring out its 45 kilowatts on 356.3 metres at a range of a dozen miles or so. Interference from the local station took the form of a very noisy background, with London's high-note modulation breaking through intermittently. The London programme could not, of course, be followed. For this the frame was naturally set to minimum on the local station. Algiers, on 363.4 metres, though faintly received, suffered no interference whatever from the local station. The same separation of 18 kilocycles on either side of either of the local transmitters was quite enough to free the received station from interruption. Much higher selectivity than this can be had if one is content to cut off the sidebands in the I.F. amplifier; the results given are those obtained with the I.F. filter adjusted for adequate high-note reproduction in the manner already described.



The connection to the components situated below the baseboard.

Unfortunately, a few minor errors crept into the theoretical diagram included in last week's issue; C10 connects to junction of C11 and R4; the lead from local station switch connects to junction of C21 and R10. R8 and C18 are below the baseboard. The two leads from switch S2 should join to the moving contacts on S3, not to coils L7 and L8, as shown.

The Theory of the Valve Amplifier



Principle of Capacity Coupling.

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

(*Continued from page 462 of October 22nd issue*)

IN last week's issue it was pointed out that before a valve can be made to act as a voltage amplifier an impedance must be connected in the anode circuit, and that the properties of the circuit as a whole depend on the nature of this impedance. Let us first consider the simplest case where the added impedance takes the form of a pure resistance. It should always be borne in mind that resistance in an A.C. circuit is actually a special form of impedance where the voltage and current are in phase, and where the power consumed is given by their product in the ordinary way. Dividing the voltage applied to an A.C. circuit by the current in it always gives the impedance (the extent to which the current is impeded) and if the voltage and current happen to be in phase or in step the impedance is in the nature of a pure resistance or its equivalent.

In the circuit of Fig. 1 a non-inductive resistance R is connected in the anode circuit of a valve whose amplification factor will be denoted by μ and its internal A.C. resistance between anode and cathode by R_a. If a small alternating voltage V_g is applied to the grid of the valve it will have the effect of introducing into the anode circuit an alternating voltage of the same frequency, and whose magnitude is μV_g volts. Now the A.C. resistance between the anode and cathode of the valve is constant for all low and moderate frequencies, and is, therefore, equivalent to a simple non-inductive resistance. Hence the total A.C. resistance of the anode circuit is $R + R_a$ ohms. It follows, then, that the effective alternating voltage μV_g in the anode circuit due to the action of the grid will set up an alternating current whose magnitude is $\mu V_g/(R + R_a)$ amperes round the anode circuit. This current is additional to the normal steady direct current taken by the valve, and is, therefore, the alternating component of a more complex current.

The D.C. component is merely a necessary evil whose effects have to be eliminated when we come to transfer the amplified alternating voltage to the grid of a succeeding valve. We are, therefore, concerned only with the alternating component of voltage set up across the anode resistance as a result of the alternating component of current, namely, $\frac{\mu V_g}{R + R_a}$ amperes, flowing through it. By Ohm's law this alternating voltage is given by the product of the resistance and the current, its value being, therefore, $V_r = R \times \frac{\mu V_g}{R + R_a}$ volts. Dividing this voltage by the original alternating voltage V_g applied to the grid of the valve we obtain the actual voltage amplification n obtained with the circuit arrangement of Fig. 1. We have then

$$n = \mu \frac{R}{R + R_a} \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Now, obviously, $\frac{R}{R + R_a}$ is a quantity which is less than unity for all values of external anode resistance R, and therefore the actual voltage magnification obtained must always be less than μ, the amplification factor of the valve. But if R is made very large compared with the A.C. resistance R_a of the valve, the value of the above fraction will be very nearly unity, and the voltage amplification obtained will be very little less than the amplification factor of the valve.

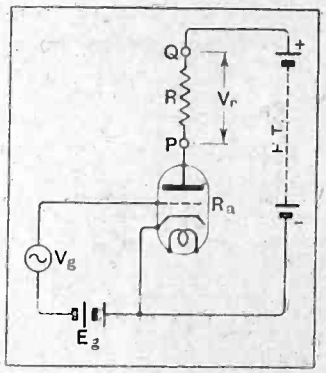


Fig. 1.—When a non-inductive resistance R is connected in the anode circuit of a valve, the theoretical value of the voltage amplification obtained is $\mu \frac{R}{R + R_a}$ where μ is the amplification factor of the valve and R_a is its A.C. resistance.

This simple theory as it stands leads one to the conclusion that the amplification obtained is quite independent of the frequency, and that the higher the value of the anode resistance R is made the greater will be the voltage magnification. But there are other factors which have to be taken into account at high frequencies, or when the added resistance R is very large compared with the internal A.C. resistance of the valve.

Loss of Anode Voltage.

For the present the question of frequency will be ignored. It was mentioned above that the presence of the D.C. component of current was a necessary evil; the particular evil here is that a certain voltage is required to drive this current through the anode resistance R and that, therefore, the actual mean potential of the plate or anode of the valve is less than the high-tension

The Theory of the Valve Amplifier.—

supply voltage by this amount. Thus, if I_a is the mean anode current in amperes, and E the high-tension supply voltage, the voltage at the anode will be only $E - I_a R$ volts. Consequently, if R is made very large, the anode potential may be reduced to such a low figure that the valve ceases to function properly. In practice it is generally safe to employ anode resistances up to five times the A.C. resistance of the valve, but a figure as high as ten times often proves quite satisfactory under certain conditions.

At the present stage, however, we are not concerned so much with the principles of resistance amplification in particular as with the general principles of cascade amplification. Consideration of the case with a simple resistance in the anode circuit merely serves as a good starting point, and gives an illustration of the general principle.

Whatever kind of impedance is connected in the anode circuit of the valve, the same general law applies, namely, that the higher the value of this impedance compared with the A.C. resistance of the valve the greater will be the voltage amplification obtained, although this can never reach a figure as great as the amplification factor of the valve (unless transformer action is resorted to). Whatever form the anode impedance takes, the variations of voltage set up between its ends should be a faithful reproduction of the voltage variations applied to the grid of the valve, and this is obviously the case for a pure resistance whose value is independent of frequency. With certain modifications this is also true for other types of anode impedance.

Coupling the Valves.

Having reproduced the signal voltage with increased amplitude across the added anode resistance or impedance, the next step is to provide a means of transferring this voltage to the grid of the succeeding valve.

This process is not quite so straightforward as it might appear, because only the alternating voltage must be transferred, to the total exclusion of any D.C. component of voltage which might exist across the anode impedance. In the case of resistance coupling the D.C. component is actually larger than the useful alternating voltage.

One of the most important points to be borne in mind is that for the sake of economy and practicability it is essential to employ a common source of high-tension supply for all the valves in the receiver, and the same applies as regards the filament heating supply. These conditions are all-important in determining the nature of the coupling between two successive valves. The use of a common H.T. source makes it essential to connect the anode impedance of each valve between the positive H.T. terminal and the respective anodes, and this means that the added impedance itself is at a high D.C. potential relative to the cathode circuits, and therefore direct connection of an anode impedance to the grid and cathode of a succeeding valve would be impossible.

Referring again to Fig. 1, it will be realised that the end Q of the anode resistance has a constant potential equal to that of the positive terminal of the H.T. battery, but that the end P is varying in potential in conformity with the alternating voltage applied to the grid of the valve. Thus, quite apart from the mean or D.C. potentials, the point Q is at zero alternating potential, whilst P is a point where an alternating potential exists. It is the varying or alternating voltage at P that has to be transferred to the grid of the next valve without allowing the D.C. potential to get across, and the means of doing this is afforded by the properties of a condenser. Although an alternating current can be passed through a circuit with a condenser in series, no direct current can be made to pass (unless the insulation is bad). Thus, by connecting a condenser between the point P and the grid G_2 of the next valve, the desired effect is obtained.

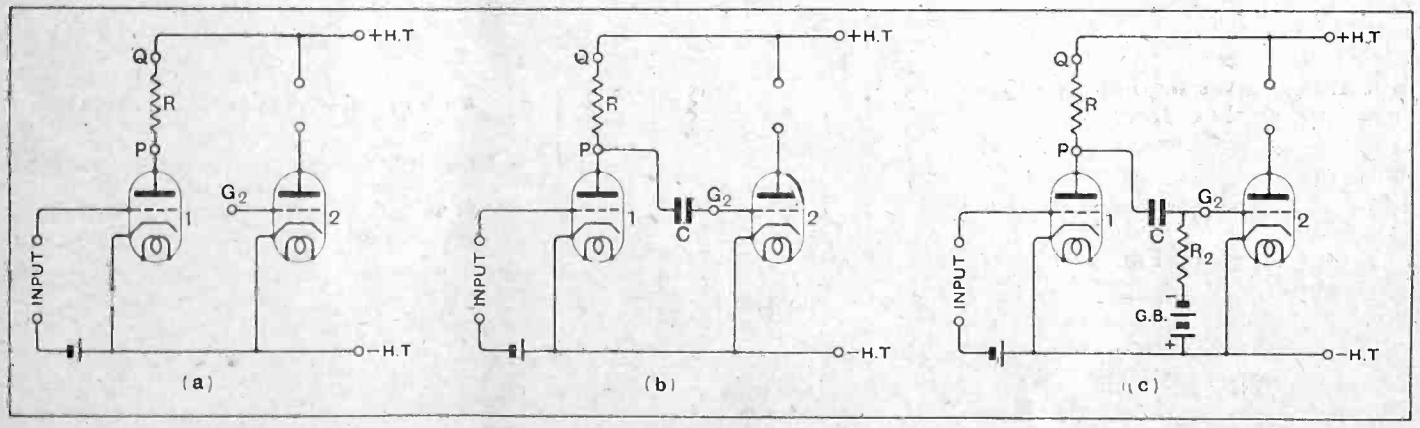


Fig. 2.—Diagrams explaining the process of coupling two valves in cascade.

In order to show clearly the successive steps in connecting two valves in cascade, and to explain the precise object of each step, the diagrams of Fig. 2 are included. The two valves 1 and 2 are shown at (a) with their cathodes joined to the negative high-tension terminal. Between the anode of the first valve and the positive H.T. terminal is the external anode resistance R (or possibly some other form of impedance Z). Assuming that the voltage to be amplified is applied to the input terminals at the left, the amplified potential variations set up at P must be made to produce the same variations at the grid of valve 2. Consequently, a

The Theory of the Valve Amplifier.—

condenser C is connected between P and G_2, as shown at (b) in Fig. 2.

If no grid current flows in valve 2, and if the capacity between the grid and other electrodes is negligibly small compared with that of the coupling condenser C, it follows that the fluctuating voltage on the left-hand side of C cannot possibly cause any alteration in the charge which this condenser might possess in the first instance. A variation of charge can only be produced by a flow of current. Thus, *the potential difference between the plates of the coupling condenser is a fixed quantity, and therefore both plates follow the variations of voltage* at the anode P of the preceding valve. So, although the actual potentials of the plate of valve 1 and the grid of valve 2 may be different, they both vary about their respective mean potentials in the same way and to the same extent.

Necessity for a "Grid Leak."

Whilst the voltage variations at the anode P are faithfully copied at the grid G_2 with the simple circuit arrangement of Fig. 2 (b) when the coupling condenser C has a sufficiently large capacity, there is another important factor to be taken into consideration, which relates to the functioning of the second valve. Although an alternating voltage is applied to its grid, the mean potential of the grid must be maintained at such a value as to make the valve operate over the correct portion of its anode characteristic curve, whether this second valve acts as a detector or a second stage amplifier. In Fig. 2 (b) the grid of the second valve and the condenser plate connected to it are insulated from the rest of the circuit, and, therefore, the grid is free to take up any mean potential as determined by slight leakage or even electrostatic induction; for instance, if the dielectric of the coupling condenser C were not a very good insulator the grid side would tend to take up the same positive potential as the plate of the first valve. The grid of the second valve would thus be given a high positive voltage which would prevent the valve from functioning, and might even cause damage.

Assuming that the second valve required a mean potential negative with respect to the cathode, the next step is to consider how this can be applied without upsetting the transfer of signal voltage variations from the previous valve. If a battery of the correct voltage were to be connected directly between the grid and cathode (positive terminal to cathode and negative terminal to grid) the desired negative *grid bias* would be obtained, but the grid voltage would then be rigidly fixed relatively to that of the cathode, and no voltage variations would be imparted to it from the preceding valve. The voltage at the point G_2 must be free to vary in accordance with the voltage at P, and yet the mean voltage of G_2 must be maintained at a definite negative value. These two requirements are diametrically opposed as regards fulfilment—the one calls for an insulated grid (infinitely great resistance between grid and cathode) and the other for a battery, or the equivalent, to be connected between the grid and the cathode.

The difficulty is overcome by using the battery as suggested, but with a very high resistance connected in series with it. The grid bias battery and the high resistance are denoted by G.B. and R_2 respectively in Fig. 2 (c). The positive terminal of the battery is connected directly to the cathode of the valve and the high resistance comes between the negative terminal of the battery and the grid of the valve.

The high resistance R_2 is generally referred to as a "grid leak," but when used in this manner it does not represent a leak at all. (The term "grid leak" really only applies in the strict sense to a grid-detector valve.) Since no direct current can flow either through the coupling condenser or between the grid and cathode inside the valve (on account of the negative bias) it follows that the resistance R_2 will in normal circumstances carry no direct current, and there will be no D.C. potential difference between its ends. The mean potential of the grid of the valve is, therefore, equal to the potential of the negative terminal of the battery G.B. for any value of R_2 provided R_2 is small compared with the insulation resistance of the grid circuit, the latter resistance being usually of the order of tens or even hundreds of megohms.

Now, as regards the reason for introducing the high-resistance R_2. The essential condition for the transfer of the full voltage variation at the anode of the first valve to the grid of the second is that the charge held by the coupling condenser C shall be the same at all times. Joining G_2 directly to the negative terminal of the battery G.B. would destroy this condition, and yet G_2 must have an *average* potential equal to the negative terminal of G.B. Hence a compromise is adopted, R_2 being made so high that it has only a small disturbing effect on the action of the coupling condenser, but is, nevertheless, quite effective in conveying the necessary negative bias to the grid of the valve. This is a general principle adopted in conjunction with several coupling arrangements.

(To be continued.)

oooo

FORTHCOMING EVENTS.

WEDNESDAY, NOVEMBER 12th.

Lensbury Radio Society (in conjunction with R.S.G.B.).—At 6.15 p.m. At 16, Finsbury Circus, E.C.2. Lecture-demonstration: "The Latest Developments in Sound Reproduction," by Dr. N. W. McLachlan, M.I.E.E.

Muswell Hill and District Radio Society.—At 8 p.m. At Tollington School, Tetherdown, N.10. Lecture and demonstration, by Mr. Frank Murphy, B.Sc., to include demonstrations of audio-frequency oscillator for checking loud speaker performance.

Tottenham Wireless Society.—At 8 p.m. At 10, Bruce Grove, N.17. Sale and exchange.

THURSDAY, NOVEMBER 13th.

Edinburgh and District Radio Society.—Lecture: "Power Amplifiers," by Mr. J. L. Minto.

Golders Green and Hendon Radio Society.—At 8.15 p.m. At Woodstock School, Golders Green Road, N.W.11. Experiences on D.F. schemes, related by members of Golders Green, North Middlesex, and Western Postal District Societies.

Slade Radio (Birmingham).—At 8 p.m. At the Parochial Hall, Broomfield Road, Erdington. Lantern lecture: "Batteries and Their Maintenance," by Mr. O. P. Lockton (of Messrs. Exide).

FRIDAY, NOVEMBER 14th.

Bristol and District Radio Society.—At 7.15 p.m. In the Geographical Theatre, University of Bristol. Lecture: "Modern Mains Receivers," by Mr. E. J. Pound (of Messrs. L. McMichael, Ltd.).

SATURDAY, NOVEMBER 15th.

Tottenham Wireless Society.—Visit to Brookmans Park.

TUESDAY, NOVEMBER 18th.

Bec Radio Society.—At Bec School, Beechcroft Road, S.W.17. At 7.45 p.m. (Beginners' Section). Lecture: "Radio Currents and Their Reception." At 9.10 p.m.: Demonstration of members' apparatus.

WEDNESDAY, NOVEMBER 19th.

Muswell Hill and District Radio Society.—At 8 p.m. At Tollington School, Tetherdown, N.10. Lecture, by Mr. J. L. Thompson, to include demonstration of Cossor sets.

BROADCAST BREVITIES

By Our Special Correspondent.

The Orchestra.—Theatres and Licence Surplus.—Cinema Organs.

Secret Name for New Orchestra?

The problem of naming the B.B.C.'s new Symphony Orchestra exercised its sponsors from the very beginning, but publicly, at least, the orchestra still languishes without a title. I understand, however, that a name has already been metaphorically inscribed in copper plate, and now nestles privately in a little back drawer of the Director-General's desk.

o o o o

Waiting.

What that name will be, and why, must remain undisclosed until the probable occurrence of an historic event, early in the New Year.

What I can disclose is that the B.B.C. will not use the name suggested by a newspaper correspondent, viz., "broadestra." Neither are they attracted by "Boultestra."

o o o o

Interest in America.

The fame of the orchestra has already spread to America. The Columbia system has announced a relay throughout the U.S. of the orchestra's performance at the Queen's Hall on Wednesday, November 19th, when Sir Henry Wood conducts.

The transmission will be picked up from 5SW.

o o o o

A Compliment to 5SW.

That the Americans calmly rely on the efficiency of the Chelmsford short-wave station is a real tribute to 5SW. For a trans-American relay elaborate arrangements have to be made with a very large number of small stations, and the U.S. broadcasting authorities do not waste "hook-ups" on items which are doubtful.

o o o o

Scotland's Radio Show.

Edinburgh holds a joy week beginning to-day (Wednesday) when Sir John Reith, speaking into a microphone at Savoy Hill, opens the Scottish Radio Exhibition in the Waverley Market.

The chairman on to-day's occasion will be the Lord Provost of Edinburgh, and others present will include Mr. Gladstone Murray, the B.B.C. Assistant Controller, and Mr. Cleghorn Thomson, the Scottish Area Director.

o o o o

A Model Studio.

The "star" exhibit will be the B.B.C.'s stand, which takes the form of a model studio surrounded by glass, through which the public will witness broadcast artistes performing before the microphone.

The last occasion on which the B.B.C. gave this very attractive kind of demonstration was, I believe, at the Olympia Radio Show in 1926.

o o o o

Hands Off the Licence Surplus!

With that attractive little pile, i.e., the broadcast licence surplus, lying unused at the Treasury, is it any wonder that certain hungry birds are beginning to flutter round in hopes of a free meal?

FUTURE FEATURES.

NOVEMBER 19TH. — Symphony concert from Queen's Hall.
NOVEMBER 20TH.—Gaelic concert from Aberdeen.
NOVEMBER 21ST.—"Pelléas and Mélisande," a lyric drama by Maurice Maeterlinck
NOVEMBER 22ND.—Running commentary on Arsenal *v.* Middlesbrough football match, by Mr. George F. Allison.

London Regional.

NOVEMBER 16TH.—Military band concert.
NOVEMBER 17TH.—Brass band concert from Newcastle.
NOVEMBER 18TH.—"Pelléas and Mélisande."
NOVEMBER 19TH.—"Before the Party," adapted for broadcasting from story by Somerset Maugham.
NOVEMBER 21ST.—Dutch National programme from Holland.

Midland Regional.

NOVEMBER 17TH.—"Stars of the Past." Some melodies of bygone days.
NOVEMBER 18TH. — "Syncopated Pianisms."

West Regional (Cardiff).

NOVEMBER 16TH.—Concert from Park Hall, Cardiff.

North Regional (Manchester and Leeds).

NOVEMBER 17TH.—A Jewish orchestral programme.

Belfast.

NOVEMBER 18TH. — "The Drone," a comedy by Rutherford Mayne.

The British Drama League.

Prominent on the scene is the British Drama League, championed by Mr. Granville-Barker, who is reported as advocating that "a grant from the B.B.C. funds (sic) might be allotted by the Government as a credit for the establishment of a national theatre."

o o o o

Pity the Poor Listener.

Doubtless Mr. Granville-Barker actually refers to the licence surplus; the B.B.C. pleads "not guilty" to the accumulation of profits, all the money which reaches the Corporation being spent on programmes.

As a broadcast listener paying my ten shillings per annum, I find it difficult to remain calm in face of a proposal that some of my money should be devoted to a theatre from which I may never derive a ha'p'orth of benefit.

The Stage and the Microphone.

True, the National Theatre might offer broadcasting facilities, but it is a notorious fact that the average stage play is unsuited to the microphone. After much wrangling with the theatre interests the B.B.C. was granted permission to broadcast twenty-six times per annum from various playhouses, but the privilege has not been exercised owing to lack of suitable material.

o o o o

Permanent Vaudeville Artistes.

The B.B.C. has decided to start a new experiment in vaudeville on November 24 in the National programme.

A band of regular artists in these programmes will perform under the name of "The Foursome," and it will be their job to link up the performances, announce the "stars," sing choruses and generally keep things moving.

Members of "The Foursome" are Hermione Gingold, Olive Groves, Bernard Clifton and Ernest Sefton.

o o o o

Studio Opera Season Ends.

On November 18 and 19 the last of the present series of studio operas, Debussy's "Pelléas and Mélisande," will be broadcast from the Regional and National transmitters.

The studio series started in September, 1929, with "Thais."

o o o o

Organs.

The first of a series of talks on pipe organs will be broadcast by Mr. K. W. Anderson from Midland Regional on November 28th.

o o o o

Are Cinema Organs Played Out?

How many listeners, I wonder, noticed that the cinema organ recital advertised in the official programme for 1 o'clock on Tuesday of last week never took place? I am not specially interested in the reason why this recital "misfired"—I believe it was due to a forgotten stage rehearsal in the Victoria Theatre. What interests me is the fact that not one listener sent a letter of enquiry to the B.B.C.

o o o o

Church Organ Broadcasts in Request

Correspondence received at Savoy Hill seems to indicate that the bleating and hiccoughing cinema organ is no longer in request. On the other hand, real organ music was never more popular, a favourite organ with listeners being the splendid instrument in All Saints, Margaret Street, which gives good results despite the absence of cycle bells, cuckoo clocks, tambourines, alligators' jaws, or even a few homely fly swatters.

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.

The Best Anti-interference Circuit.

Due to the fact that interference from electrical circuits is severe, I find that the ordinary type of sensitive receiver with an open aerial-earth system is almost useless for distant reception. In an attempt to overcome this difficulty I intend to carry out some experiments with a frame aerial, and should like to set up the best possible arrangement; a two-circuit input tuner would not be objected to, as it is understood that this complication is well worth while.

Will you please recommend the most promising circuit? A.C. valves are to be used in the receiver, which will have at least two H.F. stages.

N. P.

We think you will find it difficult to better the input circuit shown in Fig. 1, which comprises a tuned centre-tapped

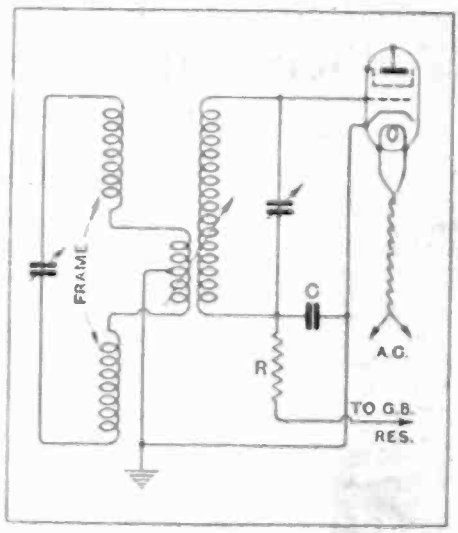


Fig. 1.—A loosely coupled frame aerial circuit with earthed centre point. R is a decoupling resistance, and C is the associated by-pass condenser.

frame, loosely coupled to a secondary circuit. The coupling coil, by means of which energy is transferred from one circuit to another, is inserted at the mid-point of the frame aerial winding, and its centre point is earthed in order to minimise "vertical" pick-up. For reception on the medium waveband a coupling coil with from six to eight turns should be quite adequate, and arrangements should be made to vary its position in relation to the low-potential end of the secondary inductance.

Of course, it will be necessary completely to shield the secondary and other receiver circuits from the frame aerial.

The Effects of Dampness.

I have been agreeably surprised to find that there is very little interference to my broadcast reception from a recently installed high-voltage overhead power line which runs within some thirty yards of the bottom of my garden. On a few occasions, however, "cracklings" have been observed; they generally seem to coincide with rainy weather, and are presumably due to leakages at the insulators.

Of late it has been noticed that this interference is sometimes evident when there is no rain, and, further, that the interference is even more pronounced than formerly. Do you think it is due to the fact that a heavier current is now being passed along the supply wires? If so, I fear that interference is likely to become more serious in the future, as the new system of electrical supply becomes more widely used.

L. B. F.

It is almost certain that the interference you have recently experienced is due solely to the damp weather which we have to expect in this country in the autumn. It has often been observed that "brushing" over insulators takes place more freely in humid weather than when rain is actually falling.

○○○○

On the Verge of Self-oscillation.

My set (anode bend detector and two resistance-coupled L.F. stages) works quite well as a receiver of wireless signals, but tends to "motor boat" when a gramophone pick-up is used. I cannot see why this should be, as the circuit is virtually unchanged, except for the fact that the pick-up is inserted in series with the detector grid, and bias is suitably reduced to convert this valve into an L.F. amplifier. Will you please give me an explanation, and, if possible, make a suggestion as to how L.F. oscillation may be prevented?

R. N. D.

When the detector is converted into an amplifier by reducing its grid bias, the impedance of the valve is reduced, and it gives a higher overall magnification. This, in turn, will be responsible for an increased tendency towards instability; it is quite probable that this tendency is present even when the receiver is operating in the normal way, and consequently the set is never working at its best.

We suggest that you should fit suitable decoupling resistances and by-pass condensers, or, if you have already done so, you should increase the values of all the decoupling components.

An Improvised G.B. Eliminator.

In the interests of economy I should like to make use of a quantity of obsolete apparatus already in my possession for the construction of a grid bias battery eliminator. It is intended to use an ordinary triode valve with grid and anode terminals connected together as a rectifier, and, as all A.C. ripple must obviously be avoided, I am thinking of using, as a smoothing choke, an old L.F. transformer with primary and secondary joined in series. Do you consider that this will be satisfactory?

H. D. V.

In this particular case the high D.C. resistance of the transformer windings should not be a serious disadvantage, and so your proposed plan should yield satisfactory results.

Care should be taken to see that the windings are connected together in the correct sense, so that maximum inductance may be obtained.

○○○○

Short-Wave Sets and Eliminators.

I am thinking of making one of the short-wave sets described in your journal, but am undecided whether to adopt the circuit of the "Superheterodyne Short-Wave Adaptor" (April 23rd, 1930), or the "S.G. Short-Wave Three" (January 1st, 1930). Of course, the adaptor would be operated in conjunction with my normal broadcast receiver. Which of these sets would be likely to work best with an H.T. eliminator?

L. B. R.

There can be no doubt that the circuit of the "S.G. Short-Wave Three" is the better when anode current is to be supplied by an eliminator. The superheterodyne unit, which includes an oscillating valve, would be definitely unsuitable for your needs, as any remaining traces of "hum" would modulate the oscillations produced by this valve.

RULES.

The free service of THE WIRELESS WORLD Technical Information Department is *only* available to registered readers and subscribers. A registration form can be obtained on application to the publishers.

(1.) **Every communication to the Information Department must bear the reader's registration number.**

(2.) *Only one question (which must deal with a single specific point) can be answered. Letters must be concisely worded and headed "Information Department."*

(3.) *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.*

(4.) *Designs or circuit diagrams for complete receivers or eliminators cannot ordinarily be given; under present-day conditions justice cannot be done to questions of this kind in the course of a letter.*

(5.) *Practical wiring plans cannot be supplied or considered.*

(6.) *Designs for components such as L.F. chokes, power transformers, complex coil assemblies, etc., cannot be supplied.*

(7.) *Queries arising from the construction or operation of receivers must be confined to constructional sets described in "The Wireless World"; to standard manufactured receivers; or to "Kit" sets that have been reviewed used in their original form and not embodying modifications.*

MISCELLANEOUS ADVERTISEMENTS.

NOTICES.

THE CHARGE FOR ADVERTISEMENTS in these columns is :

12 words or less, 2/- and 2d. for every additional word.

Each paragraph is charged separately and name and address must be counted.

SERIES DISCOUNTS are allowed to Trade Advertisers as follows on orders for consecutive insertions, provided a contract is placed in advance, and in the absence of fresh instructions the entire "copy" is repeated from the previous issue : 13 consecutive insertions 5% ; 26 consecutive, 10% ; 52 consecutive, 15%.

ADVERTISEMENTS for these columns are accepted up to FIRST POST on THURSDAY MORNING (previous to date of issue) at the Head Offices of "The Wireless World," Dorset House, Tudor Street, London, E.C.4, or on WEDNESDAY MORNING at the Branch Offices, 19, Hertford Street, Coventry ; Guildhall Buildings, Navigation Street, Birmingham ; 260, Deansgate, Manchester ; 101, St. Vincent Street, Glasgow, C.2.

Advertisements that arrive too late for a particular issue will automatically be inserted in the following issue unless accompanied by instructions to the contrary. All advertisements in this section must be strictly prepaid.

The proprietors retain the right to refuse or withdraw advertisements at their discretion.

Postal Orders and Cheques sent in payment for advertisements should be made & Co. payable to ILIFFE & SONS Ltd., and crossed Notes being untraceable if lost in transit should not be sent as remittances.

All letters relating to advertisements should quote the number which is printed at the end of each advertisement, and the date of the issue in which it appeared.

The proprietors are not responsible for clerical or printers' errors, although every care is taken to avoid mistakes.

NUMBERED ADDRESSES.

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 ooo, c/o "The Wireless World." Only the number will appear in the advertisement. All replies should be addressed No. ooo, 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 Iliffe & Sons Limited.

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.

RECEIVERS FOR SALE.

SCOTT SESSIONS and Co., Great Britain's Radio Doctors.—Read advertisement under Miscellaneous. [0264

HIRE a McMichael Portable Set, by day or week, from Alexander Black. Wireless Doctor and Consultant, 55, Ebury St., S.W.1. Sloane 1655. [0328

STRAIGHT Five Portable, makers' 12 months' guarantee; 8 guineas, complete.—Mosby, 507, London Rd., Sheffield. [1169

THOUSANDS of "Wireless World" Readers are Building the Band-pass Three. See advert. under Coils.—Groves Brothers. [2003

PHILIPS 4-valve A.C. Mains Receiver, 210v. 50c., perfect condition, £25, or nearest offer; Philips speaker, type 2007, £3.—Box 8037, c/o *The Wireless World*. [2054

Receivers for Sale.—Contd.

PHILIPS 2511 Electric Receiver, 4-valve, 240 volts, £21; Philips 2013 moving coil L.S., £7; set and speaker complete, £26; H.M.V. No. 163 gramophone, mahogany, £18.—Saul, 8, Ansdell Rd., S. Ansdell, Blackpool. [1944

£15.—1930 Everyman Four, Rigby and Woollenden cabinet, highest possible quality components. Mazda valves (new).—Fulton, 40, Kirkland St., Motherwell. [2052

ORGOLA Senior Kit, complete less panel, for "W.W."; deposit.—Bourne, Kabul, Hankham, Westham, Sussex. [2051

BRANDESET III B, with valves, £7; Pye 25 5-valve portable set, £12; Aeonic 5-valve portable set, £7; Veltone 5-valve portable set, £6; Epoch 66E moving coil speaker unit, 6-volt field, £3/10; 2 Marconi P.X.4 valves, 15/- each; 2 Marconi P625 valves, 5/-; all slightly used; reasonable offers accepted.—Atherton, Pensby Rd., Heswall, Cheshire. [2047

B.T.H. R.K. Senior (A.C. mains) Moving Coils and Last Stage Amplifier, pedestal cabinet, perfect condition; cost £45, accept £20.—Morgan, 24, Phœnix Lodge Mansions, Brook Green, W.6. Riverside 2176. [2046

1930 Kilomag Four, built to original specification in Ritherdon metal cabinet; £16.—B. V., 10, Parsifal Rd., Hampstead, N.W.6. [2041

£26 Receiver, mains, Selestion speaker; offers.—May, 31, Montague Av., Hanwell, W.7. [2037

MEGAVOX Chassis, complete, valves, accumulators, £12; Exide H.T. charger, £2; Ediswan L.T. charger, 25/-; Baker 6v. M.C. speaker, £3; Marconi ditto, £3; valves, P.M.4, P.M.24, Philips 506K, half price; all above guaranteed perfect.—Anning, Valley Drive, Ben Rhydding, Yorks. [2035

SILVER Marshall 7-valve Set, 4 screen grid det. power and superpower, extremely selective, band pass filters, several spare valves, £15; Regentone eliminator, 3 variable, 1 fixed, £5; 200v. A.C., all in perfect order; demonstration by appointment.—Colonel Kennard, 2, Adelphi Terrace, W.C.2. Temple Bar 1364. 8 a.m. to 4 p.m. [2034

NEW Kilomag Four, working satisfactory, Berclift cabinet, Wearite coils, added Ferranti pull-push, with Mazda 2-volt valves; £10/10.—Newton, "Highcroft," Stanneylands Rd., Wilmslow. [2031

PYE 232 2-valve Set, with Mullard valves, shop soiled only; £2.

B.T.H. 2-valve Set, with valves, as new; £1/10.—Vautier, 234, Brixton Hill, S.W.2. [2029

McMICHAEL Super-range Portable Four, very little used, perfect condition; £15 or near offer.—Addey, "Ramzon," Cuckoo Hill Rd., Pinner. [2074

McMICHAEL Super-range Portable Screen Grid Four, latest model, new condition; £16/10.—5, Rugby Mansions, Addison Bridge, Kensington. Fulham 4302. [2076

4-VALVE Set, S.G., Anode bend detector, R.C. coupled to L.F., transformer coupled to super power, choke filter output, best components, fully decoupled, £10; also Met-Vic or Ecko eliminator, 200v. 60 m.a., £5; suit experimenter.—Burbridge, 79, Kingshall Rd., Beckenham. [3404

McMICHAEL Super-range Portable Four, as new; £18 or near offer; delivered free any part of London.—Reply Box 8048, c/o *The Wireless World*. [2096

EVERYMAN FOUR, complete, also wet H.T., in mahogany pedestal cabinet. Marconi cone and moving coil speakers, Phillips trickle charger; lot £12, or nearest offer.—Box 8047, c/o *The Wireless World*. [2095

ENTHUSIASTS!!—Superheterodyne kit : McMichael clock unit complete, set of Mullard 2-volt valves, 0.0003 and 0.0005 Lissen variables and dials, potentiometer, etc.; owner building band-pass superhet.; £4/10, or separately.—Houldsworth, 2, Pemberton Terrace, Cambridge. [2059

LIBERTY Heterodyne Wavemeter, 250 to 3,000 metres, extra valve and tuning charts, 50/-; Victor Three 3-valve receiver, complete valves, 50/-; 1929-30 McMichael Screened Dimic Three, battery model, complete valves, as new, £15; seen by appointment.—Spice, 20, Dacre Rd., Eastbourne. [3102

SELECTOR Portable 33-guinea Attache Case Model, condition new, perfect working order, makers' guarantee; also Phillips 450 charger (110v.); what offers?—Gallagher, 3, Upper St., Islington, N.1. [2082

3-VALVE All-Mains Receivers, no batteries required, 6 guineas; Marconi A.C. eliminator, £2/10.—Brooks, 3, Anselm Rd., Fulham. [2069

5-VALVE Grebe Neutrodyne, complete with powerful eliminator and L.T. battery, wonderful results on frame or outside aerial; £18.—Mack, 58, Thornton Av., S.W.2. 'Phone : Streatham 2454. [2057

Receivers for Sale.—Contd.

YOUR Old Receiver or Component Taken in Part Exchange for New; write to us before purchasing elsewhere and obtain expert advice from wireless engineer of 25 years' professional wireless experience; send a list of components or the components themselves, and we will quote you by return post; thousands of satisfied clients.—Scientific Development Co., 57, Guildhall St., Preston. [0226

ACCUMULATORS—BATTERIES.

22 10v. Exide W.J., 2/6 each; 2 6v. 60 actual Rotax, 25/- each.—Birch, 30, Limesford Rd., S.E.15. Seen evenings. [2079

ACCUMULATOR HIRE.

DON'T Buy Dry Batteries, join our service; we keep you continuously supplied with fully charged G.A.V. high tension accumulators, by regular exchanges, anywhere within 12 miles of Charing Cross, for less than the cost of unreliable dry batteries; nothing to buy—no deposit, payment on each delivery or by quarterly subscription; if your dry batteries have been in use for one month or more we definitely guarantee that accumulators will give better and more selective reception; we also give the same service with low tension accumulators or maintain your own at equally advantageous terms from the smallest portable size upwards; over 10,000 satisfied users.—Write or 'phone now to London's largest, most efficient and complete wireless accumulator service, for their interesting folder 32, post free.—Radio Service (London), Ltd., 105, Torrlano Av., Camden Rd., N.W.6. 'Phone: North 0823 (3 lines). [1466

CHARGERS AND ELIMINATORS.

PHILIPSON'S Safety H.T. Supply Units are Famous for Reliability and Silent Working.

OUR New Prices Again Make Them Famous for Value; for D.C. mains model D.C.4 gives 120v. at 15 m.a., 27/6; D.C.5. 150v. at 25 m.a., 1 fixed, 2 var. tappings, 35/-; for A.C. mains model A.C.7, 120v. at 20 m.a., £3; A.C.5. 150v. at 30 m.a., 1 fixed, 2 var. tappings, £3/17/6; A.C.6, for 25 cycle mains, £5.

PHILIPSON'S Safety H.T. Supply Units are Guaranteed for 12 months; write for our booklet, "Radio Power."

PHILIPSON and Co., Ltd., Radio Engineers, Astley Bridge, Bolton. 'Phone: 2038. 'Grams: Safety, Bolton. Est. over 50 years. [0318

TANTALUM and Lionium for A.C. Rectifiers, blue prints for inexpensive H.T. and L.T. chargers.—Blackwells Metallurgical Works, Ltd., Garston, Liverpool. [1209

CHESTER BROS.—All types of mains transformers and chokes to any specification.—Chester Bros., 495, Cambridge Rd., London, E.2.

CHESTER BROS.—Type V3 220+220v., 35 m.a., 5v. 1.6a., C.T., 4v. 4a. C.T., 27/6.

CHESTER BROS.—Type W.10, for H.T., 3 or 4, output 135v. 50 m.a., and 4v. 4a., C.T.; 23/6.

CHESTER BROS.—Smoothing chokes, constant inductance, type C.B.2, 45 henrys, 25 m.a.; 15/-.

CHESTER BROS.—Write for lists of standard models. Please note change of address. [1477

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, 1,500 volts D.C. test, 1 mfd. 2/-, 2 mfd. 3/-, 4 mfd. 5/3; 500 volts D.C. test, 1 mfd. 1/6, 2 mfd. 2/3; 4 mfd. 3/9.

SAVAGE'S Power Chokes for the Power Pentode Two, smoothing L.C.36G, 18/-; output L.C.36P.G., 19/6; many other types available, write for list.

SAVAGE'S Mains Transformers for the New Westinghouse Units; please write for list.

SAVAGE'S New Foreign Listeners' Four Equipment. —Transformer, N.F.L.4, 33/-; smoothing choke, C32G, 20/-; output choke C32O, 20/-.

SAVAGE'S "Wireless World" Four Equipment, mains transformer, W.W.4, 34/-; smoothing and bias chokes, type W.W.4C, 16/- each; centre tapped output choke, L.C.36P.G., 19/6.

SAVAGE'S Mains Transformer, B.T.4, 500-0-500 volts 120 m.amps., 7½ volts 3 amps., 6 volts 3 amps., 4 volts 2 amps., 4 volts 1 amp., 4 volts 1 amp., all centre tapped, specially developed to facilitate automatic bias in all stages; 57/6.

SAVAGE'S Mains Transformer, V.T.37, 250-0-250 volts 60 m.amps., 4 volts 1 amp., 4 volts 1 amp., 4 volts 1 amp., 4 volts 2 amps., all centre tapped, a useful instrument for modern receivers with automatic bias in every stage; 35/-.

SAVAGE'S Mains Transformers and Power Chokes are carefully constructed from first class materials with an exceptionally generous margin of safety; they are fully guaranteed and may be purchased with confidence.

SAVAGE'S Have Moved to Larger Premises; please note new address: 292, Bishopsgate, London, E.C.2. Telephone: Bishopsgate 4297. [1784

REGENTONE W.1 Eliminator, 200-250 A.C., output 200 volts 50 milliamps, in perfect condition; £3/10.—Ross, Elmbank, Friern Lane, N.11. [2084

Chargers and Eliminators.—Contd.

H.T. Eliminator Kit, incorporating Westinghouse H.T.5 rectifier, kits consist of transformer, choke, Westinghouse rectifier; required condensers, resistance, safety plugs and sockets, and baseboard; output 20 milliamps at 120 volts, 47/6, post free; metal case for same, 3/9 extra.

ELIMINATOR Kits, transformers, choke, condensers, valve, valve holder, resistance, terminals; 36/-; post free.—Fel-Ectric Radio, Garden St., Sheffield. [2049

WESTINGHOUSE H.T.3 Rectifier, nearly new, £2/6.—Chapman, Trillick, Ground Lane, Hatfield, Herts. [2045

PHILIPS Trickle Charger, 215-230v., 30/-; Philips eliminator, A.C. 220v., 60/-; Lotus mains and battery relay, 12/-, all in perfect order.—Moore, Old Rectory, Monks Risborough, Bucks. [2043

RADIELLE D.C.100 (200-250 D.C.), output 200 volts, 100 m.a., and 2 variable tappings; cost £9/10, sell £3; brand new; sent c.o.d.—Priestley, 8, Grosvenor Gardens, Muswell Hill, London, N.10. [1969

HENDERSON H.T. Eliminator, 240v. D.C. mains, fixed and variable outputs, 18/-; also Regentone combined H.T. eliminator L.T. charger, 230-250 A.C. mains, 90/-, cost 117/-.—Box 8050, c/o *The Wireless World*. [2098

MARVELLOUS Value, can you beat it?—Eliminators for H.T. and L.T., from A.C. mains, any voltage, Model 1, H.T. 120v. at 20 m.a., £2/16/6; model 2, H.T. 200v. at 35 m.a., £3/10; model 4, H.T. and L.T., 120v. at 20 m.a. and 4v. 3a., £3/6/6; model 5, H.T. and L.T., 200v. at 35 m.a. and 4v. 3a., £4; all with variable tappings, safe, silent and guaranteed; no extras.—Hill's, 25, Byron Gardens, Sutton, Surrey. [2080

MAINS Transformers, 240+240 80 m.a., 4v. 5a., 4v. 2a., 25/-; special transformers and chokes made in 24 hours; trade enquiries invited.—Challis, 22, Park Rd., Rugby. [2064

BRYCE'S.—Mains transformers experienced constructors recommend, type A.B.64, 250-0-250v, 60 m.a., 4v. 1a. C.T., 4v. 3a. C.T., 6v. 1a. C.T., price 24/6; post 1/-; guaranteed; write for lists.—Bryce's, 54, Dawson St., Bury, Lancs. [2061

CABINETS.

DIGBY'S Cabinets.—Table models in solid oak and mahogany; from 11/6 to 71/-.

DIGBY'S Cabinets, fitted with Radion or Resiston ebonite if required.

DIGBY'S Cabinets.—Pedestal model, with separate battery components; from 56/- to £12.

DIGBY'S Cabinets Made to Customer's Own Designs.

DIGBY'S Cabinets.—Write for new 16-page art catalogue.—F. Digby, 9, The Oval, Hackney Rd., E.2. 'Phone: Bishopsgate 6458. [0128

CABINETS for All Requirements.—F. W. Ramsey, 63, Shaftesbury St., London, N.1. Clerkenwell 7139. [1479

KAY'S Cabinets.—Exclusive practical models in radio and radiogram cabinets, 50% cheaper than elsewhere, used and recommended by the most distinguished and discriminating radio experts; a range of 60 designs to select from; illustrated price lists free.—H. Kay, Wireless Cabinet Manufacturer, Mount Pleasant Rd., London, N.17. 'Phone: Walthamstow 1626. [1789

ARTCRAFT Cabinets, illustrated list free; radiograms, from 79/6; unbeatable value.—Artcraft Works, Grant Rd., Croydon. Established 1925. 'Phone: 1981. [1814

COILS, TRANSFORMERS, ETC.

TRANSFORMERS and Chokes for Battery Eliminators.—Chester Bros., 495, Cambridge Rd., London, E.2. [9706

600 and 1,000 ohms Decoupling Resistances, specified for the largest and most important "Wireless World" receivers; 1/6 each, post free.—Groves Brothers, St. Mary's Place, Shrewsbury. [1732

BAND-PASS Three Coils, 30/- set; slotted formers for winding, 8/6 set; grooved primary supports, 2/- set, all post free.—Groves Brothers, St. Mary's Place, Shrewsbury. [1904

TRANSFORMER, 300-300, 3.75-3.75, 6v. at 2 amps., C.T., 4v. at 5 amps., C.T., new, 130 milliamps.; £2/15; choke for above, 5/9.—Booth, 139, Middlewood Rd., Sheffield. [2032

BAND-PASS Three Coils, 47/-; Band-Pass Four, 70/-; Regional One and Band-Pass unit, coils, 17/6 pair; All D.C. Three, coils, 32/6; D.C. Foreign Listeners' Four, ganged coils with links and condensers, 52/6; coils for all "Wireless World" and other receivers; complete lists post free; trade supplied.—Simmonds Bros., The Original and Best Coil Manufacturers, now at 38, Rabone Lane, Smethwick. [1627a

E. C. WIRELESS for "W.W." Coils.—See under Miscellaneous. [2065

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

Coils, Transformers, Etc.—Contd.

COILS.—"Wireless World" Four, complete, screens, switches, 52/-; Band Pass Four, 25/-; Band Pass Three, 37/6 per set; c.o.d.—Smith, 3, Park Parade, Harlesden, N.W.10. [2071

DYNAMOS, ETC.

EXACTLY as New.—Mortley 12v 10a., 1,000v. 100 m.a. motor generator, flawless, ball bearing, enclosed, cost £26/10, accept £10; Peel-Connor announcer's microphone, with 50-1 transformer, cost £5, unused, 45/-; Weston 309 0-25 milliammeter, sapphire bearings, 2½in. dial, 30/-.—Matthews, "Claremont," Tudor Av., Chelmsford. [2088

TWO Rotary Converters by Lang Electrical Co., Hendon, input 110v. A.C., 50c. output, 500v. D.C. 300 m.a., £5 each.—Below.

ONE Ditto, input 230v A.C, similar output; £5.—Below.

DITTO, input 230v. A.C., output 600v. D.C., 250 m.a., £5.—Below.

TWO Ditto, input 70v. D.C., output 500v. D.C., 300 m.a.; £4/10 each.—Below.

DITTO, input 100v. D.C., similar output; £4/15.—Below.

DITTO, input 100v. A.C., output 240v. D.C., 600 m.a.; £4/15.—Below.

TWO B.T.H. Motor Generators, input 200-250v. D.C., output 730v. D.C., 140 m.a., in metal cases; £6 each.—Below.

NEWTON Motor Generator, input 230v. A.C., output 330v. D.C., 1,500 m.a., 16 volts 4½ amps, 8 volts 4½ amps, new condition; £17/10.—Franks, 42, St., Georges' St., Cannon St. Rd., London, E.1. 'Phone: Royal 8546. [2083

GRAMOPHONES, PICK-UPS, ETC.

B.T.H. Pick-ups and Tone Arms, cranked, 22/6 each; send for list.—G2VM, 27a, Bridget St., Rugby. [1834

BRAND New Celestion Woodroffe Pick-up; cost £4/4, accept 27/6.—Tetley, 9, Prince Wales Terrace, W.8. [2092

WOODRUFFE, Phonovox, Bowyer Lowe and other slightly used pick-ups at less than half price; many other used components cheap from Godfrey, 4, High St., Hampstead. [2090

VALVES.

AMPLIFIER Valve.—If you require power you cannot do better than one of these (or matched in pairs if required).

FILAMENT 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 now reduced to £5; see article "The Wireless World," 24th July, 1929, then send to North London Valve Co., Ltd., 22½, Cazenove Rd., Stoke Newington, London, N.16. [0341

LOUD-SPEAKERS.

BAKER'S SELHURST RADIO 36-page Booklet, "Sound Advice is Yours for the Asking"; write now for new edition; see displayed advertisement on page 31. [0231

REALISTIC Speakers, true to name, the greatest advance to perfection, not a cone or horn type; write to-day for particulars; Realistic chassis and speakers demonstrated daily.—Realistic Speakers, 72, Penton St., N.1; also 52, Broadwater Rd., Worthing. [1296

EPOCH 66, A.C. mains, 200-250 volts, £4; O.P.M.I.C., 15/.—79, Broadwater Rd., Tottenham. [2050

SPEAKERS.—You cannot get good results from any unit unless you use a well-made rigid cradle; the famous Squire aluminium cradle eliminates muffling, resonance and harshness, and enables any unit to work at full efficiency; cast aluminium girder structure, beautifully finished, and taking any unit; assembled complete with deckle-edge cone (7½in. cone, outside cradle 10½in., depth 5in.); price 7/-; send P.O. and state make and type of unit used.—Frederick Squire, Ltd., Leswin Place, London, N.16. [2039

OWING to Change Over from D.C. to A.C., advertiser has Baker moving coil loud-speaker for disposal, new February, 1930; cost £6/15, perfect, accept £3.—"Fenwood," Eastwood Rd., Leigh-on-Sea. [2038

R.K. Junior and Magnavox Speakers, 6-volt models, for sale at half price.—Godfrey, 4, High St., Hampstead. [2091

CELESTION C12, mahogany, perfect, used only with filter; £3.—Hawling, 4, Talbot Rd., Highgate. [2086

INDUCTOR Speaker, with chassis, as new; £2/2.—18, Bathurst Rd., Ilford. [2072

FERRANTI Moving Coil Speaker Chassis (A.C. mains, 200-240 volts), complete; cost £11/15 three months ago, accept £7; guaranteed perfect.—E. G. Maw, Kirkby Rd., Hemsworth, Yorkshire. 'Phone: Hemsworth 82. [3103

Loud-Speakers.—Contd.

COMPONENTS, ETC., FOR SALE.

BELLING-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

COMPONENTS Lent on Hire.—Details from Alexander Black, Wireless Doctor, 55, Ebury St., S.W.1. Sloane 1655. [0329

AMMETERS.—Hot wire, 0-1, 4/-; new moving coil milliammeters, 0-5 upwards, 15/-; portable micro ammeters, 5in. scale, 0-200 upwards, 105/-; double range voltmeters, 3/6; instrument repairs and alterations of every description; send for list.—The Victa Electrical Co., 47, High St., Battersea, S.W.11. [1552

VALVE Screen, 3/-; coil screens, 2/9; choke screens, 2/6; as specified in "Wireless World" Radio Gramophone and other circuits.—The Loud Speaker Co., Ltd., 2, Palmer St., Westminster, S.W.1. [1801

M.C. Speakers, pick-ups, cone speakers, microphones, transformers, etc.; send for list.—G2VM, 27a, Bridget St., Rugby. [1833

ELECTONE Times Your Wireless Programme in Advance; price, complete, 21/-.—Sole Patentees and Manufacturers. Fredk. J. Gordon and Co., Ltd., 92, Charlotte St., W.1. [1884

"WIRELESS World" Four, complete, as specified, with valves and coils, £24; Garrard motor, Blue Spot 66R., chassis, pick-up, cabinet, £15 extra; any part sold separate; send particulars.—Smith, 3, Park Parade, Harlesden, N.W.10. [1976

BAND-PASS Three (September 17th), the most popular set of the season. See advert. under Coils.—Groves Brothers. [2004

THE Following Slight Used Material is offered subject to sale; every article will be severely tested before despatch, and guaranteed in workable condition; items are nett cash and carriage paid in Great Britain.

RESIDUE of Transformers.—Ferranti A.F.5, 19/6 each; Ferranti A.F.3, Marconi Ideal, R.I. Straight Line, Hypernu, Ferranti O.P.1 and 2, all one price, 14/- each; Ferranti A.F.4, 10/- each; B.T.-H., G.E.C., small Marconi Ideal, R.I. General Purpose, all one price, 8/6 each; Formo, Lissen, Eureka, Brandes, Igranic Shrouded, all one price, 5/6 each.

RESIDUE of Pick-ups.—Wcodroffe, 35/- each; R.I. Varley, 25/- each; Brown, best model, 30/- each; Igranic Phonovox, G.E.C., Burndept, all one price, 14/- each.

APPLEBY, Chapel St., St. Marylebone, London. [0340

NEW Kilomag Four Cabinet (Ritherdon), 30/-; coils (Bercliff), 25/-; 3 J.B. Universal 0.0003, 5/6 each; 3 drum dials, 2/6 each; 3 Utility 3-pole D.T., 3/- each; R.I. dual astatic, 4/-; A.F.5, 17/6; Pye pentode output, 7/6; 2 P.M.14, 9/- each; P.M.4D.X., 4/-; L410, 47/-; P.M.24A, 12/-; transformer (Bayliss), 350 volts 50 m.a., 5 volts 2 amps., 20/-; N5, 10/-; Westinghouse R4-2-1 17/6.—Smallwood, Tanks, Lulworth, Dorset. [2033

EXPERIMENTER'S Surplus.—A.F.5C.C., 22/-; R.I. tuner, 10/-; neutralising condensers, 1/6 each; 2 50w. 50 megohms power rheostats, 3/6 each; Matched L.S.6As, 20 hours use, 21/- each; 2 P650s, 60 hours use, 14/- each; G.E.C. superhet parts, 18/-; all perfect; exchange Marconi pick-up, milliammeters.—Petty, Clapham, Lancaster. [2036

1931 Mullard Orgola Condenser Assembly, 15/-; pair Colvern coils, 12/-; screens, 1/6; A.C./S.G. Madza valve, 15/-; Pye reaction condenser, 3/-; potentiometer, 50,000 ohms, 4/6.—Legge, Countisbury, Park Rd. West, Wolverhampton. [2042

MULLARD £5/5 H.T Unit, 240v. A.C., with D.U.2 valve, perfect condition, 55/-; Celestion £3 Z12 chassis speaker, 30/-.—Box 8038, c/o *The Wireless World*. [2055

TELSEN Ace, 5/-; Lotus, 5-1, 9/-; A.F.3, 13/6; Climax Capital choke, 4/9; R.I. 100-henry, 8/6.—Below.

SEND Card for Copy of November Surplus List.—Pepper, Wakegreen Rd., Birmingham. [2075

COPPER Earth Plates, area over 500 square inches, 12ft. lead, genuine sound investment; 5/3, post paid.—Trueman, 141, Ince Av., Liverpool. [2058

OLDHAM Charger, A.C. H.T.1, £1; 100-volt accumulator, W.J. crate, 15/-; General Radio speaker, 5/-; Amplion A.R.111 ditto, Lotus L.T. and H.T. mains relay, 10/-; all in guaranteed condition.—Electroct Radio Co., Solihull, Birmingham. [2056

PART Exchange.—See our advertisement under Receivers for Sale.—Scientific Development Co., 57, Guildhall St., Preston. [0228

66K Blue Spot Unit, 15/-; Colvern D.W. Master Three Star coil, 9/6; Ekco D.C. H.T. unit, 230-250v. 20m. variable, 32/6 (used month); all guaranteed perfect.—Joyce, 3, Newlands Terrace, Queens Rd., S.W.8. [2078

Components, Etc., For Sale.—Contd.

TWO Centralabs, 500,000 and 50,000, 6/- each; 2 0.0005 Polar Ideal, 6/6 each; Epoch trickle charger, output 1 amp. at 2, 4 or 6 volts, 32/-; Wearite screening boxes; Lewcos H.F. choke, 5/-; R.I. dual astatic, 5/-; Lewcos super coils, 4/- each; primaries, 1/-.—27, Miles Hill Av., Leeds. [2099

WESTON Thermo Galvanometer (115 m.a.), model 425, unused, 55/-; Microid reflecting, pointer, galvanometer (Griffin), 18/-; Eddystone S.W. choke, 2/6; Magnum choke, 2/6; Ideal transformer (8-1), 4/-; H.W. ammeter (½), 2/6; approval.—BM/ZLME, W.C.1. [2093

FERRANTI A.F.5, 15/-; Savage B.T.4, 37/6; 2 U8 valves, brand new, 12/6 each; 10a Garrard motor, 20/-.—Wallis, 58a, Endlesham Rd., S.W.12. [2087

AMATEUR'S Surplus.—2 Colvern Varia condensers, 0.0005, 1 ditto 0.0003, all worm drive, complete, 17/6 3; 1 R.I. H.F. choke, 3/6; 1 ditto, 2/6; pair long-wave ditto, medium-wave Colvern, 4-pin coils, split primary, 25/-; 1 pair Colvern coils for Mullard's Star set, never used, 15/-; Ever Ready wave trap, 3/6; Siftron sifter unit, 3/6; 1 pair Mullard D.F.A9 super power valves, never used, 12/6 each; 2 Varley anti Mobo units, never used, 5/6 each; c.o.d. or deposit. —Smedley, 5, Birley St., Blackpool. [2085

400 Volts Exide W.T., 10 units capacity, 10,000 millamps, perfect condition, £2/15 per 100 volts, £10 the lot; A.F.4, 10/6; P.M. Permacore, 9/6; Lissen portable gramophone, 19/6; Marconi 6-volt pot and input transformer, 19/6; callers after 7 p.m.—A. W. Shaul, 22, Crescent Grove, South Side, Clapham Common. [3100

SPECIAL to Callers.—Come, browse round the stock, state your price for

ANYTHING you See! Ormond, Lotus, Mullard, Dubilier, Colvern, parts, speakers, cabinets, sets.

LESS Fortunate Readers, send requirements for quotation; example: Variable condensers, 1/-; 4in. dials, 9d.; gridleak holders, 2d.

EVERYTHING Must be Cleared, room wanted for expansion, wire business.—Frost, 132, St. John St., E.C.1. [2081

SECOND-HAND Goods, all guaranteed selected from stock, for sale, as new.

PAIR Varley Push-pull Transformers, new, 33/6; R.I. output choke, not shrouded, 13/-; Weile output choke, 30 m.a., 6/-; Ferranti output transformer, 1-1, 12/6; Pye 20H shrouded output choke, 8/-; Pye 2½-1 transformer, shrouded, 7/-; ditto, not shrouded, tap secondary, 6/-; R.I. straight-line transformer, multi, 13/-.

EXIDE Charger, H.T. and L.T. combined, with meters, perfect, 50/-; R.I. pick-up, with Watmel arm 27/6; Brown Duckling speaker, 22/6; 2 J.B. 0.0005 condensers, 6/- each, plain; Pye differential, 3/-; Talisman anode coil, 4/6; set coils for 1929 Solydine, perfect, 20/-; R.I. anti Mobo, 5/-; Dubilier R.C.C. unit, 3/6; Varley H.F. choke, 5/6; 4 0.2 T.C.C., 1/- each; Loewe 2 meg. leaks, with porcelain holder, 1/-; set Igranic SW. coils, 6/6, perfect; Igranic J transformer, 10/-; A.F.4, 9/-; Wearite W.G.2 tuner, 9/-; Goltone dual coil, 5/6; Ready Radio Q.A.T. and Q.S.P., 8/6 each.

RETAILER'S Bankrupt Stock, all new and genuine, any c.o.d. or "Wireless World" deposit system.

EDISWAN Valves, 2-volt, H.F. 210, 5/6; L.F. 210, 5/6; R.C.C. 210, 4/6; P.V. 215, 7/-.

TELSEN Ace Transformers 3-1, 5/6; Pye 20H. chokes, 9/-; Hegra B.A. speaker cone units, semi adjustable, 7/6.

LOTUS Reaction Condensers, 0.00034, 3/6; Wearite 4-pole rotary switches, 2/9; Precision anti-phonic large valve holders, 7d.

EBONITE Leak Holders, 3d.; Watmel H.F. chokes, 1/-; Loewe 2 meg. leaks, 9d.; Ediswan ½ meg. leaks, 7d.; ditto ¼ meg., 7d.; Mullard 2 meg. and ¼ meg. leaks, 8d.; Graham Farish 100,000 ohm resistances, 1/6; 150,000 ohm, 1/-; 250,000 and 500,000 ohm, 8d. each; satisfaction or cash refunded, my guarantee.

FINAL Clearance Prices.—Polar Ideal 0.0005 slow motion condensers, 7/- each, or 13/- pair; Garrard D/S gramophone motors No. 10a, list price 53/6, my price 33/6; Mullard Permacore transformers, 10/6; Ferranti A.F.3o, can be used as ordinary, 16/6; Ferranti 25-1 transformers, 12/6; Osram L.S.5 valves, 16/-; Mullard D.F.A7, 16/-; D.O.20, 16/-.

PHILIPS 506 Rectifier Valves, 12/6; Hydra condensers, 2mfd. 650v. test, 2/2; Hydra 4 mfd. 500v. test, 3/3; Hydra 4 mfd. 350v. working, 4/6; Hydra 1 mfd. 700v. working, 3/6; T.C.C. 4 mfd. 800v. working, 10/-; Hunt's Polymet 0.0003, 6d.; ditto 0.01, 1/-; ditto 0.001, 7d.; mica, Graham Farish 5,000 ohm resistances, 1/6.—G. A. Ryall, 182, Kennington Rd., London, S.E.11. Bus stop outside door, alight Fitzalon St. [2062

SALE.—B.T.H. Senior R.K. speaker, 200-240 volts, 85/-; 9 Exide W.H.10, 25/-, as new.—Santler, 5, Lansdowne Crescent, Malvern. [2067

MISCELLANEOUS.

SCOTT 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.

SCOTT 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 and in three Continents; if you so desire, we will design and construct high grade apparatus to suit your especial circumstances for quality, range and selectivity.—Tel.: Tudor 5326. Muswell Hill, London, N.10. [0262

ALEXANDER BLACK,

THE Original Wireless Doctor, will call (London and Home Counties) and cure your set.

CONSULTATIONS by Appointment without Obligation; sets installed, maintained and brought up to date; components and McMichael portable sets on hire; purity reproduction specialists.
55 Ebury St., Victoria, S.W.1. Sloane 1655. [0277

EASY Payments.—We supply, by easy payments, components, accessories, and sets, any make; 10% down, balance spread over 11 months.—Send list of requirements to London Radio Supply Co., 11, Oat Lane, London, E.C.2. [0337

RECORDING Stylus Cutters, special sapphire point to fit any pick-up or sound box; 2/2, post free.—Cairns and Morrison, Ltd., 33, Percy St., London, W.1. [1885

RYALL'S Part Exchange Service; your unwanted radio parts taken in part payment for new.

ONLY Brand New Goods Supplied, any make; please state condition and lowest price acceptable for your goods and, as far as possible, mention list price of new goods required, to save reference work.

NO Restrictions Made, goods bought for cash, if lowest reasonable price stated.

LENGTHY Quotations Cannot be Given.—Ryalls Radio, 182, Kennington Rd., London, S.E.11. [1710

WIRELESS Notes.—A monthly service of information for all those who want the very best in wireless or gramophone reproduction; frank criticism of receivers and components; immediate postal help and advice in all difficulties; something new and unique; you must have it if you want to know the truth.—Full particulars free from Ernest H. Robinson, Langmead, Pirbright, Woking, Surrey. [1979

E. C. WIRELESS.—We specialise in "W.W." Four and D.C. three; write for lists.—Premier Place, High St., Putney, S.W.15. [2066

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

CHAS. J. R. BULLOUGH, Chartered Patent Agent.—Patents, designs and trade marks.—27, Chancery Lane, W.C.2. Holborn 8105. [1883

KING'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

EXCHANGE.

TWO New Mazda 815S.G. for 815D.E.P., H.F. and L.F. valves.—22, Gilfach Rd., Penygraig, Rhondda. [2040

MICROSCOPE, mechanical stage, coarse and fine, 3 objectives, 3 eye-pieces, photographic material, optical lantern; exchange for inductor, magnet coil speaker or wireless parts.—Box 8046, c/o *The Wireless World*. [2094

GRAMOPHONE Records Exchanged, from 5/- per doz. second-hand; records bought; send envelope stamped for particulars, to Gramophones, 47, Bath Rd., Kettering. [2060

WE Will Accept Your Surplus Apparatus (making you a high allowance) in Part Payment for any new apparatus; your enquiry will be dealt with promptly.—Bostock and Stonnill, 1, Westbourne Terrace, S.E.23. [2077

WANTED.

WANTED, Osram Music Magnet Four, also Fifteen, L.H.T.L. Oldham's units, and 66R cone unit and chassis for sale, O.M.M. Three, assembled, perfect; £7.—C. Goldsworthy, 185, Mitcham Lane, S.W.16. [2048

Wanted.—Contd.

WANTED, quantity Exide W.J.60 high tension accumulators; cheap for cash.— Box 8036, c/o *The Wireless World*. [2053

4-ELECTRODE Valve, not analoy; approval.—Particulars to BM/ZLME, London, W.C.1. [2063

FOR 200 A.C. Mains Transformer, outpnt 400v. or more, eliminator 120v. 10 m.a., high voltage 4 m.f.d., mains valves, chokes, L.S.6As matched, must be sound and low priced.—Holme, Astleys Farm, Worthington, Wigan [2068

REPAIRS.

SCOTT SESSIONS and Co., Great Britain's radio doctors; read advertisement under Miscellaneous column. [0263

GUARANTEED Repairs by Exports.—Loud-speakers, headphones, cone units, pick-ups, any type, rewound, remagnetised and adjusted post free 4/-; transformers from 4/-.—Howell, 91, Morley Hill, Enfield, Middlesex. [9555

LOUD-SPEAKERS, headphones, cone units, any type, rewound, remagnetised and overhauled; 3/6 post free; repairs guaranteed; 24 hours' service; terms to trade.—Walters, 1 Durn s Terrace, Lower Compton, Plymouth. [1912

YOUR Transformer Repaired or Rewound and Returned Promptly; 3/6 post free.—James, 190, Bitterne Rd., Southampton. [2070

SITUATIONS VACANT.

INSTRUMENT Maker for Set Building and Service Man Required.—Ring Hampstead 1104. [2089

SITUATIONS WANTED.

ADVERTISER (21), P.M.G. certificate, practical and theoretical knowledge, seeks position as technical assistant or salesman.—Box 8049, c/o *The Wireless World*. [2097

SITUATION Required, practical knowledge electrical, wireless, cinema, and photographic trades.—Ryall, 42, Dewhurst Rd., West Kensington. [2073

BOOKS, INSTRUCTION, ETC.

FREE: Inventor's Guide on Patents.—T. A. A., 253, (W). Gray's Inn Rd., London, W.C.1. [1888

"TELEVISION To-day and To-morrow," the complete authorised book on transmission and reception (Baird Experimental). By S. A. Moseley and H. Barton Chapple. Fully illustrated. 7/6 net, from a bookseller, or Pitman's, Parker St., Kingsway, W.C.2. [1144

AUCTION SALES.

WIRELESS AND ELECTRICAL SALES

by auction at

13, High Holborn, W.C.1

(mostly without reserve) by order of the various liquidators,

NOVEMBER 12th and 13th,
and
DECEMBER 3rd, 4th, 10th, and 11th,

commencing each day at 11.30.

Particulars of goods to be included should reach me ten days before sale. Inclusive commission 10%. Settlements are made Monday immediately following sale.

HENRY J. SHAW,

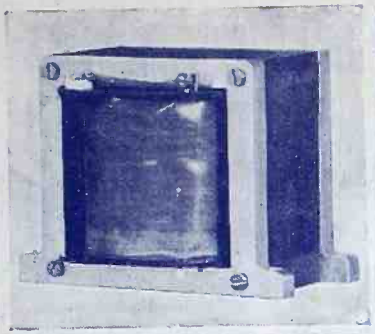
Auctioneer and Valuer,

129, Newington Causeway, S.E.1. 'Phone: Hop 3862.

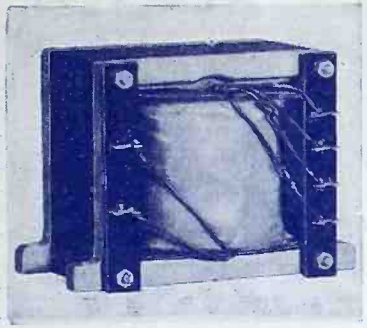
INDEX TO ADVERTISEMENTS.

BAYLISS TRANSFORMERS, CHOKES, Etc.

FOR THE MAINS



(a) A small type smoothing Choke for smoothing Rectified Output from Valve and Metal Rectifiers, made in various capacities. Prices from **15/-** upwards.



(b) A small Power Transformer for supplying Valves and Metal Rectifiers full and half-wave, including L.T. windings for supplying A.C. Valves. Prices from **21/-** upwards.

(c) Rotary Converter, Type 'C', rating 800 to 1,000 watts, for standard inputs. Can be supplied for any intermediate voltage with correspondingly lower outputs. Price **£23 10s. 0d.** including starter and enclosed heavy duty Transformer for output Voltage regulation. Approximate weight of converter, 150 lb.

The illustrations show a few of our various types of Electrical equipment.

We manufacture Transformers up to 130,000 Volts, oil insulated, for Testing purposes, pressure testing outfits, self-contained apparatus for testing overhead porcelain insulators, etc., general Testing Transformers for the Electrical Trade, Converters, Generators, etc., to 10 K.V.A., all types of smoothing chokes, reactances, etc. Oil and air insulated. Converting equipment for operating Radio receiving sets as distinct from Audio amplifiers only, and Rotary Converters for operating from low voltage storage batteries. Test sheets, etc., are issued with each component where required, indicating its performance under final test, which are guaranteed.

Our Technical Dept. will be pleased to advise and give assistance where possible to retailers, service agents and others who care to avail themselves of this.

We invite members of the Trade to our Audition room at any time, where we can demonstrate and show our products, and give useful information and help where required.

WILLIAM BAYLISS LTD.

Contractors to the Admiralty, War Office, Colonial Governments, etc.

Sheepcote Street, BIRMINGHAM

Telephone: Mid. 1409

Telegrams: "Drawbench, B'ham."

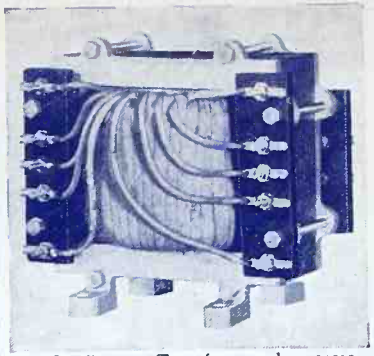
London Agents:

A. F. BULGIN & CO., Ltd., 9-11, Cursitor St., Chancery Lane, LONDON, E.C.4

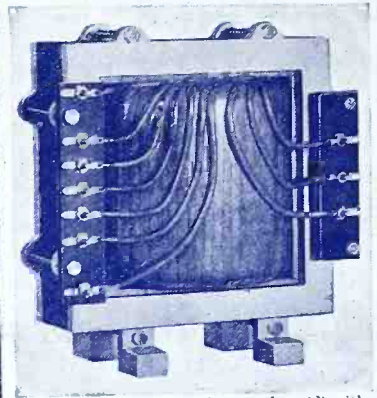
Telephone No.: Holborn 2072

BAYLISS ROTARY CONVERTERS

(D.C. to A.C.) for Radio & Gramophone Equipment



(d) Small power Transformer where somewhat larger outputs are required than our smallest type (b). Prices from **35/-** each.



(e) A larger size Transformer than (d) with a capacity suitable for Power amplifiers, etc., requiring anode voltages up to 500 at 200-250 M.A., with corresponding L.T. range. Prices from **£5 5s. 0d.** each.

(f) B. Type Rotary Converter, maximum rating 400 watts, designed for operating Audio frequency amplifiers and general purposes. Price **£12 10s. 0d.**

Arks.

Printed for the Publishers, ILIFFE & SONS LTD., Dorset House, Tudor Street, London, E.C.4, by The Cornwall Press Ltd., Paris Garden, Stamford Street, London, S.E.1.

Colonial and Foreign Agents:
UNITED STATES—The International News Co., 131, Varick Street, New York. FRANCE—W. H. Smith & Son, 248, Rue Rivoli, Paris; Hachette et Cie, Rue Réaumur, Paris. BELGIUM—W. H. Smith & Son, 78, Marche aux Herbes, Brussels. INDIA—A. H. Wheeler & Co., Bombay, Allahabad and Calcutta. SOUTH AFRICA—Central News Agency, Ltd. AUSTRALIA—Gordon & Gotch, Ltd., Melbourne (Victoria), Sydney (N.S.W.), Brisbane (Queensland), Adelaide (S.A.), Perth (W.A.), and Launceston (Tasmania). CANADA—The American News Co., Ltd., Toronto, Winnipeg, Vancouver, Montreal, Ottawa, St. John, Halifax, Hamilton; Gordon & Gotch, Ltd., Toronto; Imperial News Co., Toronto, Montreal, Winnipeg, Vancouver, Victoria. NEW ZEALAND—Gordon & Gotch, Ltd., Wellington, Auckland, Christchurch and Dunedin.