SHOW REVIEW—NEW FEATURES AT OLYMPIA.

The Wireless World

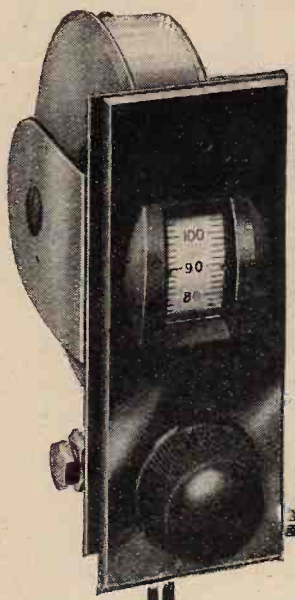
4D

AND RADIO REVIEW

The Paper for Every Wireless Amateur

Wednesday, October 1st, 1930.

No. 579. Vol. XXVII. No. 14.



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PRECISION INSTRUMENTS

Accurate in workmanship and faultless in design and finish, J.B. Precision Instruments will add to the efficiency of any receiver.

Of particular interest is the new J.B. "Chassimount" the very newest and most effective method of one-dial control for multi-valve sets.

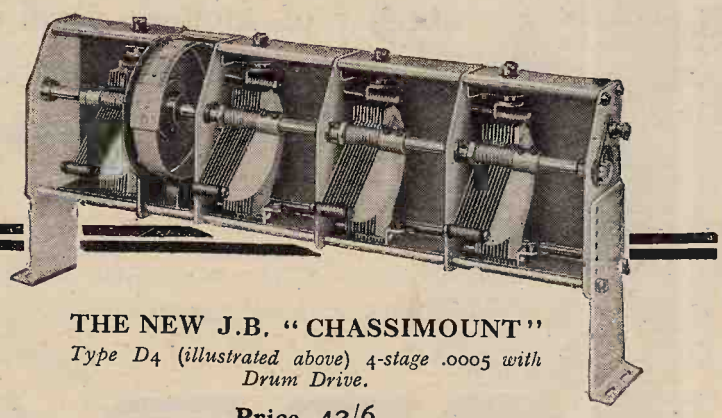
Another new J.B. Precision Instrument is the Differential Condenser, for smooth reaction control. The capacity change is the same for both halves, and is constant throughout the range.

Choose your components from the J.B. Precision range. There is a model for every purpose.

THE J.B. DRUM DIAL

Exceptionally smooth in action, and free from slip or backlash. Vernier Ratio 16—1. Bronze or Oxidised Silver finish.

PRICE 10/6

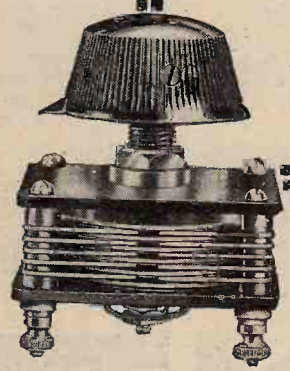


THE NEW J.B. "CHASSIMOUNT"

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



THE NEW J.B. DIFFERENTIAL REACTION CONDENSER

Bakelite dielectric between vanes. Insulated centre spindle.

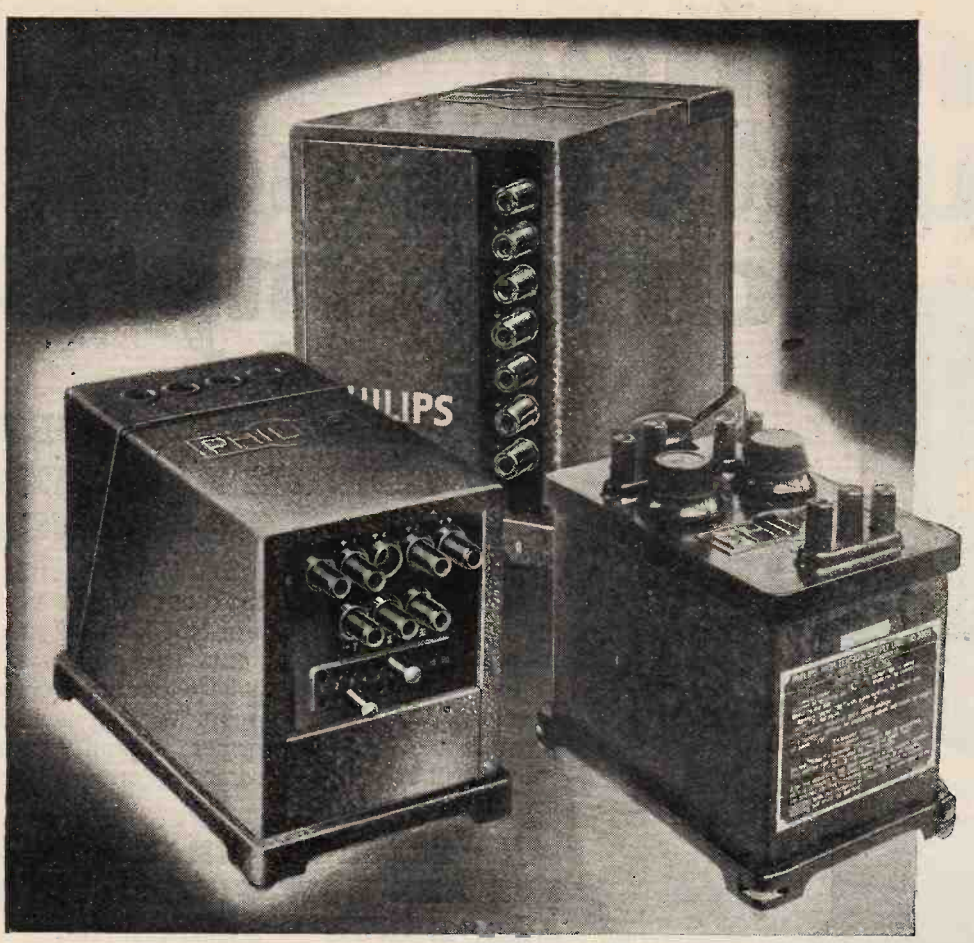
.0001 - 4/- .00015 - 4/-
.0002 - 4/3 ·00025 - 4/3
.0003 - 4/6

PRECISION INSTRUMENTS

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

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

A 2.



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

A constant H.T. Supply is essential for your receiver to give you perfect reception. Even the best H.T. batteries are exceedingly unreliable and require frequent replacement, but a Philips Battery Eliminator enables you to take your H.T. supply direct from the electric mains thus ensuring absolutely faultless reception. Once installed, it requires no attention and the amount of electricity consumed is almost negligible.

Type 3002 for A.C. Mains	- Price	**£5 . 10 . 0**
Type 3009 for A.C. Mains	- Price	**£5 . 15 . 0**
Type 3005 for D.C. Mains	- Price	**£3 . 17 . 6**

For 10/- down you can have any of these on Philips Easy Payment System.

OBTAINABLE ON 10/- DEPOSIT

PHILIPS BATTERY ELIMINATORS

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

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

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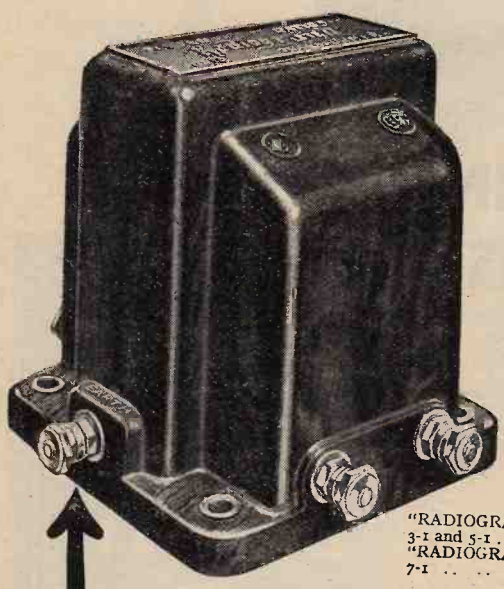
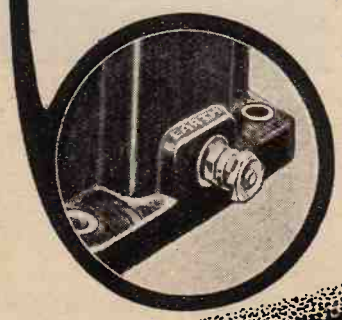
Another outstanding achievement

"ACE," ratio 3-1 and 5-1. Price **8/6**



"RADIOGRAND," ratio 3-1 and 5-1 .. Price **12/6**
"RADIOGRAND," ratio 7-1 .. .. Price **17/6**



LOOK FOR THE NEW EARTH TERMINAL ON ALL TELSEN TRANSFORMERS.

New WINDINGS *New* CORE *New* GENUINE BAKELITE MOULDINGS

Perfected in every detail, Telsen Transformers now represent the embodiment of the very latest practical principles of Radio transformer construction. Built to give long and satisfactory service—the highest quality reproduction . . . in fact . . . built as well as it is possible to build a transformer . . . and yet the prices still remain the same . . . one of their attractive features.

All "TELSEN" TRANSFORMERS ARE NOW FITTED WITH AN "EARTH" TERMINAL,

which will improve the quality of the reception and greatly assist in stabilising the receiver in cases where the general layout is apt to produce inter-capacity action.

SEE THE NEW RANGE OF TELSEN COMPONENTS.

Designed and perfected by some of the greatest authorities in the science of radio—with one object in view—to produce the world's best. After exhaustive tests we are convinced that in performance and appearance they are unrivalled.

TELSEN
COMPONENTS

Advt. of Telsen Electric Co., Ltd., Birmingham.

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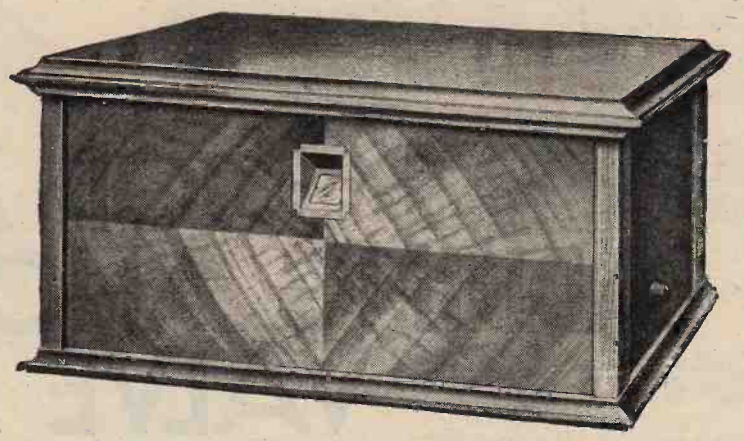
The admiration of all the experts and the critics at OLYMPIA



THE REGENTONE 4-VALVE A.C.
ALL-ELECTRIC RECEIVER.

If the opinions of the numerous experts and critics who visited Olympia count for anything—then without doubt the Regentone 4-Valve A.C. All-Electric Receiver is the outstanding All-Electric Receiver of the year. In up-to-date design, in performance, in every detail of technique, you can trace the *specialised* experience of the firm who have *specialised* in Mains Radio since 1924.

ONE KNOB TUNING. Remarkable selectivity.

TWO SCREENED-GRID STAGES H.F.
All the prineipal European programmes at full loud-speaker strength without interference. With a short indoor aerial only, there is a considerable choice of stations.

ALUMINIUM CHASSIS.
Combining great strength with a workmanlike and "clean" appearance.

BOTH COILS and S.G. VALVES COMPLETELY SCREENED. Maximum H F. Amplification.

MAINS-DRIVE COMPLETELY ENCLOSED IN SEPARATE SCREENED CASE.

Full-wave rectification by Westinghouse Metal Rectifier.

BEAUTIFULLY FINISHED MATCHED WALNUT CABINET.

PRICE COMPLETE £30 guineas
or £5 deposit, and balance in 12 monthly payments of £2 9s. 6d.

Available also in chassis form only price on application

WRITE TO-DAY FOR FREE COPY OF OUR NEW ART CATALOGUE

REGENTONE

REGENT RADIO SUPPLY CO., Regentone House, 21, Bartlett's Buildings, Holborn Circus, LONDON, E.C.4. (Telephones: Central 8745 5 lines).

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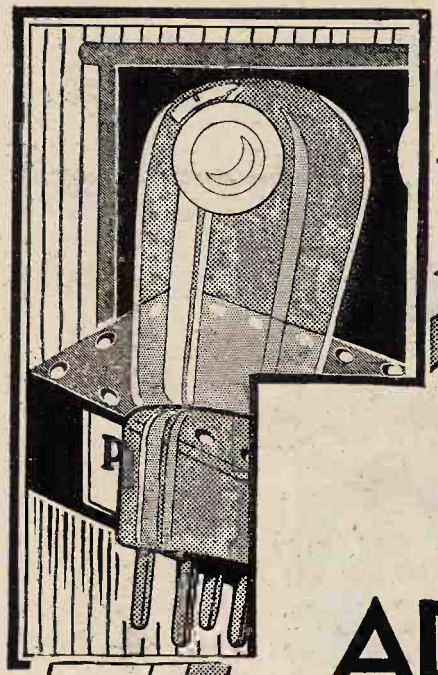

AS GOOD AS ADDING ANOTHER VALVE

That's how your radio set responds when you fit a Pertrix Non-sal-ammoniac Dry Battery. Instantly, you notice the wonderful improvement in reception, the bell-like clearness of every sound, and entire absence of battery noise. And what is more, Pertrix Batteries keep up this wonderful performance throughout their amazingly long life.
Of course, there's a reason for it—Pertrix Dry Batteries are made by an improved process that prevents corrosion . . . that prevents deterioration when not in use . . . and that does lengthen life.

Standard Capacity. (12 m/a discharge.)		Super Capacity. (20 m/a discharge.)	
60 volt	8/-	60 volt	13/-
90 volt	11/9	100 volt	21/-
100 volt	13/-	120 volt	25/6
120 volt	15/6	150 volt	31/-

PERTRIX

NON-SAL-AMMONIAC DRY BATTERIES

PERTRIX LIMITED,

Britannia House, 233, Shaftesbury Avenue, LONDON, W.C.2.

Works: Redditch.

Get An Improved Pertrix Accumulator As Well.

PERTRIX ONCE — PERTRIX ALWAYS

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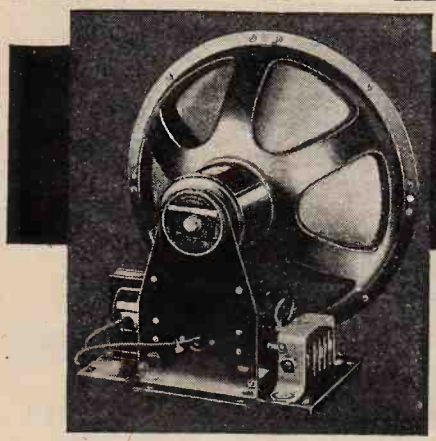

UNFETTERED REPRODUCTION

PERFORMANCE COUNTS

The Purchaser knows that the name Magnavox means something definite, and that it indicates a maintenance of leadership for fifteen years in the manufacture of loud speakers. The new Magnavox moving coil or dynamic speaker is the only type of unit capable of giving a perfectly natural performance and reproduction which cannot be distinguished from the original. There are positively no other loud speakers, irrespective of cost, which can possibly compare with a Magnavox in respect to design, construction and quality of reproduction. The moving-coil type of loud speaker was originated by the Magnavox Company, and we have to thank their engineers for the great part they have played in this great development.

Write for the new Dynamic Booklet and Special Folder.

JUNIOR MODELS.
7¾" Cone.

No.	Field Voltage.	Price.
116	110-190 D.C.	£5 7 6
118	180-300 D.C.	£5 7 6
210	6-12 D.C.	£5 7 6
410	105-120 v. 50 cy. A.C.	£8 5 0
414	220-240 v. 50 cy. A.C.	£8 5 0

SENIOR MODELS.
10½" Cone.

117	110-190 D.C.	£6 10 0
119	180-300 D.C.	£6 10 0
211	6-12 D.C.	£6 10 0
411	105-120 v. 50 cy. A.C.	£9 15 0
415	220-240 v. 50 cy. A.C.	£9 15 0

THE ROTHERMEL CORPORATION LTD.
24, MADDOX STREET, LONDON, W.1. 'Phone: Mayfair 0578/9.
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MAGNAVOX

C.A.V

The ORIGINAL *Jelly Acid Battery*

The popularity of the C.A.V Jelly Acid Battery is not explained by the mere fact that it contains jelly electrolyte—there are other jelly electrolyte batteries! There are three reasons why the C.A.V. is the most effective non-spillable yet produced

The Jelly Acid. Its composition is unknown outside our own laboratories It maintains perfect contact with the whole of the plate surfaces, yet allows unrestricted gassing when on charge. It is chemically pure, and allows maximum conductivity

The Container. Of special construction, contains a baffle-plate and moistening pad, which serves the triple purpose of arresting acid spray during charge, feeding the electrolyte with moisture to maintain an even consistency, and definitely confines the jelly to the plate chamber.

The Plates. These have been specially developed to give the utmost possible capacity when used with C.A.V. Jelly Acid.

The Whole. The C.A.V. is the lightest, cleanest, and most compact non-spillable on the market. By avoiding cumbersome acid traps, the greatest possible capacity for bulk is obtained.

C.A.Vandervell & Co. Ltd.
ACTON, LONDON, W 3

Obtainable from our Depots and Battery Agents throughout the country and from all Radio Dealers.

Compact, Clean & Non-Spillable

We issue a useful booklet on the care and maintenance of C.A.V. non-spillable batteries. Would you like a copy? Free on request to Dept. H.4

NEW RADIO FOR OLD

WE WILL BUY YOUR OLD RADIO SET

How would you like an up-to-date 3-valve Receiver which will tune in to all wavelengths! Not an ordinary Receiver which tunes in only to the high and medium wavelengths, but one which will always receive the wonderfully efficient short wave stations of the World—stations you have probably never heard. These Short Wave Sets are so amazingly efficient that listeners who possess Short Wave Sets hear America and other far distant stations regularly. Pittsburgh—Schenectady—Manila—Bangkok—Eindhoven—New York—Sydney—Nairobi—these and many others come in clear, loud and free from interference. "World Radio" gives a list of over 70 short Wave Stations—you can listen to them yourself with the "Empire Link" Receiver.

Imagine the finest Radio Receiver you have ever heard then add the advantages of Short Wave reception and you have some idea of the enjoyment you will get from the possession of an "Empire Link" Receiver.

NOW YOU CAN HAVE A NEW AND UP-TO-DATE "EMPIRE LINK" RADIO SET WHICH WILL TUNE IN TO EVERY BROADCASTING WAVELENGTH IN THE WORLD

No need to wait—you can buy an "Empire Link" now, selling your old Receiver to us in part exchange. In order to make it still easier for you the "Empire Link" is supplied as a Kit of Parts so that you can build the Receiver yourself and save pounds. No technical knowledge is necessary—the Components almost fall into position, that's how easy it is to put together.

The "Empire Link" Short Wave Kit comprises every part necessary to build the complete Receiver . . . . Cabinet, Components, Valves and Coils for all wavelengths from 15 to 2,000 metres.

The cash price of the "Empire Link" Short Wave Kit complete is only 11 gns., and we will buy your old set in part exchange. Take advantage of this generous offer now of new radio for old. Or if you wish you can purchase your "Empire Link" by easy monthly payments of 21/-. Fill in and post the coupon now.

CASH PRICE £11-11-0

EASY TERMS 12 Monthly Payments of 21/-

THE "EMPIRE LINK" SHORT WAVE KIT

Sole Distributors **Ready Radio**

FORM A W.W.

To Ready Radio (R.R. Ltd.) 159, Borough High St. London Bridge, S.E.1

I wish to purchase one of your new 1931 "Empire Link" Short Wave Kits.

(a) Complete Kit 11 gns.

(b) Complete Kit (except for valves) £10 3 s 6

(CROSS OUT WHICHEVER DOES NOT APPLY)

NAME .....

ADDRESS .....

.....

Fill in Form 'B' if you require particulars of our easy monthly payments or part exchange system.

FORM B W.W.

To Ready Radio (R.R. Ltd.), 159, Borough High St., London Bridge, S.E.1

Please send me full particulars of

(a) Your Part Exchange System

(b) Your Hire Purchase Terms

(CROSS OUT WHICHEVER DOES NOT APPLY)

NAME .....

ADDRESS .....

.....

NOTE: Part Exchange does not apply to Hire Purchase System.

Fill in Form 'A' if you wish us to purchase your receiver.

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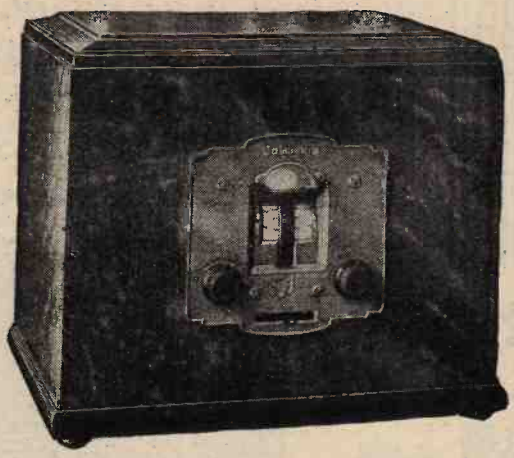
Columbia's New Model



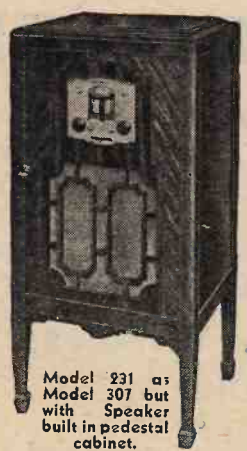
3 VALVE RECEIVER

MODEL No 307

£21

In Oak Cabinet, also in Mahogany cabinet 21 gns.

Another very efficient station-getter by Columbia. 3 Valve Circuit employing Screen-Grid, Detector and Pentode. Easiest of all tuning with illuminated drum calibrated in wavelengths. Variable aerial coupling for maximum selectivity. Adaptable for Gramophone reproduction. Tone of wonderful purity throughout. Low cost of upkeep from A.C. and D.C. Mains.



Model 231 as Model 307 but with Speaker built in pedestal cabinet.

In Mahogany 30 gns.
In Walnut 31 gns.

ALL ELECTRIC

Columbia RADIO

MADE BY:—
THE COLUMBIA GRAPHOPHONE CO., LTD., 102-108, CLERKENWELL ROAD, LONDON, E.C.1.

The Wireless World AND RADIO REVIEW

OLYMPIA SHOW COMPETITION

DIRECTIONS AND RULES.

1. Enter on the form, in the spaces provided, the names of the manufacturers and the official description of what you consider the best apparatus at the Show, based on a consideration of value at the price asked.

2. Write your name and address clearly and in ink on the entry form in the space provided, and send the completed entry form not later than Monday, October 6th, to: The Competition Editor, The Wireless World, Dorset House, Tudor Street, E.C.4.

3. The prizes will be awarded to the competitors who correctly forecast the outstanding single exhibit (No. 8 below), as decided by the majority of votes, and have also the largest number of correct forecasts in the other classes of apparatus.

4. No correspondence can be entered into in connection with the Competition, and the Editor will not be responsible for any entries lost in the post or otherwise.
Only one entry form to be sent in by each competitor.

5. The decision of the Editor must be accepted as final on all questions arising out of this Competition.

FIRST PRIZE: £50 in Cash

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

FREE ENTRY FORM

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

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

	DEFINITION OF CLASS.	NAME OF MANUFACTURER.	OFFICIAL DESCRIPTION OF APPARATUS.
1	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.		
and 8	The outstanding single exhibit at the Show, irrespective of the class to which it belongs.		

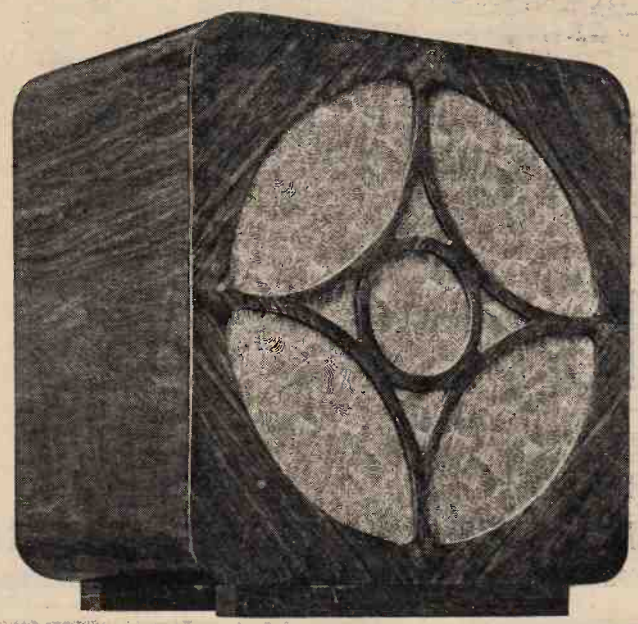
I agree to accept the rules and declare that this is the only entry form that I have completed.

NAME (In Block Letters).....

FULL ADDRESS.....

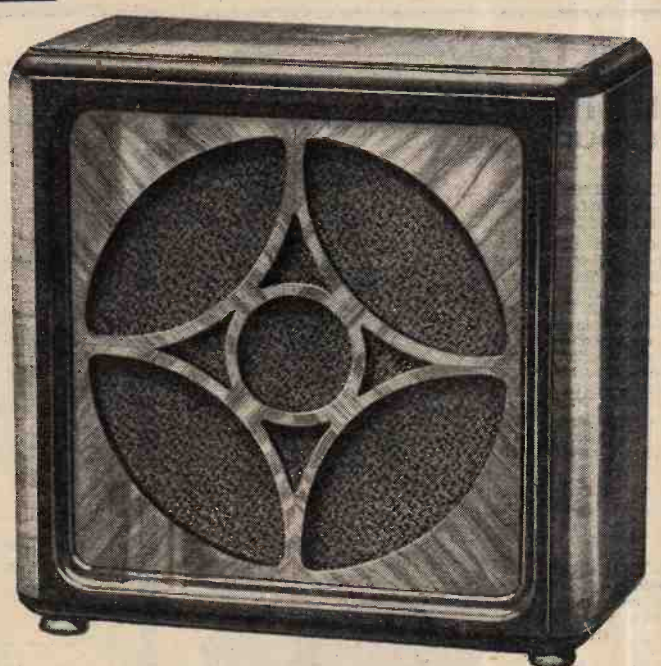
.....

TWO OF THE BLUE SPOT RANGE



51R This new speaker is driven by the world's wonder unit, 66R. That fact alone stamps 51R as supreme in its class. And the beautiful walnut cabinet—unconventional without being bizarre—will add to the appearance of any room. Price **84/-**

29R —the best Blue Spot speaker that has yet appeared. There is no higher praise. Whatever type of programme you enjoy, you will enjoy it better with this magnificent speaker. If your taste is for chamber music you can now hear it as hitherto you could only hear it in the concert room; if you prefer jazz you can listen to it with all its pep and snappiness. And the cabinet is a splendid piece of furniture in keeping with its wonderful output. Price **£6-6-0**



Meet us at - - - - MANCHESTER RADIO SHOW, Oct. 8–18, Stand No. 26, Main Hall

• 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."*

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(18th Year of Publication)

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Lessons of the Show

ELSEWHERE in this issue we review the Olympia Radio Show as a whole, and endeavour to indicate by description and illustration what is the general trend of technical progress in the design of receivers and associated apparatus. The detailed description of technical improvements we will therefore leave to those pages set aside for that purpose, but there are other points in connection with the Show which are deserving of comment. Every Show provides its lessons, and it is largely as a result of the lessons learned at the annual Show that the industry is able to progress as it does, the Show providing the greatest opportunity which the manufacturers have for assessing the requirements of the public.

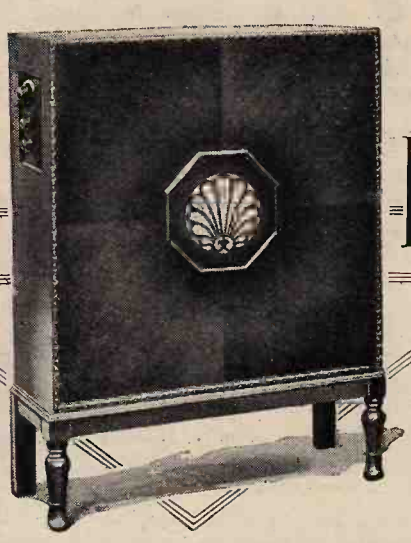
We sometimes wonder whether the standholders make sufficient use of this valuable opportunity. There is too often the tendency to take on a temporary staff with little knowledge of the apparatus displayed, and still less interest in recording the innumerable expressions of opinion passed by the visiting public which, if collected and brought to the attention of a responsible head of the firm or the designer of the apparatus, might be of great value to the firm in their future activities.

A remarkably strong impression gained as the result of repeated visits and tours round the Exhibition was that the general public are extraordinarily discriminating. In days gone by one generally found that attention was more or less equally divided between all stands, presumably because the public were not sufficiently discriminating in those days to separate the sheep from the goats; but this year the contrast between a well-patronised stand and a neglected one was so well defined that we took the trouble to investigate the reasons, and had not far to look to discover them. The neglected stands were those where apparatus was displayed which had not kept pace with modern progress. The fact that components and sets were cheap was not in itself sufficient to attract the public; the apparatus had to be modern and show evidence of careful design, and we can only think that this discriminating attitude on the part of the prospective buyer has been acquired as a result of bitter experience and disappointment in the performance of second-rate products. It is very pleasing to note this attitude, because it leads us to believe that radio of the future will be comparatively trouble-free; it is better to pay a slightly higher price for well-designed and carefully finished apparatus which will not be subject to breakdowns rather than that the listening public should be disappointed in radio and lose confidence as a result of repeated failures and frequent necessity for service arising from the use of inferior products.

Public interest in radio-gramophones has increased to a marked extent this year, whilst another indication of the Exhibition is a boom in the interest in up-to-date components, suggesting that many listeners who made their own sets a year or two back have now realised that the time has come for a complete overhaul or the construction of a new receiver on modern lines. No doubt the need for increased selectivity is one of the contributory causes of renewed activity in home set building.

In This Issue

Quality Reception



The Ear and its Frequency Response.

By JOHN HARMON.

THE ultimate aim of wireless reproduction of sound is that the vibrations of air which reach the ears of the listener should be indistinguishable from those which fall upon the transmitting microphone, so that speech and music may seem to have entered the home by a magical invasion with their quality and beauty untarnished by the long chain of transformations which they have undergone.

Such perfection is almost within our grasp at the present day; but its price is one which we cannot afford. For example, the reproduction of an orchestra is imperfect, because it seems to come from a point, whereas the instruments are actually grouped over a considerable area. The illusion could be improved by using two microphones, two channels of communication, two receiving sets and two loud speakers, but such a system would obviously be commercially impracticable.

A refinement of this kind is one which we have to learn to do without, just as we are accustomed to put up with flat photographs, pictures and cinema shows because the stereoscopic production of these things involves too much bother and expense.

IN pursuing the problems of quality reception but little attention has been paid to the investigation of the aural perception of sound. No purpose would be served in designing receivers where the overall characteristic obtained did not take into consideration the limitations of the ear. It is a strange coincidence that whereas the ear will detect loss of overtones it remains insensitive to a phase shift even of 180 degrees. Information is given in this article on how best to arrange the circuits of a receiver for high quality taking into account tone control and frequency response so that the reproduction that results may be a true replica of the original.

Range of the Human Ear.

The ear has a range of ten octaves extending from 20 to 20,000 cycles per second, but it is seldom called upon to listen in the lowest or highest octave of this range. The highest octave, from 10,000 to 20,000, is not considered to have any musical value, and, indeed, it would be difficult to construct a musical instrument which would give appreciable intensity in this region. Some insect noises lie in this compass, such as the call of the grasshopper, and for all we know some may lie above it and be for ever inaudible to our ears. The lowest octave, from 20 cycles to 40 cycles, is reached by the deepest notes of the organ and piano, but not by any sounds in Nature save, perhaps, the roll of thunder. No voice of beast enters this region; even the lion cannot get below 50 cycles, but it may be that some great reptile in a far-distant age roared on a note deep enough to tax the lower limit of hearing of the mammalian ear. However that may be, there seems to be no survival value to-day in a capacity to hear in the range between 20 cycles and 40 cycles, or between 10,000 cycles and 20,000 cycles; probably Nature has declined to devise a sharp cut-off in these regions, and the imperfect sensitiveness found in them is the result of an extension of efficient hearing to the range from 40 to 10,000.

This latter range, then, is the one which is of importance in the interpretation of sounds, and we should endeavour to preserve it in the chain of apparatus used in wireless communication of speech and music. It is true that music is not scored for frequencies higher than 3,400 cycles, the highest note of the piccolo, but the overtones which accompany the fundamental note, and which are necessary for the preservation of the quality peculiar to each instrument, carry the limit to 10,000.

Sustained Notes.

When a sustained note of instrument or voice is sounded, a series of pressure waves is set up in the air, and if these are recorded as they pass any point, a series of curves of pressure variation can be drawn. The number of complete curves recorded per second, or the frequency with which the pattern repeats itself, is equal to the frequency at which the note is produced, but the curves are not

Quality Reception.—

pure sine waves, but are wrinkled by secondary ripples and indentations. Such curves can, however, be built up from pure sine curves whose frequencies are one, two, three, etc., times the fundamental frequency on which the note is played, and whose amplitudes and phases with respect to the fundamental are properly chosen. A sustained note may accordingly be represented as in Fig. 3 by a number of vertical lines, each of which represents a pure tone of a frequency which is some multiple of that of the fundamental, whose height represents the amplitude or maximum pressure variation, and which has a definite phase relation to the fundamental.

When we say that the sound of the vowel "Ah" can be analysed as in Fig. 3, we mean that if eleven pure tones are produced (by electrically driven tuning forks, for example) and their intensities so adjusted that at any point the maximum pressure variation due to each fork alone is proportional to the height of the corresponding line in Fig. 3, then, provided the relative phases are also correctly arranged, the resultant pressure wave will be identical with that due to the sung vowel, and the effect on the ear will also be identical.

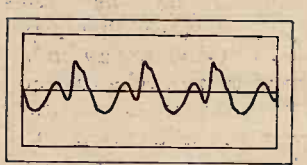


Fig. 2.—Pressure wave of organ note sounding at 256 c.p.s. as recorded by Prof. D. C. Miller. The note contains a large number of overtones.

In reply to the question whether the overtones have any physical existence we can say that with a little practice the ear can distinguish at least some of them in addition to the fundamental, and that they can be reinforced by resonators.[1]

Overtones Necessary for Good Reproduction.

The quality or colour of tone which distinguishes one instrument from another is due to the number and strength of overtones; thus, the clarionet owes its sharp brilliant tone to the presence of strong 7th, 8th, 9th and 10th harmonics, while the mild and mellow flute gives almost a single pure tone. Some remarkable gramophone records have been produced by the Bell Telephone laboratories in which low-pass filters have been used to remove any desired number of overtones. For example, when the same note is sounded in succession by a piano, 'cello and French horn, and all overtones are removed, leaving the fundamental only, the three instruments sound alike, as might be expected, the quality being similar to that of a tuning-fork. The admission of the first overtone, in addition to the fundamental, makes it possible to identify each instrument, and the identification becomes more certain as further overtones are admitted. The absence of high overtones, such as those above the 8th, is perceptible in piano notes, reducing the brilliance and richness of the sound.

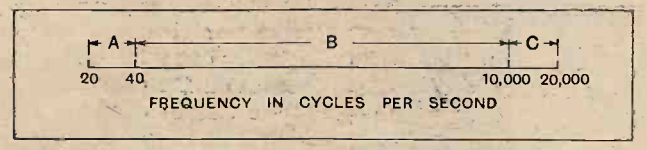


Fig. 1.—The range over which the human ear is sensitive. The region B is that which is used in speech and music. Some organ and piano notes extend into region A, but are heard on their harmonics in region B. Region C is reached by high hissing sounds and insect noises.

Phase Changes are Immaterial.

It is evident, then, that when a note of frequency 500 is played on a piano, higher frequencies up to at least $500 \times 8 = 4{,}000$ should be allowed transmission.

It has been pointed out that when a complex wave is analysed into its component frequencies, due regard must be paid to the phases of the components; alterations in relative phase may profoundly affect the resultant waveform. Changes of this kind must inevitably take place in valve circuits, for alternating currents are retarded when traversing coils to an extent which increases with the frequency, and advanced in passing across condensers in a similar way, so that the shape of a complex wave may be greatly altered in passing through an amplifier.

It is, indeed, a fortunate as well as a curious circumstance that the ear takes no notice of such changes in phase. Many experiments have confirmed this statement, and perhaps the most striking is one due to Dr. Van der Pol, who has invented an instrument which he calls a wave shifter.[2] The wave shifter is a valve

[1] A resonator is a hollow spherical or cylindrical metal vessel furnished with a small opening, which is applied to the ear, and a larger one which admits the sound waves. The larger the resonator, the deeper is the note which it intensifies.

[2] *Phil. Mag.*, May 7th, 1929, p. 477.

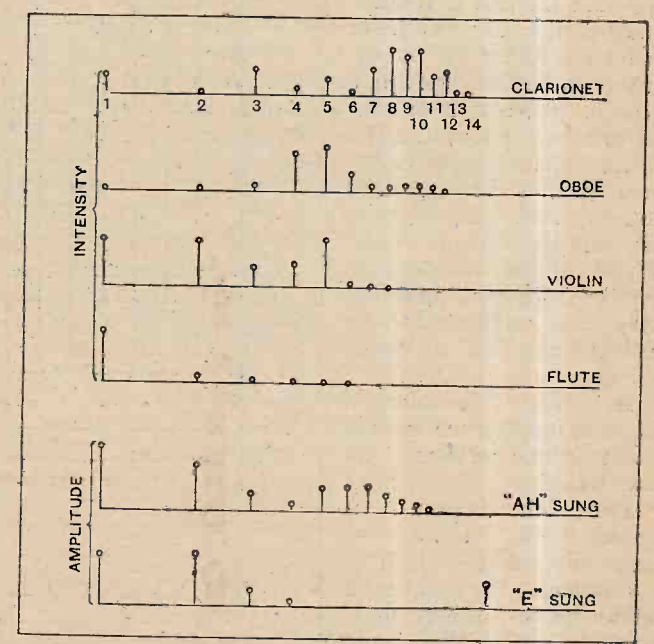


Fig. 3.—Analysis of some instrumental and vocal sounds, showing the relative intensities of the fundamental and overtones. The upper four records are due to Prof. Miller, the lower two (in which amplitude is plotted vertically) are due to Dr. H. Fletcher.

Quality Reception.—

circuit which retards high frequencies relatively to low ones while leaving intensities unaltered; it can be inserted between the output valve and the loud speaker,

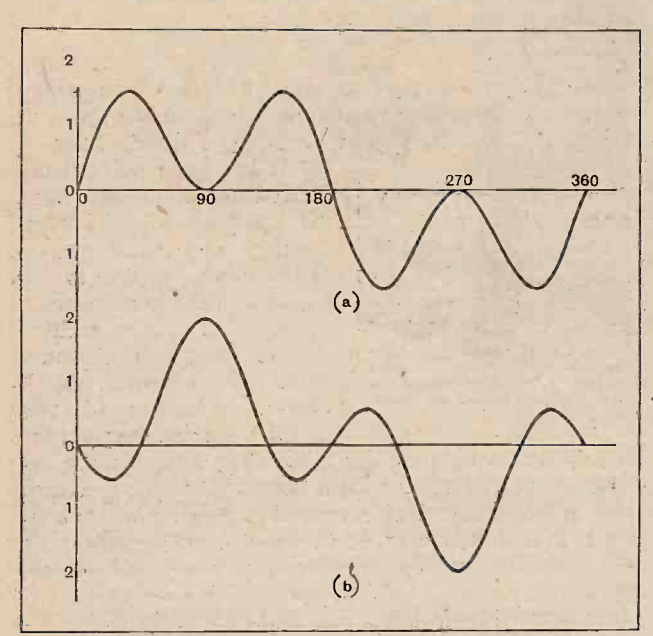


Fig. 4.—Pressure wave due to frequencies f and 3f of equal amplitude; (a) fundamental and harmonic in phase; (b) 180° out of phase. The change of phase modifies the resultant wave profoundly.

and is operated by a single condenser dial.

When the dial is rotated, the quality of speech or music is found to be entirely unaffected, though a relative phase shift of 180° may have been produced.

We conclude that in the reproduction of sustained notes it is necessary to transmit the tones and overtones without alteration in relative strength, and that the phase relations can be left to take care of themselves.

A strange phenomenon is this indifference of the ear to phase relations. On the resonance theory of hearing the sound is analysed by tuned ear strings, each of which is connected to the brain by a single nerve. Where these nerves end in the brain there would seem to be a lack of cross-connection resulting in a lack of information as to phase relations. It is as if trains arrived punctually at half-hourly intervals at each platform of a terminus without any passenger ever being able to find out whether his train would arrive before or after its neighbours at adjoining platforms.

A Frequency Chart.

The chart shown in Fig. 5 gives the ranges of most of the instruments employed in music. The highest notes are given by the piccolo, violin and piano, followed by the flute, clarionet and oboe. These notes are the fundamental notes, and the accompanying overtones actually carry the upper limits higher by an amount not shown on the chart or on any orchestral score.

We cannot combine Figs. 3 and 5 to discover how high our range of wireless hearing should extend in order to include the more important overtones of any instrument, for the analyses in Fig. 3 have only been carried out for fundamental tones near middle C, and the distribution of overtones may be quite different for high tones. But we know that as a minimum requirement the fundamental and the first overtone must be present if an instrument is to be recognised.

If, then, we take 5,000 cycles as the upper limit of reproduction by a high-class receiving set, it is evident that no fundamental higher than 2,500 cycles will retain

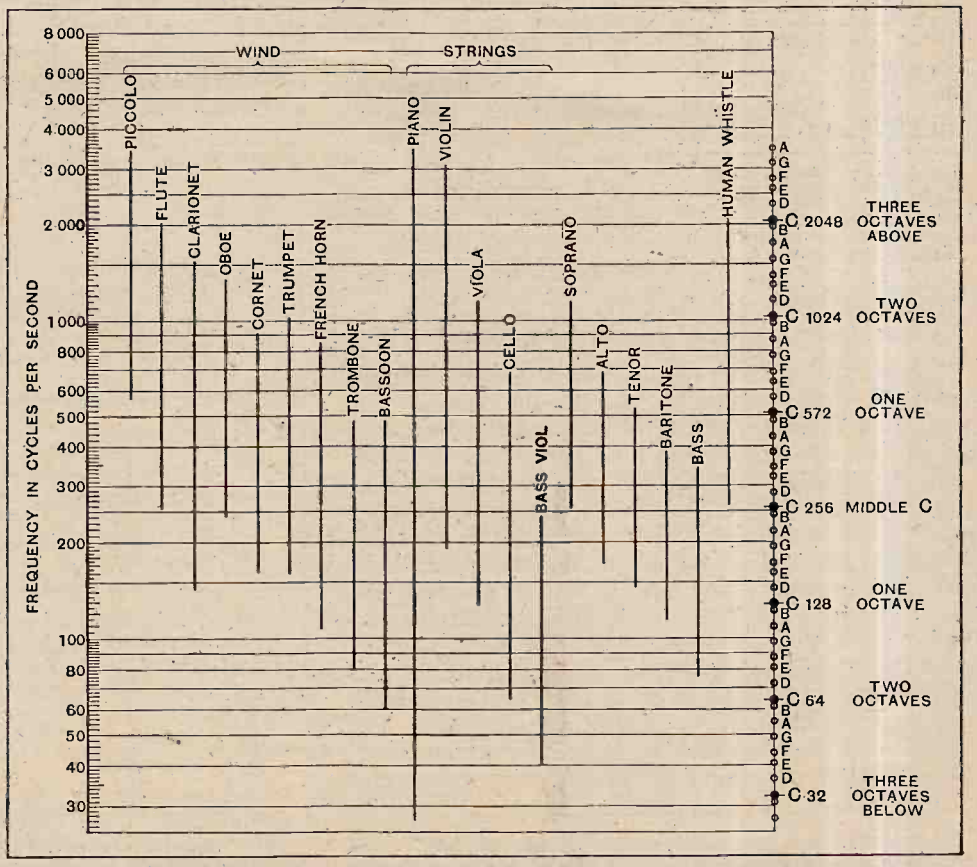


Fig. 5.—On the left is a logarithmic scale of frequencies, on the right are the notes corresponding to the white keys of the piano. The upper limits shown for instruments are not necessarily the highest notes that can be produced, but the highest notes found in orchestral scores.

Quality Reception.—

anything of its characteristic quality. Fig. 5 shows that at 2,500 cycles the only instruments interfered with are the piccolo, violin and piano, and that the latter two have their upper limits shortened only by three whole tones.

Reproduction from 50 Cycles to 5,000 Cycles.

The frequency of the lowest note on the piano is 27 cycles, and it may seem at first sight that the reproducing apparatus should transmit down to this frequency. But, in fact, such low notes contain very little energy in the fundamental, or even the first overtone They are heard almost entirely on higher overtones, and can be reproduced perfectly by suitable combinations of pure tones, none of which has its frequency below 50 cycles. The chief reason for the absence of these tones is that the piano frame cannot vibrate at a frequency low enough to reinforce them. The same lack of fundamental power occurs in deep organ tones, though in this case the explanation is not so simple.

The lower limit of reproduction can accordingly be raised to 50 cycles with perfect safety; indeed, it can be raised much higher owing to a peculiarity of the ear, which is the salvation of many a wireless constructor.

The ear, owing to certain dissymmetries in its construction, acts as a rectifier, and, like a rectifying valve, gives rise to beat tones between the frequencies which fall upon it. Even if the fundamental and a few overtones are absent, it can reproduce them by beat tones between the remaining overtones to such an extent that the fundamental pitch of the note is clearly heard. When a filter is used to cut out the fundamental component of a bass voice singing "Ah" on middle C (256), no alteration in pitch or quality can be detected, but as the cut-out frequency is raised the quality gradually changes to that of a soprano trying to force her voice down to middle C.

In brief, we may say that unimpaired reproduction from 50 to 5,000 gives excellent, well-nigh perfect, results. As the upper limit recedes to 4,000, treble notes become thin and colourless, like boys' voices accompanied by flutes. As the lower limit rises to 200, low notes, though still of considerable intensity, are strangely altered, emasculated and reedy. It is estimated that half the wireless sets in use to-day transmit only between 250 and 3,500; their owners are probably satisfied with this performance *once their ears have become accustomed to it.*

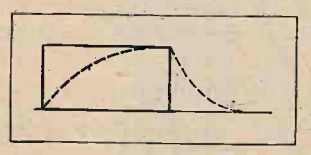


Fig. 6.—An iron-cored coil of high inductance possesses inertia and the current through it cannot respond faithfully to an abrupt impulse. Thus when the applied e.m.f. rises and falls as shown by the full line the current follows the broken line.

Therein lies a great public danger. Since speech and music tend increasingly to reach our ears by mechanical channels rather than directly, there is a prospect that toleration of imperfect reproduction may lead to decay in the standard of pronunciation and lack of appreciation of musical quality. If any reader doubts this statement, let him reckon up the number of minutes each day during which he hears speech and music directly and free from a noisy background, and compare it with the period spent in listening to the telephone, loud speaker, gramophone and talkies.

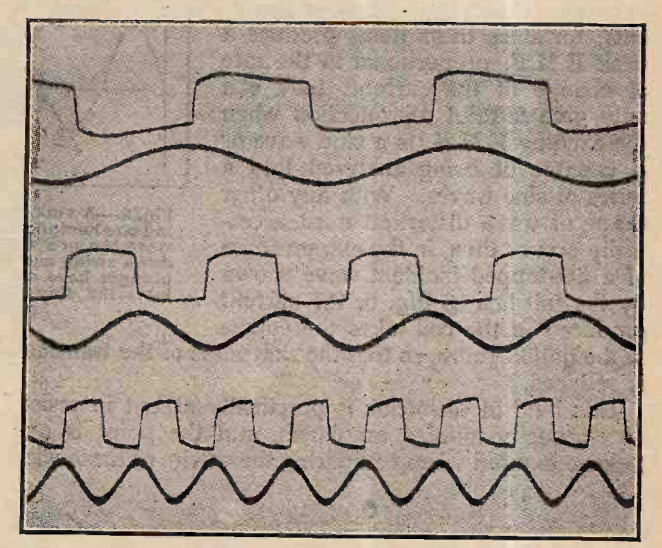


Fig. 7.—Reproduction of flat-topped waves by a 6-stage amplifier devoid of inertia. The sine curves are timing waves of frequencies 80, 150 and 300 c.p.s.

Later in this article a review will be given of the methods which have proved most effective in improving the range and quality of receiving sets; in the meantime let us go on to consider some of the curious and at times ludicrous transformations which sounds are often forced to undergo.

Transients.

Many discussions of the design of receiving sets assume that the only problem is that of reproducing sustained sounds which change by a slow melting of one note into another without any abrupt or explosive transition. But such abrupt effects or transients are common, and form an essential part of speech and music. The consonants "p," "t," "k," are produced by the emission of a single puff of air accompanied by a train of highly damped waves of high frequencies. The wave-fronts of these disturbances are steep, and it will presently appear that there are three points in a receiving set where distortion is likely to occur. These consonants are notoriously difficult to convey over a telephone system.

Again, in emotional music, such as Liszt's "Hungarian Rhapsody," and in Wagner's operas, we meet with transients in abundance. Percussion instruments, like drums, cymbals and bells, the sounds of pistols and hand-claps, popping of corks, and splashing of water, give further illustrations. The first place in which transients may suffer mutilation is the tuned high-frequency circuit. When reaction is used, the damping of this circuit is greatly reduced and an appreciable time is taken to build up the full response to incoming waves, or to annul the response when the stimulus has ceased. Accordingly, the use of reaction is liable to alter or even to obliterate transients by

Quality Reception.—making the H.F. tuned circuit the analogue of a heavy flywheel which cannot respond to rapid changes.

In the second place, the use of chokes and voltage transformers in the audio-frequency amplifier leads to distortion of transients, for since these items produce a back E.M.F. proportional to the rate of change of the current, they can only give faithful reproduction when the exciting E.M.F. is a sine wave or is capable of being analysed into a series of sine waves. With any other shape of wave distortion must necessarily occur; thus, in the extreme case of a flat-topped incident wave shown by the full line in Fig. 6, the current produced in the coil takes the course of the dotted curve, so that the sharpness of the transient is reduced.

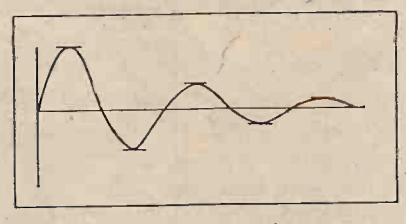


Fig. 8.—A train of damped waves acting on a loud speaker. In each complete wave the up swing is greater than the down swing and the forces on the diaphragm have a resultant tending to leave the diaphragm in a displaced position.

This kind of distortion is practically absent in resistance-capacity-coupled amplifiers, and the point is one to keep in mind when comparing the merits of these with transformer-coupled amplifiers. Fig. 7 shows the degree of success obtained by Dr. Crandall [3] in reproducing flat-topped waves using six stages of resistance-capacity amplification and a recording oscillograph which was without inductance.

Finally, the loud speaker must be considered both because it contains inductance, giving rise to the kind of distortion shown in Fig. 6, and on account of the natural resonances of the diaphragm. When the diaphragm is displaced by a sudden impulse it oscillates in its natural frequencies in the process of returning to rest, and so adds an unnatural and metallic colour to transients of all kinds. A train of highly damped waves acts in a similar way, for, as is evident from Fig. 8, such a train leaves the diaphragm in a displaced position just as a single impulse does.

(*To be continued.*)

[3] Bell System Tech. J., October, 1925.

THE SIMPLEST ANTI-FADING DEVICE.

The Use of Reversed Reaction.

THE idea described looks too simple to be effective. Nevertheless, as far as can be judged from aural observations, it seems to work. Like all anti-fading systems, it is useless, except for strong signals; hence as fading does not trouble the reception of local stations, good high-frequency amplification is presupposed.

Swinging Coil or Condenser-controlled Reaction.

Fading is at its worst in a receiver where reaction follows a tuned anode (or tuned grid) high-frequency amplifier, since the decrease in carrier current then acts doubly, not only directly reducing the signals but also reducing the reaction effect and hence increasing the effective resistance in the tuned circuit, which, in turn, decreases the amplification.

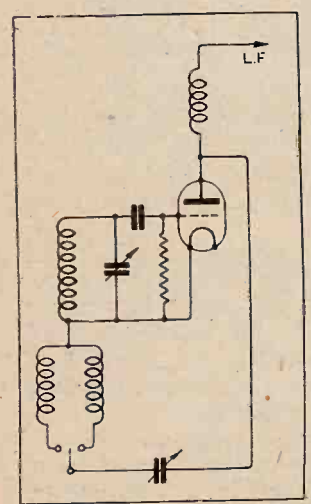


Fig. 1.—When condenser-controlled reaction is employed a second coil must be wound for reverse reaction.

If, however, signals are so strong that it is possible to use *reversed* reaction—for example, with the old-fashioned swinging coil by turning it through 180° from its point of greatest effect—a decrease in carrier current will tend to *increase* the amplification, since the effective resistance of the tuned circuit will now decrease with the decrease in counter-reaction; and this increase in amplification will tend to make up for the decrease in the signals arriving at the antenna. (Actually, of course, it is more complicated, since the decrease in carrier-current will decrease the counter-reaction, which will increase the amplified carrier-current; but this increase will increase the counter-reaction until a balance is attained. However, the tendency is there.)

With the swinging coil the idea is quickly tested; with the modern condenser-controlled reaction it would be necessary to wind an auxiliary reaction coil, in the reversed direction to the normal coil (Fig. 1).

The Case of the Screen-grid Valve.

There is, however, one case where the device is of special interest, and this is where the high-frequency amplifier is inherently unstable. It is where the amplification obtained is too great for the internal capacity of even a screen-grid valve. In such cases it seems worth while "quieting down" the amplifier by means of reversed reaction rather than by reducing the overall amplification or by neutralising; in such a case the reaction coil would, of course, be wound in the reverse direction to normal, and no "normal" reaction coil would be used—the handling of the set is quite normal, except that an increase in the reaction condenser tends to stop oscillations instead of starting them. In this case the anti-fading tendency of the reversed reaction can be taken advantage of without difficulty, and without in any way complicating the construction or handling of the receiver.

R. R.-H.

Current Topics

EVENTS of the WEEK in BRIEF REVIEW

ALL ROADS LED TO OLYMPIA.

All attendance records for previous wireless exhibitions have been smashed this year at Olympia. In the first six days more than 170,000 visitors passed through the turnstiles. The daily average exceeded that of 1929 by nearly 6,000.

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GOOD BUSINESS.

The Exhibition helped to prove that the radio industry is one of the most prosperous in the country at the present moment. Orders were taken which will keep some firms busy until the spring.

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CHIEF OF PAPAL BROADCASTING STATION.

The *Osservatore Romano* announces that the Pope has appointed as president of the new Vatican broadcasting station the Rev. Guiseppe Gianfranceschi, S.J., of the Pontifical Academy of Sciences. The station, which has been built by the Marconi Company, will be formally opened within the next fortnight.

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"BY COURTESY OF PORK PACKERS, INC."

The opening of the first course in broadcast salesmanship is announced by the College of the City of New York. It is stated that Mr. F. Arnold, the instructor, has travelled 100,000 miles studying "listener reaction," and is an expert in making the programme fit the product.

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MEDAL FOR A HERO.

Mr. Frank Davidson, the wireless operator of the British liner *Tahiti*, which sank in mid-Pacific after the rescue of her passengers and crew by the American liner *Ventura*, has been awarded a gold medal by the Veteran Wireless Operators' Association.

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A SECOND MOSES?

"An eminent British scientist may be the Moses who will lead North America and the rest of the world out of the wilderness of radio congestion." In these words a Washington journalist hails the forthcoming arrival in New York of Dr. James Robinson, who will demonstrate his invention of the Stenode Radiostat before leading experts in American radio.

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DISCONTENT IN HOLLAND.

A seven-mile procession of Dutch listeners, numbering nearly 140,000, from all parts of the country, filed through the streets of Houtrust, near The Hague, a few days ago, in protest against the rigid radio censorship. The Control Commission is charged with censoring items which all listeners are entitled to hear, an instance being the suppression of speeches from the League of Nations at Geneva.

A correspondent states that a petition to the Queen protesting against the present regime contained 460,000 signatures

HAVE YOU MET THEM?

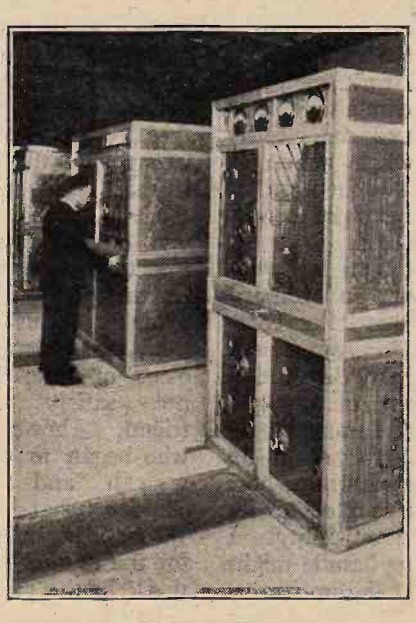
Non-paying listeners who escape the charge of piracy have a few honeyed words to themselves in the current number of the *Indian Radio Times*. Says the writer: "A number of our Patrons, we find however, are not actually Licenses-holders. They listen-in at the residences of their friends. . . . This is all very nice. . . . We must impress upon them, however, that it would be to their greater interest if they put their appreciations into action by investing in RADIO SETS. . . . The Licenses Fee is a paltry sum."

We Want Your Vote

With the appearance of this, our third Show Number, readers are reminded that entry forms for THE WIRELESS WORLD Olympia Show Competition are due to be sent in to reach THE WIRELESS WORLD offices not later than Monday, October 6th.

We do not anticipate that it will be possible to announce the results for two or three weeks, owing to the time required to sort out the votes and ascertain the winners in each class.

The entry form is again included in the advertisement pages of this issue, and we hope that every reader is participating in the ballot and will forward his completed form by the date specified.



TO BEAT MOSCOW? A portion of the 158kW. broadcast transmitter at the Marconi Company's Chelmsford Works, ready for despatch to Poland. The station may be used to "shout down" Russian propaganda.

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NOT NICE.

Paris listeners are protesting against the broadcasting of medical talks from Radio Paris during the lunch hour.

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EARLIER BELGIAN SHOW.

The annual Brussels Radio Show is to be held earlier than usual this year, the dates being October 18th to 27th. The venue will be the Parc du Cinquentenaire.

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ARE U.S. CHURCHES SELLING RADIO LICENCES?

"Trafficking" in radio transmission licences is strongly suspected by the American Federal Radio Commission as a result of the unusually large number of recent applications for changes in the ownership of broadcasting stations, writes our Washington correspondent. Since the wavelength band is congested already, the commission is disposed to eliminate stations of doubtful status and to scrutinise carefully the financial repute of the proposed new owners.

The Commission eyes askance the trend of church and educational stations towards new commercial owners. In the last year at least a dozen church stations have "gone commercial."

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BRITISH GEAR FOR EUROPE'S BIGGEST BROADCASTER.

The most powerful broadcasting installation in Europe is now undergoing its final test at the Marconi works at Chelmsford. This is the long-wave 158 kW. transmitter, which is shortly to be erected for the Polish Broadcasting Company at Rasin, some 20 kilometres from Warsaw.

The aerial at Rasin will be of the half-wave type terminating in a feeder house underneath the aerial. The two masts, 600 feet high and 750 feet apart, will be the highest in use at any European broadcasting station.

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TELEVISION AND THE THEATRE.

What is regarded as marking the definite recognition of television by American theatre interests is the decision to erect a television broadcasting station on the roof of the New Amsterdam Theatre, West 42nd Street, New York, the work to be undertaken by the Radio Corporation of America.

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THE NOVOTONE.

In our issue of September 24th we repeated information given by the manufacturers that the original type Novotone has a voltage step-up of 1 to 2.6. This we are now informed should be 1 to 2 at 250 cycles.

UNBIASED.

By

FREE GRID.

That Outstanding Exhibit.

I SUPPOSE, as a temporary (depends more on the Editor than on me) contributor, I am officially precluded from participating in *The Wireless World* Ballot Competition, but nevertheless I have very carefully filled in an entry form for my own edification, and it will be interesting to see how far adrift I am in my prognostications when the results are published. I think that readers will have little difficulty in agreeing with me as to what is the single outstanding exhibit of the Show, which comes under Class No. 8 in the competition.

"... into a convenient receptacle."

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Strange?

In spite of the fact that the Show is really all British this year, or at any rate supposed to be so, I could not help noticing that on one or two of the wholesalers' stands apparatus had crept in which must surely have been manufactured over the water.

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Advice Wasted.

If I have a bee in my bonnet, it is on the subject of gramophone motors. What interested me exceedingly was a special electric-cum-clockwork movement which was being exhibited. Briefly, a clockwork motor is used to drive the gramophone—so eliminating any possibility of electrical interference—and an electric motor is used to wind it up. The whole action is automatic, the winding motor being switched on at the conclusion of the record and being switched off again immediately the motor is fully wound.

This series of operations is controlled by a low voltage and low current relay operated from an ordinary flash-lamp battery. The presence of this latter component on an otherwise "all-mains" arrangement immediately aroused my ire, batteries of any description in an all-mains arrangement being one of my pet aversions. Seizing the nearest pamphlet I immediately began to draw diagrams on the back of it in order to explain to the politely bored demonstrator how the relay might be operated from the mains at relatively little cost and with absolute safety and reliability. I also suggested that an emergency winding handle might be provided in case the electrical part of the apparatus refused to function at any time, or in case the owner of it moved to a non-electrical district. But, alas! my enthusiasm carried me too far, and my good advice fell on stony ground, since, as I moved away, I surreptitiously observed my victim drop my diagram into a convenient receptacle, and I must say that on second thoughts I don't blame him, as I daresay that at the end of a day's work many stand people must get heartily sick of ill-considered advice, to say nothing of fool questions.

Talking of questions reminds me of an interesting experience I had when I sought the neighbourhood of *The Wireless World* stand for a rest from my peregrinations. I took up a position near where a representative of the technical staff was endeavouring to satisfy the thirst for information of what appeared to be a veritable horde of budding Einsteins out in front. Seriously, though, I was considerably astounded at the high order of technical knowledge commanded by those propounding the questions and at the intelligence displayed in the supplementary queries which usually followed the answer. It was a veritable eye-opener—at any rate to me. There were, naturally enough, the inevitable exceptions.

Perhaps I might mention one particular interrogator, whom I recognised as a well-known figure in the motoring world and one whose name—to use a hackneyed but useful expression—is one to conjure with in matters concerning the technicalities of the motor car. Briefly put, his question was that his all-mains set, which had (he said) been built to a *Wireless World* design, would not work. Why? The presiding Solomon immediately proceeded to cross-examine him as to whether he had followed the specifications; had he tested this and tried that? Apparently he had done all this and more also, for, not only had he thoroughly "vetted" everything with a family of meters, but he had gone to the length of calling in two well-known wireless experts who had declared that there was nothing wrong with the set!!

Two experts declared there was nothing wrong.

"Then surely if there is nothing wrong with the set it must work perfectly," interjected one of the rather impatient crowd surrounding the stand. This—to me—unanswerable piece of logic did not satisfy our friend, however, who began to wax wrath and demanded what *The Wireless World* was going to do about it. Fortunately for the reputation of the set "up spoke a brave Horatius" in the crowd who had built the set in question.

In the discussion which ensued, *The Wireless World* technical man with commendable tact lent his ear to a clamorous Caledonian who wanted to know all about oscillating crystal circuits, presumably being under the impression that they were economical. Meanwhile, I

Unbiased.—continued to listen to the discussion anent the all-mains set, and eventually it turned out that (*a*) the motoring expert lived in the country outside the reach of electric light mains, and so presumably his question was "fictitious"; (*b*) the set he had built was not a *Wireless World* design anyhow. Now, the intricacies of the internal-combustion engine are as a sealed book to me, but I really think that if I had a question to ask him on his pet subject I would at least contrive to make sure of the make of car I had purchased!!! Apart from this extreme instance, other somewhat similar "cases" presented themselves for diagnosis, and it struck one that the hardest type of question to answer is: "Why won't my set work?" It appeared to me—at any rate—that, in order to answer all-comers without giving offence, it needed the Wisdom of Solomon combined with the Caution of an Agag with perhaps a dash of Datas thrown in.

"... stating he had been a reader since the first number."

Yet another class of questioner who interested me was the youth with the cricket-match moustache, who commenced his question by stating that he had been a reader of *The Wireless World* from the first number. Instinctively my mind flew back over the years to April, 1913, before wireless had turned my hair grey, and I saw the youth, in my mind's eye, chortling gleefully as he assimilated nourishment for the body from a bottle and nourishment for the soul from Vol. 1 No. 1 of this venerable journal.

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The Trek to the North.

It is only a few more days before the Manchester Show opens, and I shall be wending my way northward to see what good things are in store for us at the rainy city. The Manchester Show is, in my opinion, always very interesting, and in some respects it is more instructive than Olympia itself. The organisers might, however, find a more inviting-looking building in which to hold it.

By the way, I have been threatened by Mrs. Free Grid that she intends to visit the Manchester Exhibition next week with the avowed object of purchasing a set and of presenting me the bill, owing to the fact that as a result of my experimental work the "Old Homestead Three" is being constantly disembowelled. I am half tempted to let her get on with it, as there were several very tempting receivers on show this year at Olympia, and they will, of course, be all seen again, together with some additional ones, in the Northern Exhibition.

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A Novel Explanation.

I made a very interesting tour of the various *centrally heated* demonstration theatres where for the most part radiograms were being demonstrated. What struck me very forcibly was the amount of noise picked up by the almost universal electrically driven motor, nor was this confined solely to the cheaper instruments. I proved this in one particular case by the simple expedient of stretching forth an impious hand and lifting the pick-up from the record. At this perhaps rather high-handed act of mine the onlookers gave horrified gasps, evidently expecting me to share the fate of Uzzah, while the young man in charge nearly swooned, I having, unfortunately, scratched the record slightly in replacing the needle. Another remarkable example of somebody having missed their vocation was vouchsafed to me here, for, in reply to my criticisms of commutator interference, I was told that I was quite mistaken, as the distressing noise was due to the battery eliminator!!! It so happened that later in the evening I came across one of these particular radiograms, as they now appear to be called, with its "innards" exposed, and at once saw the cause of the trouble, which was the use of a superannuated motor of foreign origin in which no attempt had been made either by screening or otherwise to eliminate the interference. This, mark you, in a radiogram costing a few shillings less than £50.

In fairness to the foreigners concerned, it should be said that the model has been obsolete for the best part of a year, having been replaced by one in which special screening arrangements are made to reduce commutator noise to vanishing point. It must be admitted that the case I have quoted is an extreme one, but, nevertheless, I found that motor interference was far too prevalent in certain models; at the same time I must give credit where credit is due and place on record the fact that there were a very large number of motors on show in which the whole of the electrical portion, including, of course, the all-important commutator, was totally enclosed in a metal box, a terminal being provided for the purpose of "earthing" this to the cathode or common negative connection of the amplifier in a radiogram.


The young man in charge nearly swooned.

It is evident that the B.B.C. are still dubious about employment of an electric motor, however, since I noticed that they were using an ordinary clockwork instrument for supplying music to the 200-*odd* loud speakers distributed about the various stands. Incidentally, the particular make of pick-up which they used was plainly visible and easily recognisable, although, of course, this would convey nothing new to regular readers, as I have already seen the name of the particular instrument favoured by the B.B.C. disclosed in *W.W.*

BROADCAST BREVITIES

By Our Special Correspondent.

Those Continental Relays.—A Royal Broadcast.—Accommodation at Broadcasting House.—Mr. Adrian Boult.—Winter Symphony Concerts.

Foreign Relays: Who Wants Them?

Do listeners want foreign relays? This innocent-looking question is arousing genuine concern at Savoy Hill, principally because so few individuals have troubled to write letters in appreciation of the B.B.C.'s recent efforts to give us the best from the Continent as well as from America.

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Unspoken Desires?

The costly business of chartering wires half-way across Europe, as in the case of the recent Salzburg festival, can only be justified if thousands of home folk desire to hear the best music imperfectly reproduced in preference to the next best perfectly reproduced. In my experience, only one class of listener would confess anything of the sort, and he is the man who listens direct to distant stations on his own set.

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Too Late

If the B.B.C. could have staged these elaborate relays six years ago there might have been a demand for them, but it is doubtful whether receivers and landlines were equal to the task. The irony of the present situation lies in the fact that the improvement in Continental landlines and repeater methods comes too late. The majority of listeners interested in Continental programmes can pick them up direct.

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A New Policy?

Many observers would not be surprised if the B.B.C. were shortly to alter their foreign relays policy, deciding to use the Continental landlines only for events of exceptional importance, such as the sessions of the League of Nations. All efforts to relay music will probably be abandoned.

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The Prince to Broadcast.

The Prince of Wales's speech at the League of Nations dinner on October 30th will be one of several to be relayed from the Guildhall in the National programme.

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Sad Thoughts.

Sentimental rumours have gone the rounds to the effect that the B.B.C. hates the idea of leaving the old premises on Savoy Hill. It is said that even when Broadcasting House is ready for occupation some of the staff will remain, Casabianca-like, on the old decks.

I can discover no truth in the suggestion.

Makeshifts.

Opinion among the staff at Savoy Hill is all the other way. The present headquarters are a makeshift, as full of improvisations as the piano interlude. One of the talks studios is a converted scullery.

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Overflowing Departments.

Uncertainty does exist as to whether Broadcasting House will be able to absorb all the London departments of the B.B.C., for some of these have already

RELAYS FROM GENEVA. M. Ramseyer, chief engineer of Radio Genève, at the line amplifier and switchboard during an international relay of a League of Nations meeting.

flowed over into the Strand and odd corners in the neighbourhood. But there is no thought of retaining Savoy Hill.

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The Palladium Again.

Relays from the stage of the London Palladium are to be revived on October 9th.

Another series of revivals towards the end of October will be the "Diversions" programmes, but these will be broadcast thereafter monthly, instead of every week as in the case of the first series.

The Director of Music.

Mr. Adrian Boult will make his first appearance as conductor for the B.B.C. at the inaugural winter symphony concert to be broadcast from the Queen's Hall on October 22nd. Madame Suggia, the eminent 'cellist, will take the solo part in Saint-Saëns Concerto in A minor for violoncello and orchestra.

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Conductors and the Orchestra.

In order that the new orchestra of 114 players shall give the best possible account of itself, conductors who are participating during the season have each been invited to take control of the orchestra for a period in advance, in most cases of three weeks.

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Features of the Programme.

The chief choral works to be performed during the season include Handel's "Israel in Egypt," Beethoven's "Missa Solemnis," and Vaughan Williams' "Sea Symphony."

The important orchestral items include the Brandenburg Concertos of Bach, many of the Beethoven symphonies, and works by Brahms, Schubert, Schumann, Berlioz, and Tchaikowsky. Lovers of modern music should find gratification in compositions by Schonberg, Stravinsky, and Bartok.

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Lord Beaverbrook at the Microphone.

Lord Beaverbrook may be expected to agitate the ether on October 16th, when he inaugurates a series of talks under the title, "Trade Within the Empire." Other speakers in the series will be Sir Basil Blackett, Sir Arthur Salter, and Mr. Frank Livett MacDougal.

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Drums in Lifts.

"R.U.R.," which was broadcast so successfully last week, had a prologue which listeners did not hear. It might have been called "The Episode of the Big Drum."

To produce the sounds of gunfire from a battleship, it was decided that something larger than the ordinary orchestral drum should be used. No difficulty was met with in obtaining an outsize in drums, until the instrument was brought to the Savoy Hill lift. Apparently no one could be found who specialised in the art of inserting extra large drums in medium-sized lifts, and it was only after a hard struggle that the feat was accomplished. The lift attendant was inserted afterwards.

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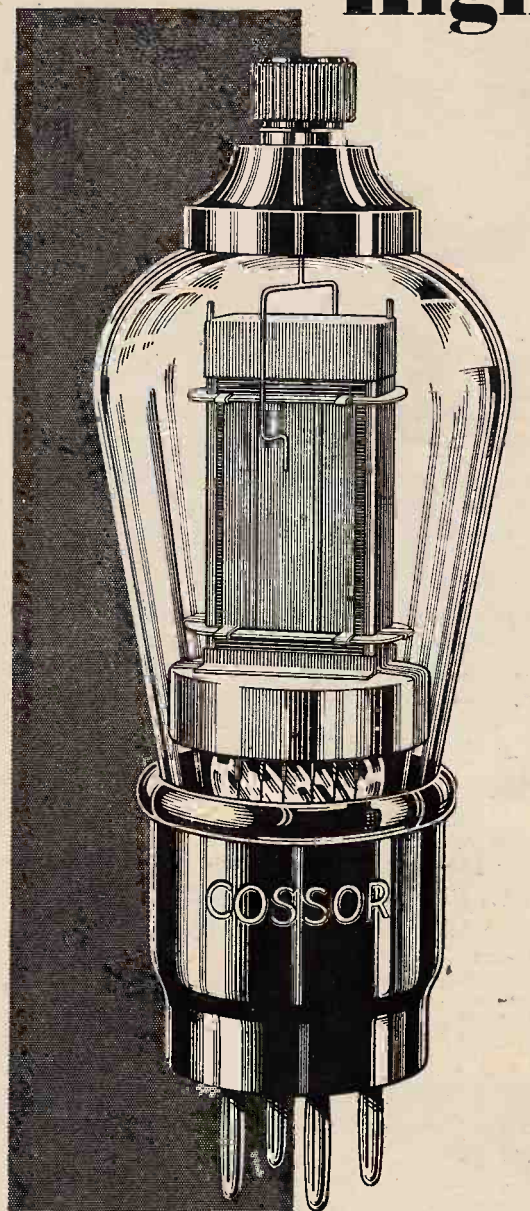
yet attained with a Screened Grid Valve



Radio technicians know that it is useless to expect a substantial stage gain from any Screened Grid Valve—however good its other characteristics—which has a high inter-electrode capacity. Cossor engineers have been striving for months past to reduce the self-capacity of Cossor Screened Grid Valves to a negligible figure. So successful have they been in their efforts that the new Cossor 215 S.G. has an inter-electrode capacity of the order of ·001 micro-microfarads — lower than that of any other Screened Grid Valve on the market. As a result, this new Cossor Valve permits a degree of effective amplification which a year ago would have been considered utterly impracticable. The use of this Valve will considerably increase the efficiency of your Receiver.

Cossor 215 S.G. 2 volts, ·15 amp. Impedance 300,000. Amplification Factor 330. Mutual Conductance 1·1 m.a./v. Normal working Anode Volts 120. Positive Voltage on Screen 60-80. Price **20/-**

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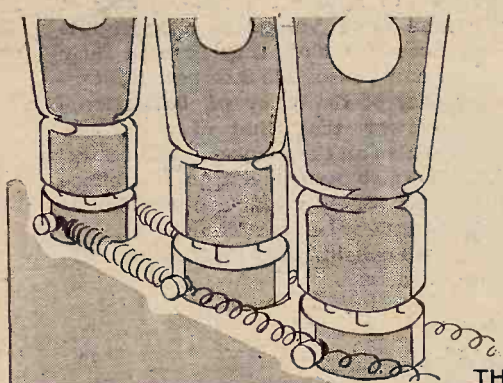

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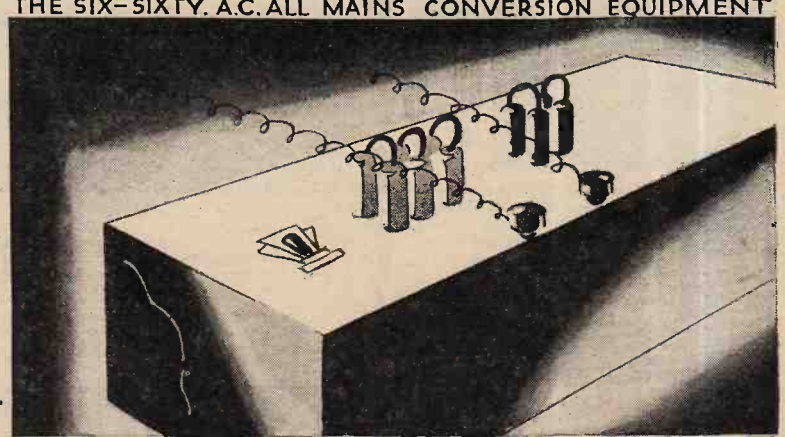

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THE TREND of PROGRESS

A Review of Points of Novelty Illustrated by Typical Examples.

TO say that the National Radio Exhibition of 1930 has brought forth nothing that is radically new, and to let this bald statement stand as an implied reproach, would be cruelly unfair to the hard-working research and development staffs of the manufacturing firms concerned. True, there were no startling innovations, but mere novelty for novelty's sake is even less worth while in the wireless art than in the majority of others. There was abundant evidence to show that infinite pains have been taken to ensure that the average new set may be much better in every way than its predecessors. After all, results are the deciding factor, and, in the matter of performance in the ordinary user's hands, the set of 1930, being essentially practical, should show a greater advance, as compared with that of 1929, than has been made in any other single year. If this opinion be true—and it is not made without due consideration—the Olympia Show just ended must be admitted to have been a complete success from the technical point of view.

It was most gratifying to find a definite tendency to divide receivers into distinct categories with regard to their sensitivity; exaggerated claims were seldom made, and sets were frankly offered as being intended for medium- or even for short-range work only. The purely local-station outfit has made its appearance, and is likely to appeal to an increasing number of listeners as the Regional scheme of twin-station transmitters is extended. Indicative of this tendency was the new Ferranti receiver, with a switch change-over between two pre-determined wavelengths. This is a two-valve detector-L.F. combination, with two distinct tuned circuits and four semi-variable condensers, so arranged that the circuit out of use for tuning purposes is converted into an absorption wave-trap operative on the frequency of the unwanted station. A new Columbia "Twin Station" receiver, available in models for A.C. or D.C. supply, is similarly arranged for alternative programme reception, and has a built-in loud speaker.

Due partly to changes in the patent situation, and to the adoption of mass-production methods, certain manufacturers have been able to produce simple detector-L.F. sets at extraordinarily low prices—in the neighbourhood of £3.

THIS year's Show has made a contribution to radio progress not exceeded by that of any previous year. In view of the highly developed state reached over the years since broadcasting began the changes that have taken place represent a remarkable achievement.

Sets are capable of far better performance than hitherto in range and quality of reception as well as ease of control. Design and manufacturing details give improved appearance and increased reliability.

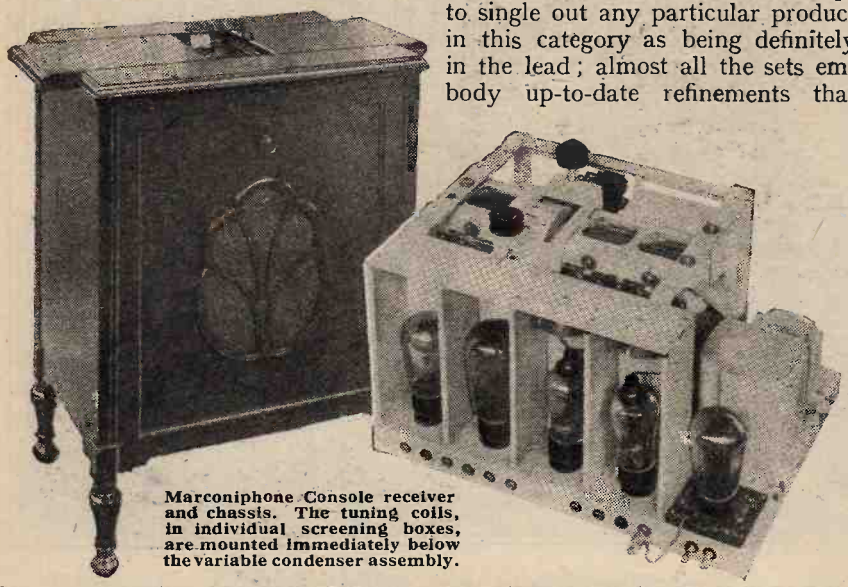
Compiled from a critical inspection of all the apparatus that was shown at the stands this article serves as a guide, illustrated by typical examples of those features one should look for when scrutinising this season's sets and accessories.

THE NEW SETS

These receivers seem likely to satisfy the none-too-exacting needs of a large but hitherto unexploited section of potential listeners, and so their introduction must be welcomed by all who have the interests of broadcasting at heart, although our welcome would be warmer if they did not include reaction. It is hardly to be expected that they should embody any features of especial technical interest, but ingenuity has been shown in devising circuit arrangements that lend themselves to economical manufacturing methods. Mention should be made of the Burton and Red Star products, and also of the cheapest set of all—that made by Messrs. Hustler, Simpson, and Webb, which embodies a device whereby filament switching and wave-range changing is effected by inserting a plug into the appropriate sockets.

It has been suggested that the popularity of the H.F. detector-L.F. type of three-valve set is declining, but, in spite of the fact that at least one leading manufacturer has not produced a new model of this popular, general-purpose type for the present season, it seems certain that its appeal is but slightly diminished. This is natural enough; wireless is essentially a matter of compromise (to which we as a nation are supposed to be particularly addicted), and this circuit arrangement undoubtedly provides the best all-round compromise as regards range, quality, selectivity and cost.

It would be invidious to attempt to single out any particular product in this category as being definitely in the lead; almost all the sets embody up-to-date refinements that have been proved to be worth while from the user's point of view. Thanks largely to continued improvement in valve technique, the sensitivity of these sets shows a considerable improvement, so their range should be sufficient for all except the most exacting requirements or the most difficult conditions. In the matter of volume, the single L.F. stage, which, of course, is an essential part of the circuit, can now be made to provide sufficient power output for all ordinary needs.



Marconiphone Console receiver and chassis. The tuning coils, in individual screening boxes, are mounted immediately below the variable condenser assembly.

There has been a well-marked increase in the number of mains-operated receivers, and it is now certain that the listener with access to an electric supply is better catered for than those who must depend on batteries. Possibly this is accountable to the fact that many sets are sold on the hire-purchase system, and that the trader, knowing human nature, prefers to sell something that is unlikely to require any renewals during the period in which payment is being made. A.C. receivers are in the majority, but many makers have faced the rather difficult task of designing satisfactory apparatus for operation on D.C. supplies; among others, the new Ekco set has many points of interest.

Direct calibration in wavelength has now become a feature of relatively inexpensive sets, and is adopted much more generally than formerly. It is clearly a great convenience to the ordinary listener who requires no very wide choice of programmes, but, for the long-distance enthusiast, is perhaps slightly less susceptible to accurate recording of station settings than is a dial

Burndept Type 1850 chassis, with semi-ganged tuning, large-diameter inductances and completely screened anode coupling coils, which are mounted behind the detector valve.

The Trend of Progress.—

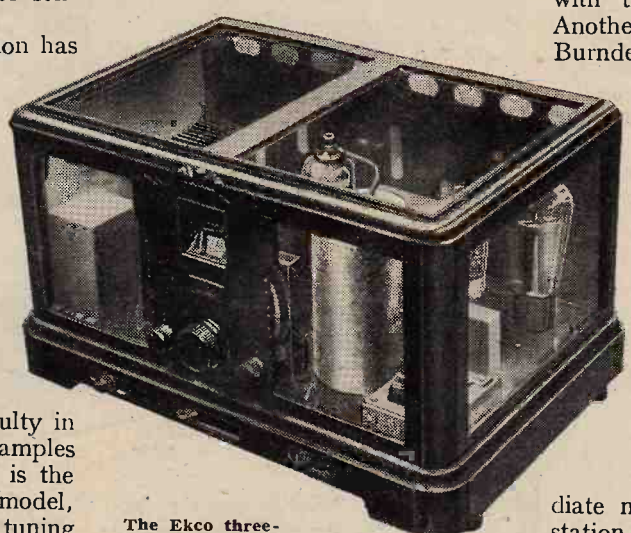
marked off with an arbitrary scale.

Single-knob control of tuning condensers is certainly one of the most important advances to be placed on record. The word "advance" is used advisedly, as there can be no doubt that the unskilled listener regards this feature as of paramount importance. Even the knowledgeable enthusiast (as we know from our correspondence from readers) considers it to be desirable, providing that its inclusion does not entail a sacrifice of sensitivity and selectivity.

An entirely new form of construction adopted in the McMichael three-valve receiver. The correct ganging of the single-control tuning condenser is maintained as the volume control is operated.

Development in this direction has proceeded, in the main, on lines of accepted practice. In most cases a trimming condenser is fitted for the aerial input circuit, or, alternatively, provision is made for rocking the rotor of the first variable condenser through a few degrees. It is sometimes found that the range of variation as provided is unnecessarily great; this is rather likely to lead to difficulty in operation. One of the best examples of a gang-controlled receiver is the new Marconiphone Console model, Type No. 560, in which the tuning of all three circuits is controlled by a single dial.

When it is realised that a signal voltage of perhaps as much as 10 volts (peak) may easily be developed across an efficient aerial input circuit at quite a number of miles distance from a powerful transmitting station, it will be appreciated that some form of input volume control is becoming essential, particularly as the average screen-grid valve is capable of dealing faithfully only with a fraction of a volt. It is extremely difficult to devise a method of regulating signal voltage to the first valve in such a way that the tuning of its grid circuit shall not be affected, and many ingenious schemes have been devised to overcome this trouble.



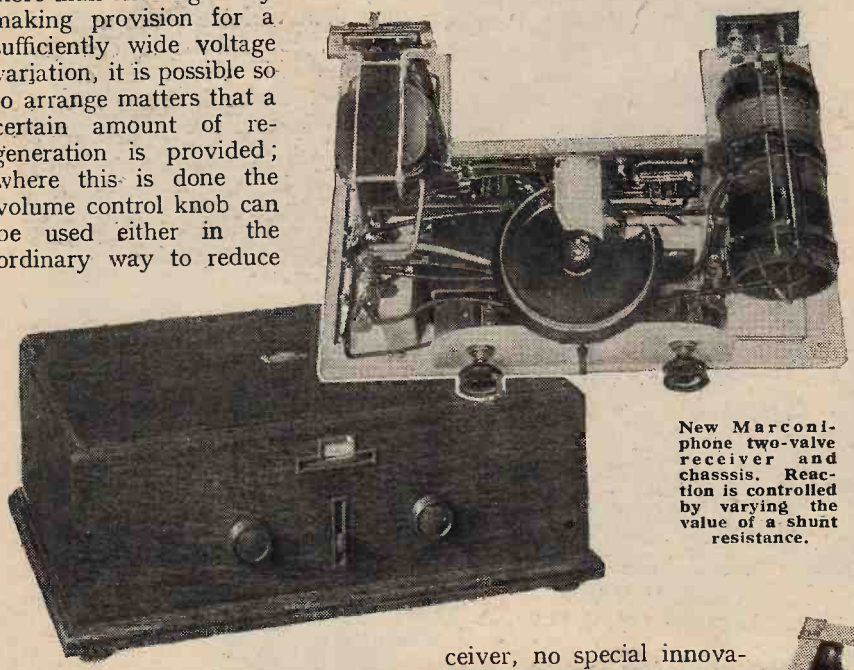
The Ekco three-valve all-mains set is a good example of modern construction employing metal framing throughout, effective screening and a durable moulded container.

Probably the most interesting is that adopted in the new McMichael three-valve H.F.-det.-L.F. set, where control is effected by operation of a variable series aerial condenser; the inevitable changes in effective grid circuit capacity that would otherwise be brought about by alterations of its setting is compensated for by linking it mechanically with the input tuning condenser. Another plan is adopted in the new Burndept set, where a differential condenser is arranged to replace capacity taken from the aerial circuit and so to preserve a balance. Somewhat similar precautions against alterations of tuning are taken in the Columbia receiver.

Volume control arrangements of this kind all have the additional advantage that reductions of intensity are accompanied by an improvement in selectivity; consequently, they are particularly useful in the immediate neighbourhood of a powerful station. This is also a property of the simple series aerial condenser, which is to be found in many sets, and of the system of variable magnetic aerial coupling, as adopted by the Ekco firm.

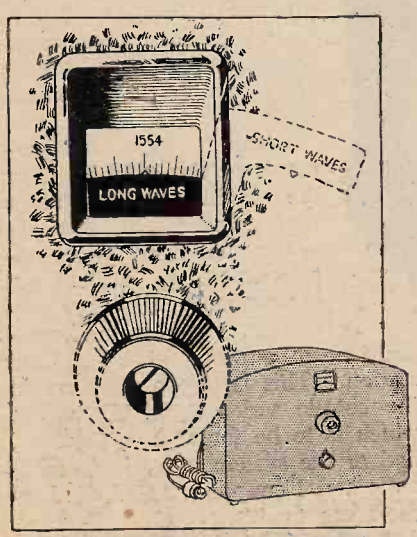
Another favourite method of controlling detector input is to fit a potentiometer for regulating screen-

The Trend of Progress.—ing grid voltage of the H.F. valve—or valves; this plan seems to be most popular with those responsible for the design of H.F. amplifiers with more than one stage. By making provision for a sufficiently wide voltage variation, it is possible so to arrange matters that a certain amount of regeneration is provided; where this is done the volume control knob can be used either in the ordinary way to reduce intensity below the normal level or to increase sensitivity in the same way as a reaction control. This arrangement is adopted in the Marconiphone four-valve set, in which the voltage-regulating potentiometer is mounted on the same shaft as the post-detection volume control, which comes into operation when gramophone records are being reproduced.



New Marconiphone two-valve receiver and chasssis. Reaction is controlled by varying the value of a shunt resistance.

Regarding the regulation of volume at the L.F. end of the receiver, no special innovations were noticed except in the R.G.D. radiogramophone, in which a tapped potentiometer, with a single operating knob, controls intensity of both gramophone and radio L.F. input, and acts also as change-over switch from one method of reproduction to the other in such a way that either may be faded in or out at will without abrupt breaks.

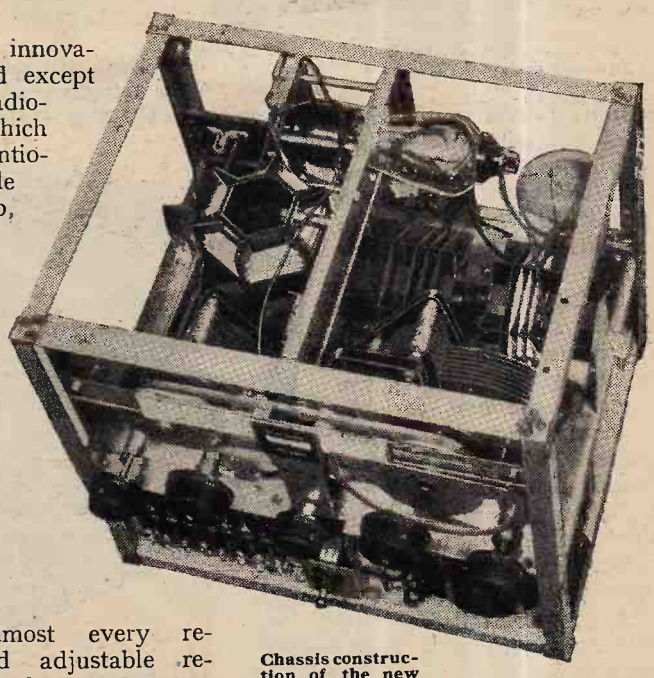


Ferranti receivers are fitted with a shutter which is operated by the wave-change switch arranged to expose the appropriate calibrated wavelength scale.

Last year almost every receiver included adjustable reaction, but now there are many without it. In this one sees the effect of better circuit design and more effective screening, which gives greater H.F. stage gains. Even when reaction is fitted, it is often pointed out that it need seldom be used, again implying that the H.F. amplifier is capable of doing its work without adventitious aids.

With regard to actual methods of applying reaction, a rather unusual scheme is embodied in the Marconiphone det.-L.F. set; here the reaction winding (which is common to both medium- and long-wave grid coils) is shunted by a variable damping resistance, wound in such a way that equal angular displacements of its control knob throughout the scale do not bring about equal resistance changes. This is done in order that the range of effective control may be more evenly distributed and a critical control obtained at all settings.

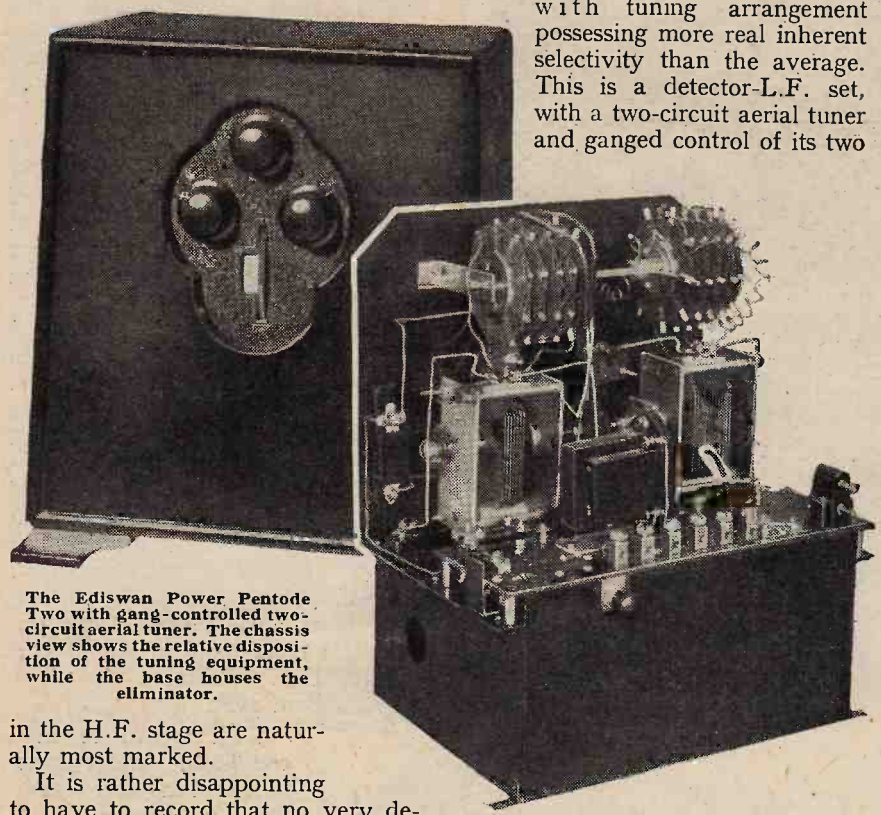
Differential reaction condensers are now widely used, mainly because they allow a suitable value of capacity to be maintained between anode and filament of the detector valve, thus ensuring that anti-reaction feed-back shall be kept within reasonable bounds even when the reaction control is set at "minimum." This is probably one of the reasons why the new sets are less dependent on reaction.



Chassis construction of the new Ferranti three-valve receiver. Transverse ganging of the tuning condensers is provided and trimming is accomplished by means of a rocking stator.

A revival of variable magnetic reaction was observed in the Ferranti

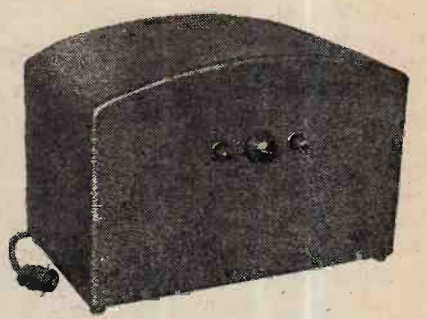
The Trend of Progress.—three-valve sets, where provision is made for reversing the sense of coupling, mainly in order that excessively sharp tuning with consequent loss of sidebands may be avoided at the lower end of the tuning scale, where regenerative effects in the H.F. stage are naturally most marked.



The Ediswan Power Pentode Two with gang-controlled two-circuit aerial tuner. The chassis view shows the relative disposition of the tuning equipment, while the base houses the eliminator.

It is rather disappointing to have to record that no very determined effort seems to have been made to get to the root of the interference problem, although in the matter of selectivity sets are better than they were, if only because their coils are better; probably the average dynamic resistance of tuned circuits has increased in the year by as much as 25 per cent. Admittedly, almost every set shown should be capable of separating a pair of Regional transmissions, even at short range, when properly operated, but this is not enough. Receivers with pretensions as to range should be able not only to separate the local stations but also to receive others free from interference; this is just what a number of those shown are incapable of doing, as much of the selectivity they may have is obtained by sacrificing signal strength. This does not apply to some of the new frame-aerial sets, and those with two H.F. stages, which should have a good enough performance in this respect for almost any condition, mainly because their signal pick-up is small or because very weak aerial coupling is provided.

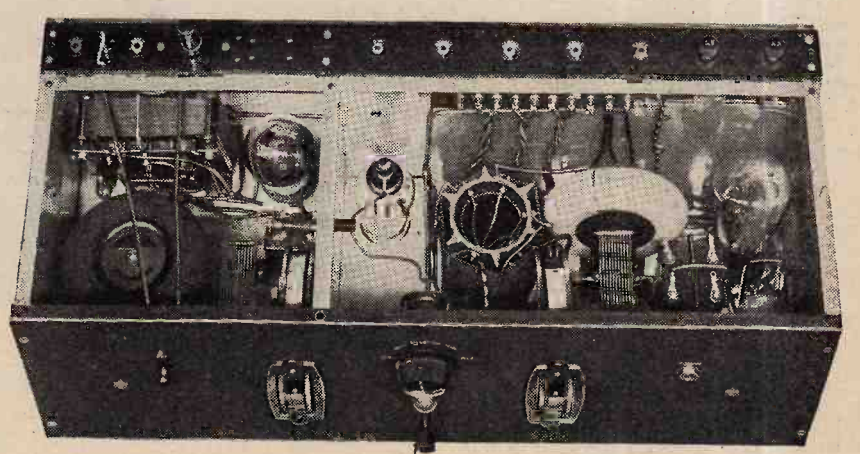
The Ediswan "Power Pentode Two" is one of the few receivers with tuning arrangement possessing more real inherent selectivity than the average. This is a detector-L.F. set, with a two-circuit aerial tuner and ganged control of its two tuning condensers. It is thus no more difficult to operate than ordinary sets of the same type. Inter-circuit coupling is magnetic, one of the coil assemblies being mounted in such a way that it may be moved with respect to the other. When once fixed to suit local conditions, it is intended that this coupling should not be subsequently adjusted, as, to make it, the back cover of the set must be removed. As this set makes use of a super-power pentode output valve, its capabilities in the matter of volume are considerable, but one could wish that this promising input tuning system had been included in a set with greater pretensions as to range, where its selectivity would have been of greater advantage.



A unique design adopted for many of the new Ferranti sets. A two-station receiver with switch changeover and pre-set tuning.

Another real selectivity device was found in the R.G.D. radio-gramophone, which employs a capacity-coupled band pass filter, followed by two cascade H.F. amplifiers. Again, no extra operating complications are introduced, as all four tuning condensers are mechanically linked together and controlled by a single knob.

Portable sets have undergone little change, with the notable ex-

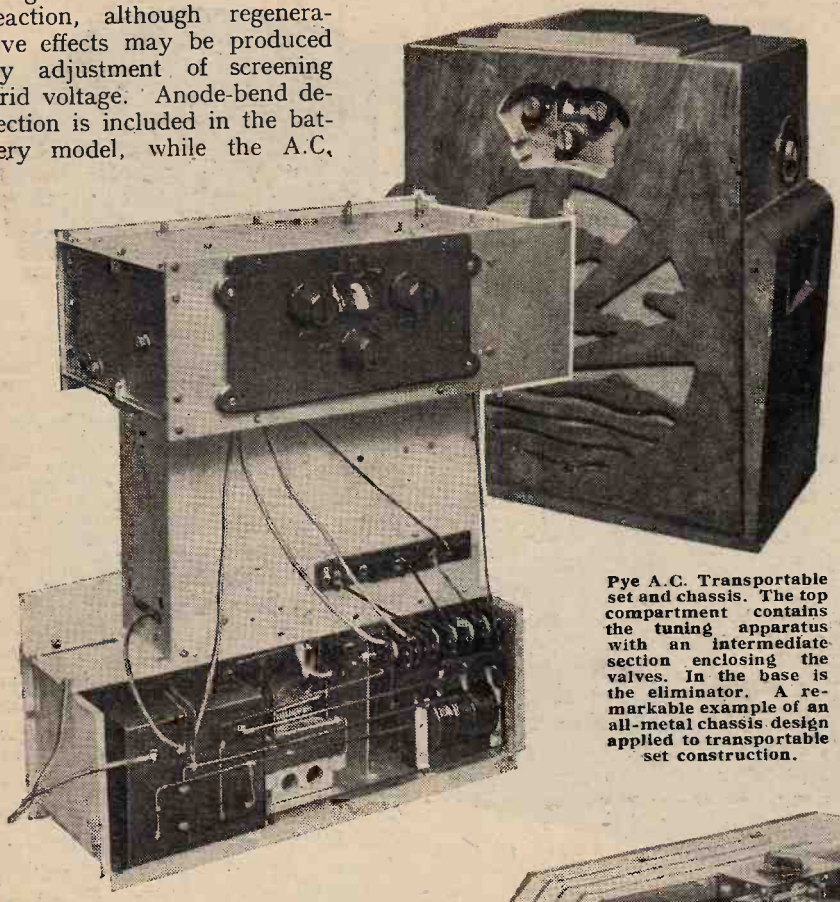


The Dubilier chassis. Separate tuning controls are provided.

The Trend of Progress.—ception of the new Pye productions. These sets include a high-efficiency two-stage tuned H.F. amplifier, ganged condensers, and no direct reaction, although regenerative effects may be produced by adjustment of screening grid voltage. Anode-bend detection is included in the battery model, while the A.C. version, which may be described as a mains transportable, has power grid rectification. These sets, by the way, are not sold as "boxes of mystery"; full data as to measured selectivity, frequency response, and overall amplification was made available on the stand.

The Murphy Radio Portable is another instrument bearing the hall-mark of scientific modern design; it has an H.F.-det.-2-L.F. circuit, and its tuning controls are completely ganged.

Mains transportables, of which only one or two examples were available last year, were shown in greatly increased numbers; their circuit arrangement is, as a rule, on conventional lines, and either frames or very short aerials seem to be preferred as collectors for these self-contained sets. As these sets are not limited in the same way as a battery portable with regard to anode current, liberal power outputs are available, and in at least one three-valve receiver—the "Enemains" transportable—a moving coil loud speaker is fitted.



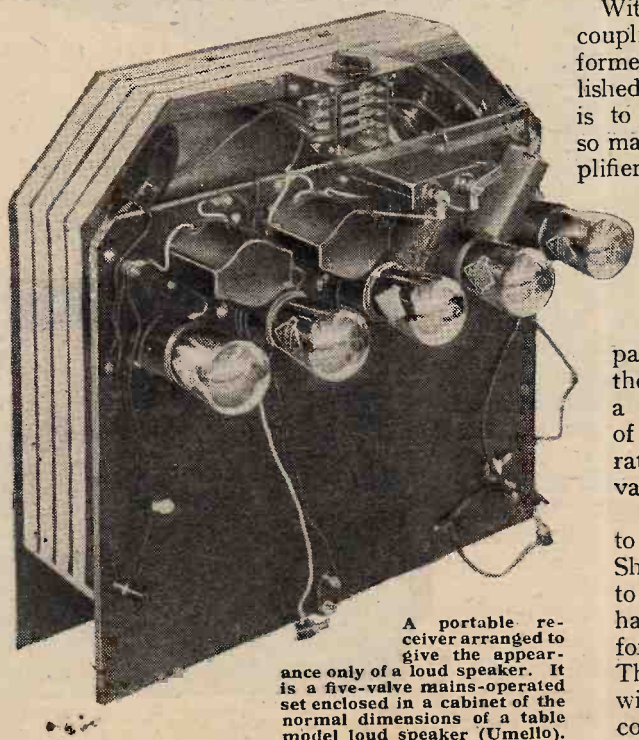
Pye A.C. Transportable set and chassis. The top compartment contains the tuning apparatus with an intermediate section enclosing the valves. In the base is the eliminator. A remarkable example of an all-metal chassis design applied to transportable set construction.

High-frequency amplifiers with two H.F. stages are gaining ground; with regard to inter-stage couplings the double-wound transformer and the tuned-grid system are both popular, the latter being preferred in sets with ganged control. The tuned anode method is rather a bad third, but it seems now to be generally agreed that, properly used, each type of coupling has its uses.

The anode-bend detector has suffered a definite set-back, probably due partly to increasing depth of modulation at the transmitting end and to secessions to the new system of power grid detection, which has been widely adopted.

Single L.F. stages are to be found in a very large number—perhaps in the majority—of the new receivers. Increasing efficiency of modern valves, and in particular the recent introduction of super-power pentodes, is responsible for this state of affairs; two modern stages give an almost embarrassingly high overall magnification which is excessive for most ordinary requirements, particularly when a good deal of amplification is done prior to the process of detection. Pentodes are more popular than ever.

With regard to L.F. couplings, the transformer has now established a clear lead, as is to be expected when so many single-stage amplifiers are in use. Push-pull amplification has hardly gained any ground, probably on account of the patent position, and the tendency is to use a single output valve of the required rating rather than to connect valves in parallel.

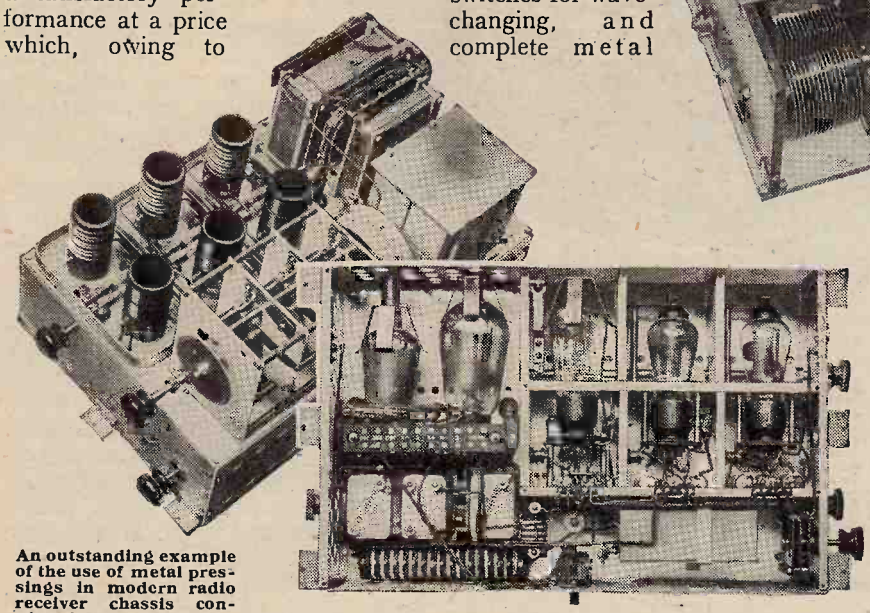


A portable receiver arranged to give the appearance only of a loud speaker. It is a five-valve mains-operated set enclosed in a cabinet of the normal dimensions of a table model loud speaker (Umello).

Passing from stand to stand around the Show one cannot fail to notice that sets have adopted new forms of construction. The simple baseboard with screwed-down components and ver-

The Trend of Progress.—tical front panel and screening barriers has gone for ever. In its place are metal pressings stiffened by bending combined with the use of bakelite mouldings.

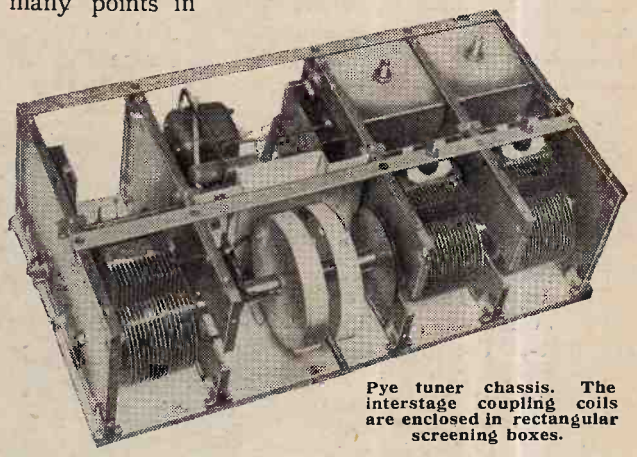
Progress is not well demonstrated by reference to the simple sets, but here one does find reliable make-up in that the manufacturer has not hesitated to incur the cost of tools for pressings and mouldings. As a result, the public gets a set giving a satisfactory performance at a price which, owing to competition, is exceptionally low. The sets of Burton and Red Star are examples, the former being enclosed in a moulded container.



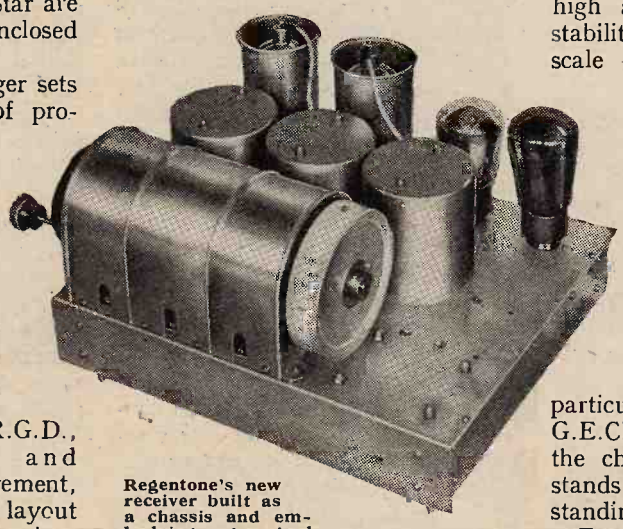
An outstanding example of the use of metal pressings in modern radio receiver chassis construction. The G.E.C. four-valve all-mains set with single-dial control.

Only by turning to the larger sets can conspicuous examples of progress be recorded. Most generally adopted is the design consisting of hollow baseplate, housing the decoupling and distributing equipment, and above the base the valves and tuned circuits. There are many examples of this form of construction which is adopted by Marconiphone, G.E.C., Kolster-Brandes, R.G.D., Regentone, Burne-Jones, and others. It is a good arrangement, lending itself to a convenient layout of components, effective screening, straightforward and concealed wiring. In every case this type of set has two screen-grid stages, detector and one L.F. stage, and is all-mains operated. This class of receiver has suddenly come to the front, and all of the sets have many points in common.

We find, for the first time, coils under screening containers, ganged condensers giving single-dial control, ganged switches for wave-changing, and complete metal screening around the valves. These details are all to be found in this entirely new type of receiver, of which there was no example at last year's show. It would seem that the manufacturers have caught up with the arrangement of the separately screened coil with its ganged switch control combined with the one-shaft tuning condenser, which has already firmly established itself in amateur set construction. Complete screening around the coils and usually the coil switches also, and earthed capacity barriers between the fixed plates of the tuning condensers, are the essentials of the arrangement. High-efficiency coils are by no means desirable in these circumstances, and with such complete screening and a small degree of valve reaction pulling its weight, high amplification results, with stability over the entire tuning scale on both wave ranges.



Pye tuner chassis. The interstage coupling coils are enclosed in rectangular screening boxes.



Regentone's new receiver built as a chassis and embodying ganged tuning, screened coils and valves, while the decoupling and voltage regulating equipment is carried in the recessed metal base.

Decoupling equipment right up to the point of distribution to the tuned circuits is an advantage brought about by underbase wiring, and, providing the bridging condensers are not of large dimensions, there is ample space for the most generous of feed circuits and voltage regulating components. This is particularly well revealed in the G.E.C. and Marconiphone sets, and the chassis interiors shown on the stands have been two of the outstanding exhibits of the Show.

Examination of the ganged condenser units reveals, hidden away, small parallel condensers used for

The Trend of Progress.—

bringing the circuit capacities up to a uniform value. They are used on the assumption that the inductance valves in the tuned circuits are identical, and their purpose is merely that of compensating for what is considered inevitable differences in the stray capacities thrown on to the tuned circuits by the valves, wiring, voltage feeds and screens. It can be predicted, however, that the use of these trimmers which may have a limiting effect on the tuning range of the circuits will eventually go, and that all the stray capacities can be carefully determined and taken into account. It was good to see that no provision is made in these gang-controlled sets for slip ganging the moving plates, as this would mean that a correction at one end of the scale would be widely out at the other owing to the use of logarithmic scale plates. We know, however, that by displacing the plates of logarithmic condensers discrepancies in the inductance of the various circuits may be corrected. This is a contingency which one need not guard against. It is perhaps possible, therefore, that a reversion may be made to the use of the semicircular straight line capacity plate where a small change of capacity can be compensated for by "unganging." Thus the small correcting difference of capacity will remain uniform across the scale, and the use of auxiliary trimmers will prove unnecessary. Uniform separation of stations across the tuning scale is of little importance when operating through a reduction gearing. Two forms of condenser drive are establishing themselves for this class of set. When the operating control is on the front of the set we find a positive cord drive to the indicating dial, as is the case in the Marconiphone receiver. Alternatively the condensers, which usually run along with their common spindle parallel to the front of the set, may be operated from the end, so that the control appears on the side of the cabinet, such as in the Gecophone and Regentone sets. This results in a particularly comfortable operating position. Mains equipment in sets of this class is found housed sometimes above and sometimes beneath the hollow base, or is built as a separate unit.

There is, perhaps, a decline this year in the number of three-valve sets. Their general construction is varied, and most of them follow the simple form of make-up, involving two tuning dials. Exceptions are the "threes" of Ferranti, McMichael and Ekco, in which we find gang tuning giving single-knob control. This is a marked development from last year when the three-valve receivers of each of these manufacturers were still designed for two-dial operation.

This season's Mullard "Orgola" Kit Set.

Mechanically, the McMichael set is unique. First, the wheel on the shaft of the condensers which provides for reduction gearing operates a travelling indicator by means of a cord running in a groove on its rim. The pointer travels horizontally across a scale, and indicates the wavelength calibration. Next, a piston-like device at the rear of the chassis is a pre-H.F. volume control operating by change of capacity in the aerial lead. The particular form of construction is adopted in order that calibration may hold good with change of the volume adjustment, and it is probably more, therefore, than merely a differential aerial condenser. In the Ekco three-valve receiver we find two important developments relating to manufacturing tendencies. In the first place, the entire container is an exceedingly well-finished moulding, and next the use of comparatively heavy pressed-out ironwork as a frame for the chassis. On its structural side this set can be taken as a fine example of a carefully tooled-out mass-production job which should give durable service.

This year marks definitely the passing of the five-valve portable, and but few examples remain, these being offered at very low prices, and therefore representing good value. In their place we find the single-screen grid stage, and maybe next year, if the portable persists, we shall find gang-controlled, two-screen grid sets following very much the principle of the four-valve mains sets which have been a feature of this Exhibition. A forerunner, however, is the Pye Twintriple, which with its single dial control and two H.F. stages is an outstanding example of a chassis-built transportable.

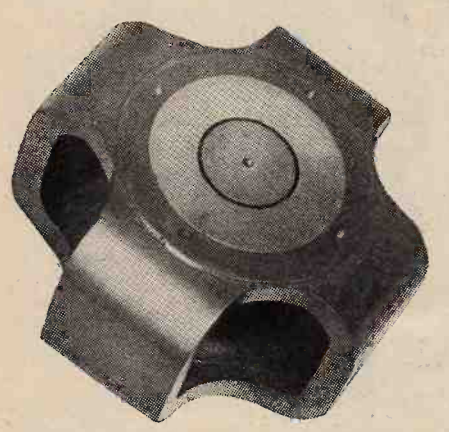
Among the portables, in general, however, there is nothing radically new except, perhaps, the more extensive use of screening. Any portable is now supplied as a mains-operated set, for the reason that there are at least half a dozen combined H.T. and L.T. eliminators, such as R.I., Regentone, Ekco, Junit, Atlas and Godwinex, which, being of the same overall dimensions as an H.T. battery, provide an easy conversion. All these units make use of the Westinghouse metal rectifier, and deliver charging current to the L.T. accumulator.

Under the heading of battery eliminators no novelty was to be found. Eliminators of modest output are mostly fitted with metal rectifiers, and the more generous models invariably use valves. This observation likewise applies to the eliminators in the sets, and where a generous power valve is fitted valve rectification is generally adopted, although there were exceptions. A.C. and D.C. mains units have, in certain cases, been developed by portable set manufacturers, as, for example, one of the sets of the Loud Speaker Company is arranged by means of an interchangeable unit to provide the complicated conversion from D.C. to A.C. mains operation.

NEW ACCESSORIES AND COMPONENTS

NOWADAYS the loud speaker must be regarded not only as an accessory but also as a component, for it is incorporated permanently in many receivers and radio gramophones.

One of the most important developments since last year's Show has been the marked increase in the number of moving-coil loud speakers with permanent field magnets. As

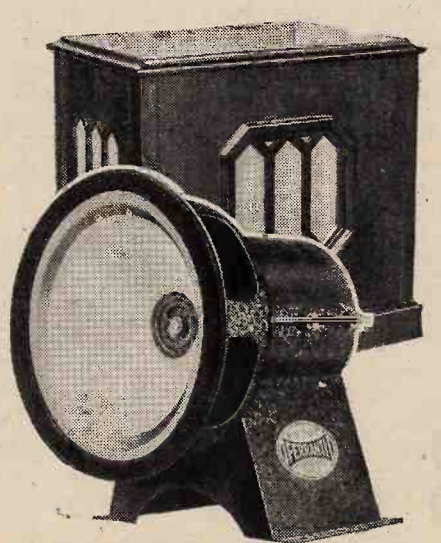


Swift, Levick permanent magnet with soft iron pole pieces. Flux densities of 8,000 lines per sq. cm. in a 1.5 mm. gap have been achieved with 9 per cent. cobalt alloy.

the result of combined efforts on the part of the Sheffield steel makers and designers of loud speakers, permanent magnets this year have been placed on the same footing as mains-energised electro-magnets so far as the flux density in the gap is concerned.

As evidence of the improvement achieved during the year, it is interesting to compare the magnets on the stand of Messrs. Swift, Levick and Sons, Ltd., with those exhibited by the same firm last year. By careful proportioning of the length and cross-section and by making use of soft-iron pole pieces, working flux densities of 6,000 to 8,500 lines per square centimetre are now obtained in a 1.5 mm. gap with 9 per cent. cobalt steel where only 3,500 to 6,500 was obtained before with 35 per cent. steel. In a 1 mm. gap, which is quite practicable with accurate centring, densities as high as 11,000 to 14,000 lines are possible.

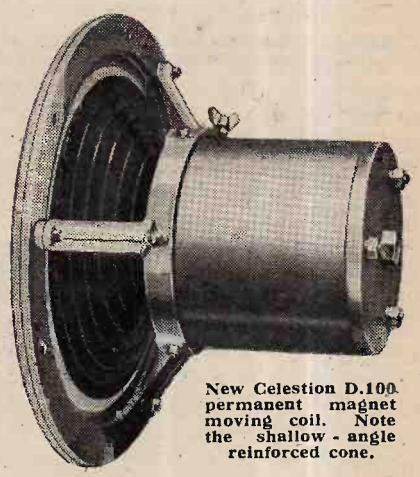
Incidentally, it is gratifying to find that all makers of repute now give only the useful working flux density. Hitherto it was customary to take readings by removing the fluxmeter search coil from the gap and dividing the total flux density indicated by the area of the gap. The leakage fringe outside the gap was thus included and gave a spuriously high reading. Now the movement of the search coil is limited to the normal travel of the speech current coil in the complete loud speaker, so that the designer gets credit for any of the leakage lines which he may succeed in persuading to remain in the gap. In the Ferranti "Magno Dynamic" loud speaker a $\frac{3}{8}$in. movement of the fluxmeter coil indicates a flux density of 8,300 lines per square centimetre. The active portion of the pot is a 35 per cent. cobalt steel cylinder, soft iron being



Ferranti "Magno Dynamic" loud speaker with permanent magnet field.

employed for the end plates and centre core. Experience has shown that a better flux density is obtained with this form of construction than with a centre core of cobalt steel cast integral with the outer shell. Specimens of the type of magnet finally adopted have been subjected to systematic maltreatment without producing any reduction in the flux density. Incidentally, a freer cone suspension has been adopted, and the bass resonance is now well below 50 cycles.

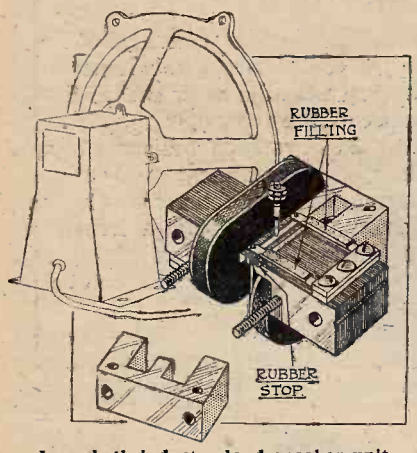
Another interesting unit is the new Celestion D.100 permanent magnet moving coil. The magnet consists



New Celestion D.100 permanent magnet moving coil. Note the shallow-angle reinforced cone.

of a 15 per cent. cobalt steel shell with mild steel end plates and centre core. The total flux is 120,000 lines, giving a working flux in the 0.05in. gap of over 8,000 lines. By making use of the well-known Celestion method of reinforcing it has been found possible to employ an unusually shallow angle for the cone without losing the requisite degree of stiffness for low note reproduction The advantage of a shallow angle is that focusing of the high frequencies along the axis is reduced. A system of tangential cords is used for centring the moving coil, and the cords are mounted on adjustable phosphor bronze springs which effectively prevent damage should the diaphragm exceed its normal travel under the influence of any shock

The Trend of Progress.—such as an atmospheric. The attachment of the magnet to the cone ring and spider has been so arranged that it is easily removable for cleaning the air gap without upsetting the adjustment.

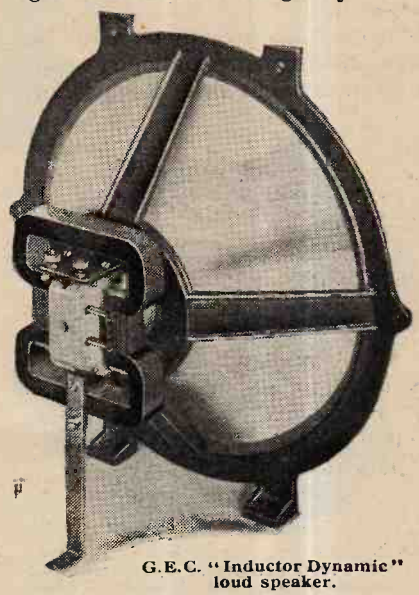


Lamplugh inductor loud speaker unit with die-cast end plate removed.

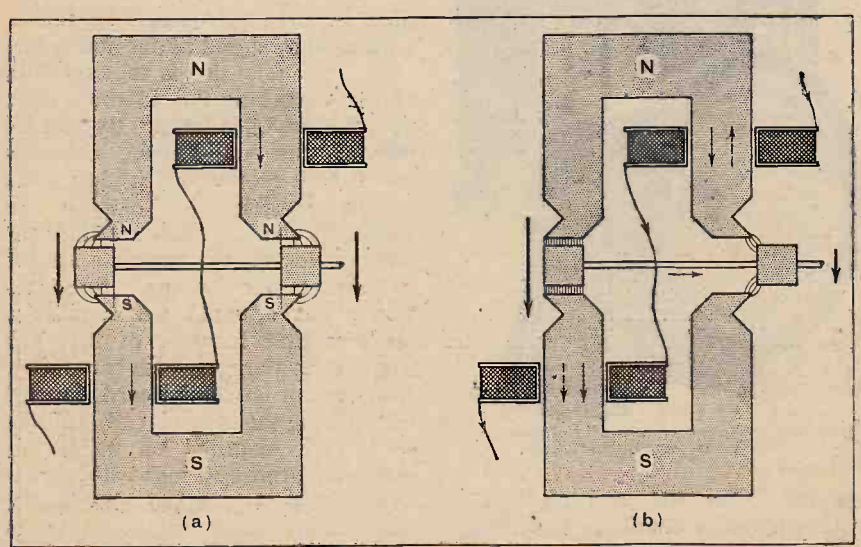
Among cone loud speaker movements of the moving-iron type undoubtedly the most important development is the introduction of the "inductor" principle of construction. For some years past the balanced armature principle has remained unchallenged, and although superior to the older single-acting reed it is not entirely free from amplitude distortion. If it were practicable to employ a wide gap between the pole pieces the balanced armature movement would produce, for all intents and purposes, a differential change of flux, but the necessity for achieving a reasonable degree of sensitivity precludes the use of too wide a gap. A small gap not only results in amplitude distortion but requires a fairly considerable restoring force to hold the armature in a central position and prevent it from sticking to the pole faces on either side. Consequently, the armature system resonates—generally at a frequency in the middle or upper middle register.

All these difficulties are overcome by the inductor principle of construction. In this the armature system moves in a plane parallel to the pole faces and cannot chatter, no matter how great the amplitude. For all normal displacements the *total* flux in the magnetic circuit remains constant; in other words, the movement is strictly differential. Further, the armature system is self-centring, and naturally takes up its normal position under the influence of the magnetic flux. Consequently, no mechanical restoring force is necessary, and the spring strips used to suspend the armature can be made extremely light (in practice about 0.008in. thickness). In this way the mechanical resonance can be reduced to about 60 cycles.

The principle of operation is best explained by reference to the accompanying diagram. The armature system is suspended in the air gap between two magnets by vertical flat spring strips and is free to move in a horizontal plane parallel to the pole pieces. The movement transmitted to the apex of the cone is therefore linear, and does not contain a lateral component as is the case with many balanced armature movements. The laminated pole pieces of the permanent magnets are specially shaped to reduce leakage flux, and two diagonally opposite poles out of the four are surrounded by speech current coils connected in series. The pole faces are the same width as the armature bars, which are so spaced apart that their inside edges coincide with imaginary lines between the centres of opposing pole faces. With no current flowing through the coils, the magnetic flux, seeking to follow the path of least reluctance, tends to pull the armatures inwards towards one another; but, being linked together, the armature system takes up a position of equilibrium as shown at (*a*). A current flowing through the speech coils in the direction indicated at (*b*) produces an additional flux shown by the dotted arrow, which increases the total flux (indicated by thick arrows) between the left-hand pair of poles and reduces the flux between those on the right. The inward pull on the left-hand bar is thereby increased, while that on the right-hand bar is decreased, with the result that the system moves to the right and would take up a new position of equilibrium for a steady current. A fluctuating current produces cor-



G.E.C. "Inductor Dynamic" loud speaker.



Illustrating the principle of the inductor loud speaker movement.

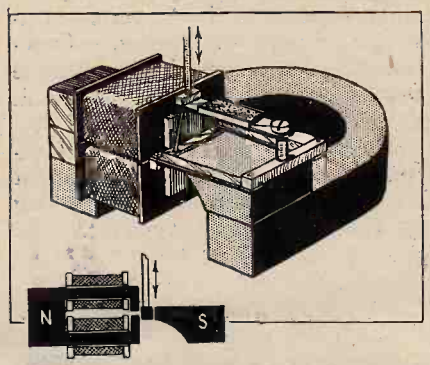
The Trend of Progress.—

responding fluctuations in the movement of the armature system. Provided the overall movement does not exceed the width of the pole pieces or armature bars, it is obvious that the total area of overlap is constant. Hence, assuming that leakage is negligible in relation to the flux in the gap, the total flux remains constant and the magnetic system is truly differential. It follows that sensitivity can be improved by reducing the air gap to the limit dictated by manufacturing difficulties without affecting the characteristic in any way.

Obviously a steady current in the loud speaker windings would permanently displace the armature system, and it is therefore necessary to use a transformer or filter feed circuit for coupling to the anode circuit of the output valve. Following a push-pull amplifier, however, the transformer may be dispensed with. A centre tapping between the two coils is provided, and the two components of the anode current cancel each other as far as the armature is concerned, but tend to increase the field of the permanent magnet system.

Inductor loud speakers seem to be more sensitive to changes in the impedance of the output valves with which they are associated than those of the balanced armature type, and care in the choice of a suitable valve is essential if the full benefits of the new principle are to be derived. Under favourable conditions, however, the results are remarkably good—particularly in the bass, where the amplitudes developed justify comparison with loud speakers of the moving-coil type.

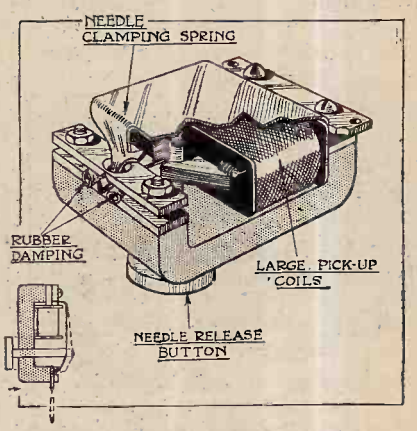
Two examples—the Lamplugh "Silver Ghost" and the G.E.C. "Inductor Dynamic"—are being manufactured in this country under the original Farrand patents. The Celestion D.50 also works on the inductor principle, though the method of construction is different. A single armature bar is situated between an arrangement of three pole pieces, and takes up a position of rest at the magnetic centre. The speech coils are mounted on adjacent pole pieces, and it is claimed



Inductor movement of the Celestion D.50 loud speaker.

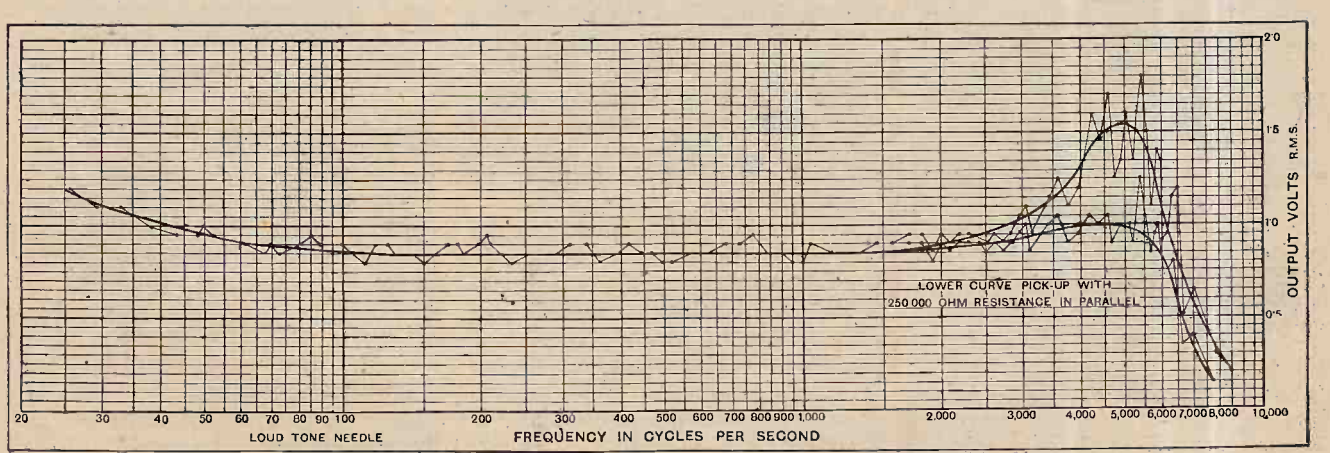
that this gives an improved magnetic circuit. The armature is coupled to the apex of the cone through a stirrup, and lateral motion is restricted by a thin locating strip.

Gramophone pick-up design has advanced along the lines indicated by theory. Many manufacturers have redesigned their units with a lighter armature and freer damping, with the result that their products have in many cases risen from mediocrity to distinction. It is gratifying to note that yet another firm now publishes a measured



Constructional details of the new Celestion pick-up.

characteristic showing the variation of voltage output with frequency. We refer to the new Celestion Model W.5 pick-up, the published characteristic of which is reproduced on this page. The new model should not be confused with the Woodroffe pick-up, as it is of entirely different design. The armature, which is equal in mass to the average steel needle, is formed from thin soft-iron sheet. The needle rests in a V groove, and is held in position by a strong phosphor-bronze spring. To remove the needle the spring tension is released by a press-button on the outside of the case. The damping rubber is so disposed that the armature rotates about the point



Frequency characteristic of the new Celestion pick-up.

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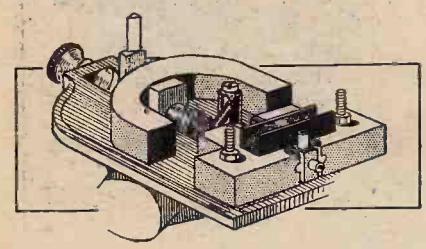
of contact between the retaining spring and the needle, so that friction at this point is negligible. The pick-up coils are unusually large, and the laminated poles are designed to reduce magnetic leakage. The air gap is wider than usual, and this has two important consequences.

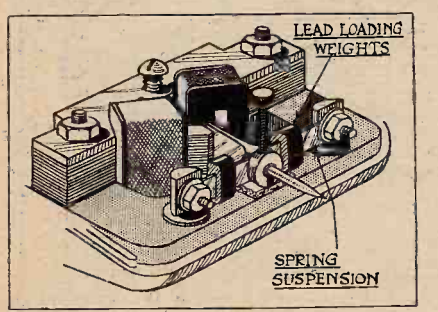
The first is of fundamental importance, and is likely to be the subject of much controversy among pick-up designers. It is well known that frequencies below 250 on the average record are restricted in amplitude and require correction, also that the usual method of achieving this is to introduce amplitude distortion by closing up the air gap. The Celestion designers refuse to do this for the following reason. Imagine part of an orchestral record in which two notes are being played simultaneously, one of, say, 50 cycles, and the other 3,000 cycles. The 50-cycle note having the greater amplitude will bring the armature near to the pole pieces at the limits of its travel; but the armature is also carrying at all positions the smaller vibrations of 3,000 cycles. The latter will, therefore, produce a greater E.M.F. in the pick-up coils during the peaks of the 50-cycle note, when the armature is near the pole pieces, than during the passage of the armature through the zero position. In other words, 50-cycle variations of *amplitude* are superimposed on the 3,000-cycle note. For this reason amplitude distortion at the lower frequencies has been avoided, and the characteristic does not show the customary steep rise below 250 cycles. In the view of the Celestion engineers any correction for low-note loss should be made elsewhere than in the pick-up itself.



Edison Bell "Volume Control" pick-up.

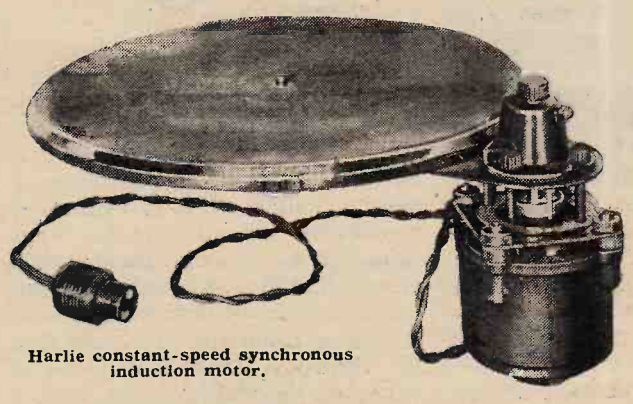
The second point concerns the impedance of the pick-up. A wide air gap cannot be used without sacrificing efficiency, and this must be made up by increasing the turns in the pick-up coils, resulting in a high-impedance winding. Now, high-impedance pick-ups are sensitive to loading, and the upper frequencies are easily lost unless tone-correction devices are intelligently applied. Further, volume-control potentiometers should have a total resistance of not less than 250,000 ohms.

The Edison Bell "Volume Control" pick-up is worthy of comment for the ingenious method of varying the general level of the output. The permanent magnet is not attached to the pole pieces, but slides in guides and its position is adjusted by a quick-thread screw. This has the effect of varying the steady flux between the pole pieces, and so reduces the voltage developed without materially affecting the form of the characteristic.



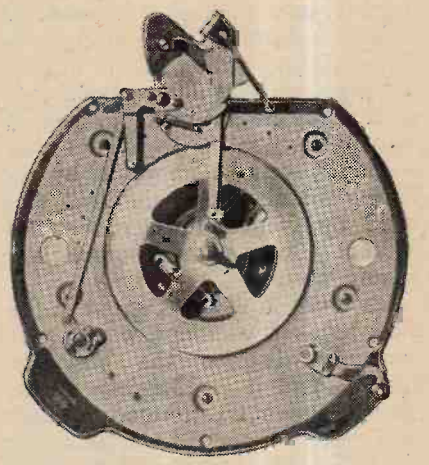
Brown No. 4 pick-up, which is free from rubber damping.

Another pick-up of interest is the new Brown No. 4, which is entirely free from rubber damping and should retain its characteristics indefinitely. The armature, which is of small dimensions, is mounted on a thin spring strip which permits longitudinal as well as lateral movement. It is claimed that this tends to reduce needle scratch. Parasitic vibration of the suspension strip is damped out by two small lead pellets attached to the spring between the armature and the supporting posts.



Harlie constant-speed synchronous induction motor.

The number of electric gramophone motors shows an increase, particularly in the inductor class. An interesting example is the Harlie constant-speed motor, which is of the synchronous type and does not require a governor. Variations in speed are effected by means of a variable V-pulley on the motor shaft, the drive being transmitted through an endless round rubber belt.



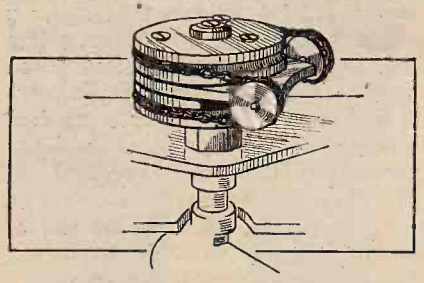
Garrard induction motor and fully automatic stop.

Interference from sparking at the commutator is overcome indirectly in the Henderson A.E.D. self-winding motor. The turntable is driven by clockwork, which is electrically wound in the intervals of playing.

The application of scientific principles to the design of gramophone motors is exemplified in the Garrard range of motors. A new type of governor has been fitted as a result of work with constant-frequency records. This has inverted weights and overcomes all the many distinct types of speed fluctuation known to the gramophone motor manufacturer. The new Garrard induction motor is

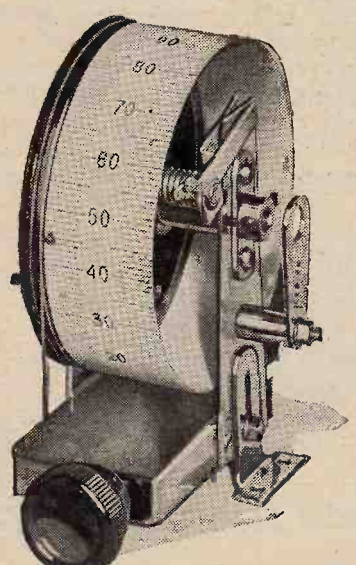
The Trend of Progress.—

a beautiful piece of mechanism, the rotor having a laminated iron ring and poles cased in aluminium. The stator windings have series-parallel connections for 100-130 volts or 200-250 volts at 40 to 60 cycles. Maximum speed is reached in three revolutions from the time of switching on. The power absorbed is 17.6 watts at 200 volts, and 23.6 watts at 230 volts, while the temperature rise of the frame is only 12.5° C. after three hours' working. In the universal motors unusual attention has been



Utility chain-drive induction gear.

given to the commutator design. A special locking ring is fitted which enables all the shellac to be squeezed out of the micanite separators under heat treatment, and loose segments are unknown. Special attention has been given to the bedding down of



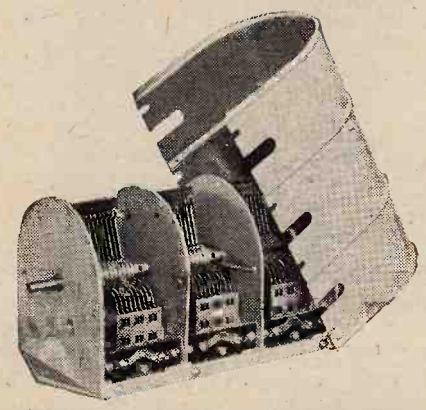
Cyldon drum dial with cord-drive slow motion device.

brushes, and a machine has been evolved for carrying out this operation. All armatures are dynamically balanced to eliminate vibration.

HAVE YOU VOTED?

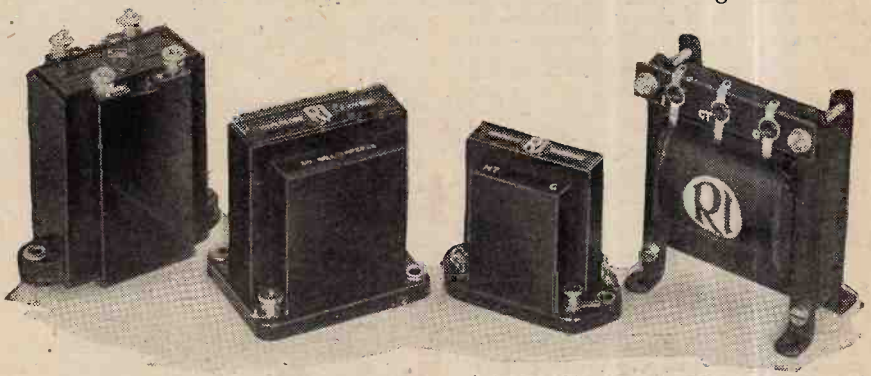
See page 373.

Among components, one of the most important developments is the production of a variety of triple-gang condenser units, complete with built-in trimming condensers. Modern H.F. amplification requires very complete screening, not only of coils but of individual groups of condenser vanes. Consequently we find that the majority of gang condenser units are housed in partitioned screening boxes. Notable examples



Polar "Tub" triple-gang condenser with built-in trimmers.

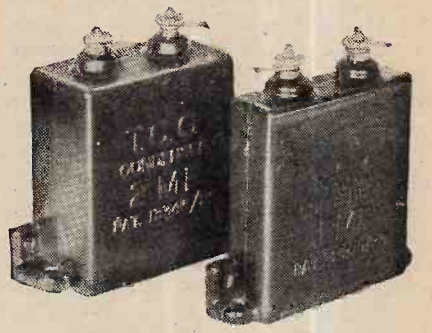
are to be found in the Formo ganged condenser, the J.B. "Chassimount" —which is extensible up to six sections—and the Polar "Tub" con-



A group of L.F. transformers and chokes with nickel-iron cores.

denser with cast aluminium frame. Slow-motion devices consisting of cord- and chain-drive mechanisms are new adaptations of an old principle which give smooth control without backlash in the Cyldon drum dial and the Utility drum dial. The latter has a 2:1 reduction ratio, which is useful in operating filter circuits.

Paper-dielectric fixed condensers of the non-inductive type have frequently been advocated in this journal for by-passing in screen-grid H.F. circuits. It is gratifying to



T.C.C. non-inductive condensers.

record that it is now unnecessary to look to foreign manufacturers for condensers of this type; a full range of capacities is now made in this country by T.C.C.

Intervalve transformers of the nickel-iron type were a feature of last year's show, and the "Permacore," "Ni-core," and "Hypermu," etc., are already well known. The useful properties of these special alloys have now been made use of in the construction of smoothing chokes and output chokes with great success. Not only does the nickel-iron core effect a considerable saving in the weight and dimensions of chokes for a given inductance and current-carrying capacity, but the reduction in the quantity of copper required for a given inductance results in a reduction of D.C. resistance, which is a factor of considerable importance in both anode and smoothing chokes.

THIS SEASON'S VALVES

THE valve manufacturers' objective this season is undoubtedly consistency of characteristic and improved performance rather than the addition of valves to the large number of types already existing. Progress in valve technique has outstripped the progress in application, and it is particularly interesting to see that the valve makers, especially the Marconi and Osram companies, are issuing catalogues with valuable hints on circuit design. We welcome the publication by these two companies of anode volts/anode current curves, without which it is almost impossible to make intelligent use of output valves. *The Wireless World* has consistently advocated this policy. It was shown in this journal just over a year ago that the anode-grid inter-electrode capacity of a screen-grid valve was almost its most important constant, but, with the exception of two firms, no information was available at that date. It is, therefore, pleasing to note that practically every valve manufacturer to-day includes this characteristic in his valve catalogue, and the calculation of maximum stage gain

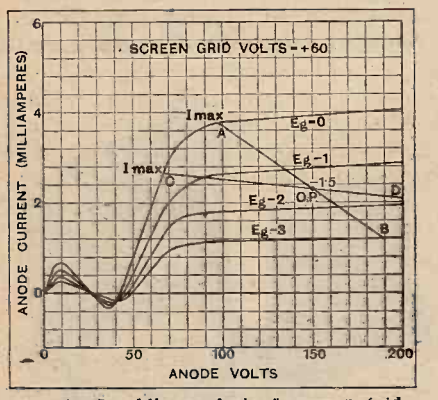


Fig. 1.—Load line analysis of a screen-grid valve at once shows why the input grid swing is reduced when efficient anode coils are used.

before instability sets in becomes possible.

It will be as well to examine typical valves now on the market for H.F. amplification, detection and power output—in that order.

This season's screen-grid valves not only have improved mutual conductances but all the A.C. and a number of the battery models have residual capacities of the same low order, namely, 0.001$\mu\mu$F to 0.004$\mu\mu$F. A point has now been reached when it can safely be said

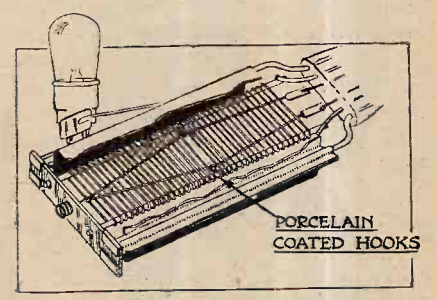
New Cossor 215 S.G.

An A.C. valve—the Cossor 41MHF.

that so long as external screening is carried out with the greatest care the valve's internal screening is likely to prove perfect enough to prevent self-oscillation with coils of the highest efficiency. Stage gains of 200 or more—of laboratory interest a year or two ago—now become commonplace. The Cossor 215S.G. and 220S.G., sectional drawings of one of which were shown in the stand to stand report, are interesting new valves. The electrodes are mica-locked at top and bottom, and the grid is in the form of a box. The dielectric properties of the material used in the base of the valve are particularly good and the losses are negligible.

Another battery S.G. valve of which mention should be made is one manufactured by the pioneers of valves with low interelectrode capacity, namely, the Mazda 215-S.G. It has two screening grids in cascade and a mutual conductance of 1.1 mA. per volt is maintained under working conditions. With regard to the indirectly heated type of screened valve, the new Mullard S4VA and S4VB are worthy of particular note. These valves are low-impedance counterparts of the S4V, in which the residual capacity has been lowered to what appears to be the irreducible minimum of about 0.0015$\mu\mu$F. A test in *The Wireless World* laboratories showed that a stage gain of 400 to 500 was possible with the S4VA. The S4VB has a nominal A.C. resistance of 250,000 ohms and can be used in cases where the A.C. resistance of the S4V is too high. The Marconi and Osram M.S.4 valve has a cross-meshed screening grid and a residual capacity of about 0.0025$\mu\mu$F. Last, but not least, we have an improved Mazda AC/SG. It will be remembered that this valve in its earlier form set the pace in efficient H.F. amplifier design.

Let us take stock of the conditions obtaining in a modern S.G. high-frequency amplifier. As with all other valves nothing of interest can be learnt from the conventional grid volts/anode current curves. Reference must be made to the less well-known anode volts/anode current curves now published, a typical example of which is given in Fig. 1. Every valve in a receiver has some impedance or load connected in its anode circuit which can be represented by a "load line" which traces the grid swing from zero grid



Showing the 5-point suspension of the filament in the non-microphonic Cossor 210 Det.

volts to a value of grid potential which is twice the bias voltage. At the same time, the "line" must show the actual anode voltage and current reached during the working cycle. This method of investigating the dynamic characteristic is also

The Trend of Progress.—

essential when calculating the amount of distortion and power output from a loud speaker of known impedance coupled to an output valve.

The load line, in the case of a screened valve is the dynamic resistance of the intervalve tuned circuit

Mullard high-voltage pentode—PM24A.

New A.C. screened valve—the Mullard S4VA.

at resonance. If a plug-in coil of, say, 40,000 ohms dynamic resistance were used, the load line would be represented by AB in Fig. 1. In this case the A.C. resistance of the valve is maintained at its normal figure of about 200,000 ohms both at the end of the cycle representing maximum current (I_{max}) and at the mean operating point (O.P.). If now we replace the plug-in coil with a highly efficient inductance of about 250,000 ohms dynamic resistance, the load line is given by CD where the valve's A.C. resistance is normal at O.P., but drops to the comparatively low figure of about 30,000 ohms at I_{max}. The importance of the A.C. resistance at I_{max} has already been pointed out in *Experimental Wireless*, and there is reason to believe that its low value in the circumstances mentioned provides at least a partial explanation of the inordinate lack of selectivity experienced when a "good" H.F. transformer of optimum ratio is used after a screen-grid valve. Another important point which emerges from load-line analysis is that the better the coil used the greater the inequality of the intercepts between equal grid voltage curves (see CD in Fig. 1). This means that as soon as we design the intervalve circuit to have the lowest possible losses we at once reduce the available grid swing before rectification and cross modulation begin. With the majority of S.G. valves on the market the safe input grid swing with a good anode coil is a small fraction of a volt.

In view of the foregoing, it would seem that progress in H.F. amplifier design will lie in the direction of using quite "poor" intervalve coils to give a good input grid swing, to increase the number of stages and gang them, and at all costs to provide a volume control in the aerial input circuit to prevent cross-modulation. Furthermore, because of the input limitations of the S.G. valve, selectivity should not be relied upon after the first valve, but be obtained by pre-selection, preferably with a band pass filter.

With regard to new special detector valves, mention should be made of the Marconi and Osram H.2. The electrodes are sturdily supported, rendering the valve non-microphonic, and the A.C. resistance of 35,000 ohms suggests efficient leaky grid detection. The Cossor 210 Det. is a new detector, the electrode construction of which is illustrated herewith. By virtue of the five-point filament suspension it is entirely

Osram super-power pentode PT. 625.

New Marconi detector — the H.2.

non-microphonic and the electrode disposition ensures a marked bend in the grid current curve. To *The Wireless World* readers the Mazda AC/HL and the Marconi and Osram MH4 and MHL4 will be particularly interesting, as they are recommended by their makers for power grid detection.

Indirectly heated valves have undergone great improvement. It is now possible to state with confidence that the bugbear of grid emission has vanished, and there is not any

Marconi LS6A valve.

A Marconi battery S.G. valve.

danger, at any rate, in the case of the Marconi and Osram valves of this series, in applying a difference of potential of 100 volts between emitter and heater. There are practically no new indirectly heated triodes, but last year's models all have higher mutual conductances.

To the large range of output valves have been added the remarkably efficient Mazda P.220A and the Marconi P.2—both 2-volt battery valves. The Marconi and Osram PX4 has been considerably improved, and there is a new Mullard output valve—the PM256A, capable of some 700 to 800 milliwatts undistorted output. For raw A.C. filament supply the Mullard AC064, AC104 and AC044, with 4-volt 1 amp. directly heated filaments, form a new series in the output class. An indirectly heated filament is unnecessary where there is no subsequent amplification, and an "automatic" grid bias circuit can be more completely decoupled where emitter and heater are not separate.

And what of the pentode? This valve, soon after it was introduced, came to be regarded as a means of

The Trend of Progress.—economising in L.F. stages at the expense of quality. In portable sets, where the exigencies of space demand a small consumption of anode current, its comparatively large output for a small battery wattage is a valuable feature.

The present exhibition reveals a great increase in the use of the pentode, not only because of its efficiency measured in terms of power output for a given input, but also because, in the light of a better knowledge of the valve's behaviour under working conditions, it can be shown that the quality of reproduction can be just as good as that of a triode. This is especially true with the larger pentodes for all-mains operation, which have lately found their way on to the market—such models as the Mullard PM.24A, PM.24B, Marconi and Osram PT.625, and the Mazda AC/PEN. These valves, when properly operated, have outputs between one and two watts—enough, with a moving-coil loud speaker, for a small hall, and more than enough for domestic purposes.

An indirectly-heated pentode—the Mazda AC/PEN.

Mazda 215 S.G. valve.

It has been brought to light during the last year that the average working impedance of the pentode is only a few thousand ohms; rather different from the makers' official figure of, say, 60,000 ohms! The load into which the pentode must work—that is, the speaker impedance—must not exceed 8,000 to 10,000 ohms. Unfortunately, directly a deviation from this condition is made the quality of music and speech rapidly becomes shrill, and high notes are over-pronounced. With a triode quite a large degree of mis-matching of speaker and valve will not give audible distortion.

It is because of this hitherto little understood property of the pentode that disappointing results have been sometimes obtained. If a moving-coil speaker with an impedance which remains constantly high over the frequency bend is used, the results leave nothing to be desired. On the other hand, if a reed-driven cone speaker is employed in which the impedance usually rises rapidly with frequency, and in which the load at, say, 256 cycles has been designed to match that of a triode of 2,000 ohms A.C. resistance, the use of a pentode without compensating devices is all wrong. In the circumstances, it is essential to include a resistance, or a resistance in series with a condenser, in the output circuit as developed by *The Wireless World* early this year, to limit the impedance of the load to some 10,000 ohms, and to use a tapped choke of high inductance or step-down output transformer to adjust the impedance relationship, otherwise low notes will be lost.

Provided consideration is given to these two points—and the added expense incurred by the necessary components is trifling—the power pentode will be found to give an exceedingly good account of itself, and certainly will give a greater number of milliwatts undistorted output per volt grid swing than any other valve. Owing to its sensitivity it must, of course, be used directly after the detector valve, without an intermediate L.F. amplifier and a volume control provided to prevent the peak grid swing exceeding the grid bias voltage. There is a brilliance of tone in pentode reproduction which is often in welcome contrast to the deep and "boomy" reproduction of very low impedance triodes so often used with ill-matched speakers. Brilliance of pentode reproduction may be purposely introduced to compensate for loss of sidebands in an H.F. amplifier.

Another point in favour of the pentode is that it lends itself well to the use of a tone control. Those who are designing sets with this type of output and who are none too sure of the load that their speaker imposes, should watch the needle of the milliammeter placed in the anode circuit. If with the correct bias and H.T. voltage a strong signal causes the needle to flick upwards, there is second harmonic distortion, and a higher load impedance is required. A flick downwards, which is the more likely to occur, suggests the presence of a third harmonic component, and the impedance of the load must be reduced as already outlined.

The popularity of all-mains sets has led to the marketing of a number of new mains rectifying valves. An interesting newcomer is the Marconi and Osram G.U.1. It differs from the vacuum type in that the bulb contains mercury vapour, which is ionised by the electrons emitted from a hot cathode, and thus the anode current is considerably increased.

By this means the impedance is reduced and the voltage regulation greatly improved. This half-wave rectifier will give ¼-amp. rectified current at nearly 1,000 volts, provided the H.T. is switched on about a minute after the filament. For such valves as the D.A.60 a heavy-duty rectifier of this type is invaluable.

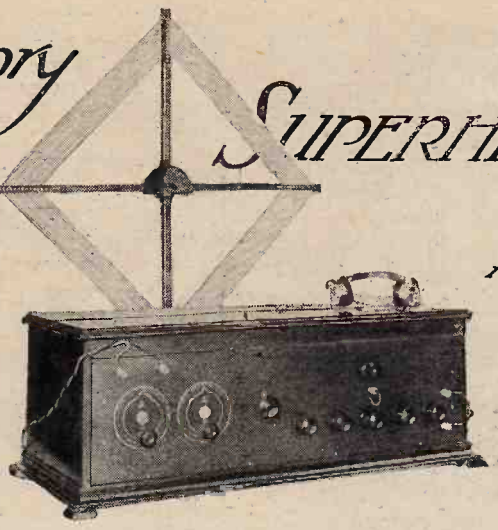
Mazda HL.210. An efficient detector.

New high-voltage mercury vapour rectifier—the Osram G.U.1.

The Marconi and Osram U10 has been added to the U5, U8, U9 range, and in the Mazda series we have a number of new full-wave rectifiers styled UU.120/250, UU2, and UU.30/250, which possess the advantage of having indirectly heated filaments, ensuring a good margin of overload capacity.

The Theory of the SUPERHETERODYNE

by A. L. M. SOWERBY, M.Sc.



The Basic Principles of a Highly Selective Receiver Explained.

THERE was once a time, now about five years since, when it was the ultimate ambition of every really keen wireless enthusiast to become the proud possessor of a "Superhet," which was regarded as the last word in luxury receivers.

The principle of this receiver was invented by the well-known American investigator Edwin H. Armstrong, but it must not on that account be confused with that other favourite of the early days of broadcasting, the "Armstrong Super." The latter has, as its unabbreviated title, "The Armstrong Super-regenerative Receiver," and generally used only one valve, whereas the one we are about to discuss was known, *in extenso*, as the "Armstrong Supersonic Heterodyne Receiver," and simply exuded valves from every pore. If a "superhet" contented itself with five or six valves one might with fair safety hazard the guess that some of them were doing double duty by being made to amplify at two frequencies simultaneously (reflex working); from seven to nine valves was the usual allowance, while the enthusiastic sometimes ran the total up to a round dozen.

The basic idea of the superheterodyne receiver is the exact opposite of that of every other kind of set. Normally, one tunes the high-frequency amplifier to fit the wavelength of the signals being received, readjusting all the tuning controls every time one passes from one station to another. With the superhet, the amplifier is set once and for all to one unchangeable wavelength, and the wavelength of the received signal is altered to suit the amplifier. Since one valve at least—and more usually two—must be provided for the sole purpose of effecting this wavelength change, the superhet must inevitably be a little extravagant in valves, although, with modern valves, six or seven would very comfortably provide long-range frame-aerial reception.

In the days when the superhet was highly popular, neither modern valves nor modern knowledge was available. As a result, amplification at high frequency was a very unsatisfactory business, for all attempts to obtain an appreciable stage gain on wavelengths below about 750 metres were thwarted by instability. On much longer wavelengths, from about 3,000 metres upwards, the difficulties were much less acute, and real amplification, approaching that which is usually obtained to-day on the broadcast wavelengths, was readily attainable. For receiving distant stations on a wavelength round about 300 metres there were only two possibilities: either one paid scrupulous attention to the aerial-earth system, and then used a plain det.-L.F. set with very critically adjusted reaction, or one used a superhet, changing the received signal from its original wavelength to a much longer one, which could be amplified effectively even with the imperfect apparatus of the time.

The steady improvement in valve characteristics and the appearance of the screen-grid valve, combined with the persistent attacks of innumerable investigators and experimenters upon the problems of high-frequency circuits, gradually made it possible to amplify signals at their original wavelength, so that the need for converting them into a long-wave signal became less imperative. The advantages of the superheterodyne receiver thus became of less and less importance, while its defects, which were many, became correspondingly more obvious. For the last three years or more the superhet has taken a very back seat, for the excellent reason that almost equivalent sensitivity, with a much higher standard of quality in reproduction, could be attained with the expenditure of fewer valves by using straight high-frequency amplification of the signals on their original wavelength.

The reference just made to the defects of the superhet must not be taken to mean that these faults are in any way bound up with the principle of the receiver. The truth of the matter is that while straight high-frequency

WHY has the Superheterodyne receiver taken a back seat during the last three or four years? It is because stable high-frequency amplification at the fundamental frequency of the transmission can now be accomplished with certainty using the minimum of valves and associated apparatus. The demands for selectivity, however, which become more and more exacting suggest that the superheterodyne with band pass filters and other modern embellishments may become popular again.

The Theory of the Superheterodyne.—

amplification advanced by leaps and bounds, the design of the superhet, owing to its waning popularity, received practically no attention at all. In the light of experience gained in other directions, it should now be possible to design a superhet which would be free from all the defects commonly attributed to receivers of its type.

Where the Superhet Principle Scores.

While the writer does not anticipate that the present type of receiver will need to be superseded for short-range work, he is inclined to think that for long-distance reception the superhet, in some form or other, will eventually return to its old position of dominance, though for quite new reasons. If this is so, it will be the demand for high quality, that is becoming almost daily more insistent, that will bring the superhet back into favour, for high quality, combined with high selectivity, can only be attained by the very free use of band-pass filters in a multi-stage amplifier. While it is comparatively easy to design and build such an amplifier for a superhet, where it has only to deal with a single wavelength, it has proved difficult to produce a compromise that will be really satisfactory when tuned over a wide range of wavelengths in a receiver of normal type. Moreover, difficulties of tuning limit the complexity permissible in a straight amplifier, whereas in a superhet, in which the amplifier is tuned once and for all when the set is built, even the most elaborately complex circuits can make no difference whatever to the ease of handling the completed receiver.

It has already been said that the difference between the superhet and all other receivers is that instead of adjusting the amplifier to suit the wavelength, the wavelength of the received signal is adjusted to suit the amplifier. This result is achieved by a feat of electrical jugglery carried out within the receiver itself, and since a very similar wavelength change is performed in a

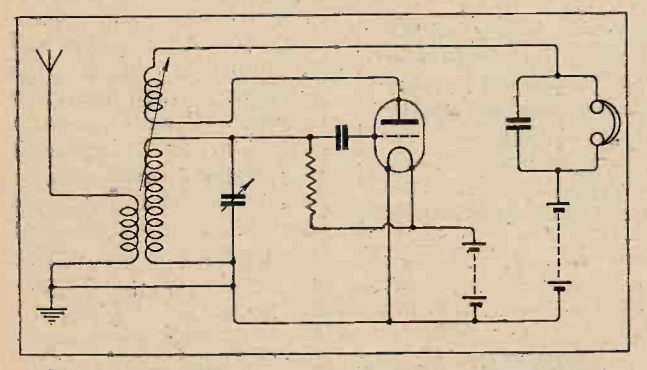


Fig. 1.—Single-valve receiver. This simple set will perform the frequency-changing operation which is the whole foundation of the superheterodyne receiver.

simple one-valve set whenever it is allowed to oscillate, we will take this as a starting point in following out the changes that occur.

If some such circuit as that of Fig. 1, which represents a leaky-grid detector with reaction, is allowed to oscillate, there will be heard in the telephones certain noises with which almost every reader is familiar. When the tuning is such that no station is being received, nothing but a slight hiss is heard, but as the tuning condenser is varied one hears a succession of whistles, beginning as very high notes, sinking down to below audibility, and then rising in pitch once more until the note be-

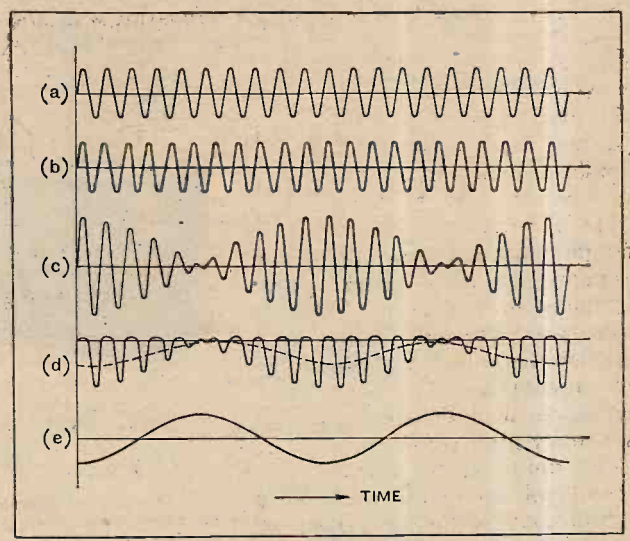


Fig. 2.—Diagram to illustrate the production of a heterodyne beat note, a and b represent separately the oscillations generated by the valve and the oscillations picked up from a transmitter and c is the sum of a and b; it represents the resulting voltage applied to the grid of the valve while d represents the anode current of the valve, assuming it to be a nearly perfect grid rectifier. The resultant anode current is represented by e, ignoring fluctuations too rapid for telephones to follow. The curve thus shows the frequency of the beat note.

comes too high for the telephones to reproduce or the ear to hear. Each of these whistles, as everyone knows, stands for a station—one speaks, conveniently but quite erroneously, of "hearing the carrier waves," meaning that the whistles just described have been heard.

An Explanation of the Whistles.

The manner in which these whistles arise is indicated roughly in Fig. 2, in which is shown five sets of waves. The upper set, marked *a*, is intended to represent the waves generated by the oscillating valve in the receiver itself at some particular setting of the tuning dial; there are twenty complete oscillations shown in the diagram. The next row, labelled *b*, stands for the oscillations picked up by the aerial from some transmitting station; there are twenty-two of these on the diagram. Since the two rows have been so drawn as to have exactly the same length, we are expected to understand that the distant transmitter sends out twenty-two complete waves in the time represented by the width of the diagram, while the oscillating receiver generates twenty waves during the same period.

The two sets of waves are arriving simultaneously at the grid of the detector valve shown in Fig. 1, so that at any instant the high-frequency voltage applied to this valve will be the sum of the voltages from the two sources. This sum is shown in the third row of waves, lettered *c* in Fig. 2. It will be noticed that a new periodicity has made its appearance through the addition of the two sets of waves; the high-frequency voltage

The Theory of the Superheterodyne.—alternately dies away and then rises again to a maximum as the two original waves come in and out of step with one another.

If the valve were adjusted to act as an amplifier, the plate current would vary in exact sympathy with the voltage impressed on the grid, so that *c* may also be taken to show the variations in plate current that would take place in these circumstances. It would vary rapidly at high frequency on either side of the mean value represented by the straight line, and, since the telephones could not possibly follow this variation, no sound would be heard.

We started, however, with the assumption that the valve was arranged to act as a leaky-grid rectifier. If this is the case, the anode current will no longer be a faithful copy of the voltage applied to the grid, but will follow some such course as that indicated at *d*, one-half of each high-frequency alteration being suppressed. The excursions made by the plate current will now all be on the same side of the steady value represented by the straight line, so that the *mean* plate current will vary at a rate much slower than that of the high-frequency oscillations. The dotted line drawn through the high-frequency waves shows this slower variation, which is repeated, with the high-frequency fluctuations omitted, in the curve marked *e*. This curve has a new frequency, entirely different from those of the original pair of high-frequency oscillations which gave rise to it. A moment's examination of the figure will show that in the time in which the high-frequency oscillations *a* and *b* go respectively through twenty and twenty-two cycles, the final resultant rectified plate current goes through two cycles—the difference between the two original frequencies.

It will be appreciated that if the two original high frequencies differ by only a comparatively small amount, the resultant oscillation *e*, which is commonly called the *beat note*, will lie within the audible range. The received signal, for example, might have a frequency of 1,000 kc., while the detector valve generated oscillations might have a frequency of 999 or 1,001 kc.; in either case the beat note would have a frequency of 1 kc. (or 1,000 cycles) and would be audible in the telephones as a musical note of this frequency, which is nearly two octaves above Middle C. It is this beat note which is heard when the oscillating receiver is tuned through the wavelength of a transmitter.

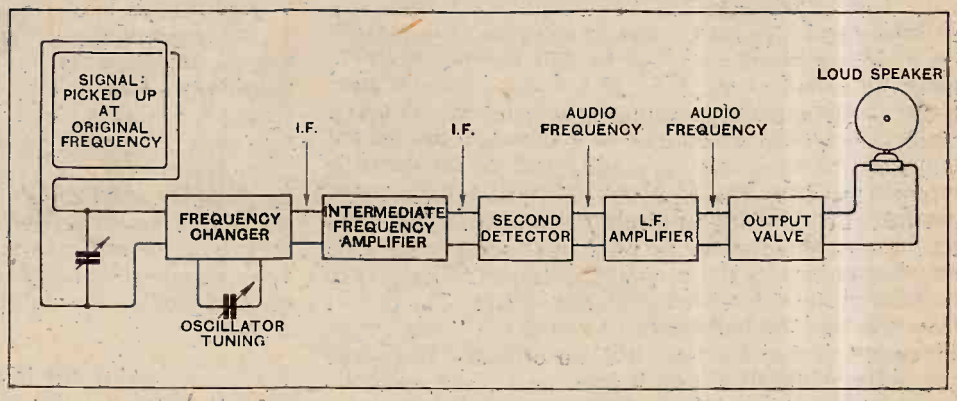


Fig. 4.—Schematic diagram of a fully fledged superheterodyne receiver. The various stages through which the signal passes from frame to loud-speaker are here separately shown. It will be noticed that there are only two tuning controls, for once the frequency has been correctly changed the rest of the process of amplification needs no tuning.

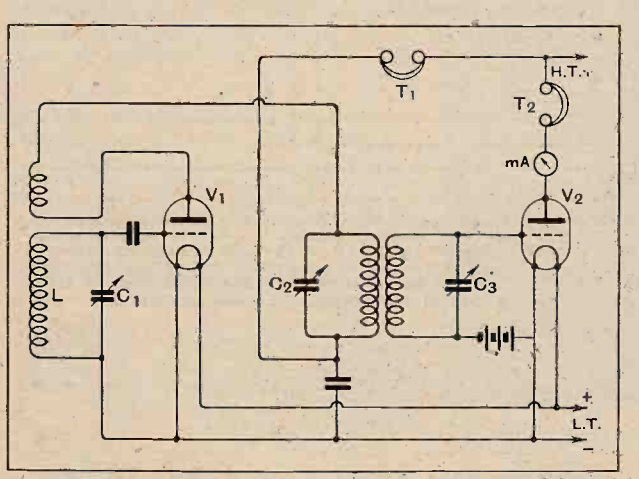


Fig. 3.—The simplest "superhet." The oscillating detector V_1 acts as frequency-changer, and the detector V_2 acts as receiver of the signals on the new frequency.

Changing the Beat Note.

As the frequency at which the receiver is oscillating is changed by altering the setting of the tuning condenser, the beat note between signal and receiver is changed too, the note of the whistle heard rising as the difference between the two frequencies is made greater. It is usual, and very natural, to regard the beat note as non-existent when it has risen to so high a frequency that the ear cannot hear it nor the telephone diaphragms respond quickly enough to reproduce it. But it is still there, although too high in pitch to be audible, and it is quite easy to show its existence by electrical means—for example, by coupling the anode circuit of the valve to a detector tuned to the frequency of the beat note.

A circuit of this kind, which is almost identical with one that the writer has used in connection with laboratory measurements, is shown in Fig. 3. In this, both valves are set for rectification, the first valve being made to oscillate. When the setting of the condenser C_1 has detuned the oscillating circuit so far from the frequency of the signal that it is no longer possible to hear a beat note in the telephones T_1, it is still possible, by tuning C_2 and C_3 to a suitable long wavelength, to pass the supersonic beat note on to the second valve, its presence being made visible by the

The Theory of the Superheterodyne.—

deflection of the meter mA. If the source of the signals with which the oscillations of V_1 are beating is simply a local oscillator, there is nothing to be heard in the second pair of telephones T_2. But if the coil L is replaced by a frame aerial, and the local station is used as the incoming signal in place of a simple oscillating valve, then, when the meter mA. shows that the supersonic heterodyne note has been tuned in by suitable adjustment of C_2 and C_3, the programme is quite well heard in the telephones T_2, though the first pair T_1 make no sound at all.

The experiment shows that if one of the two original waves from which the beat note is compounded is modulated by speech or music, then this modulation is reproduced on the new wave formed by rectifying the mixed oscillations as already described. It follows that a second detector, as used in this experiment, is required to extract the programme from the long-wave beat-frequency delivered by the first valve. The output from this valve, hereafter to be called the "frequency-changer," is thus identical with an ordinary long-wave transmission as picked up by an aerial, and must be treated as such in all respects. It can therefore be heard with any receiver, from a simple crystal detector to the most ambitious multi-valve set, so long as this is tuned to the required long wavelength.

The whole box of tricks, consisting of a frequency-changer followed by a long-wave receiver, makes up the supersonic heterodyne receiver we are discussing. Usually, the long-wave set that follows the frequency-changer is much more ambitious than a mere crystal detector; it consists usually of a long-wave amplifier, known as the intermediate-frequency amplifier, a detector (second detector), and a low-frequency amplifier. The whole is shown, in schematic form, in Fig. 4, which represents a complete "superhet."

The Intermediate Frequency Amplifier.

The signals are picked up on the frame and passed on to the frequency-changer, which consists, as we have seen, of an oscillating detector valve or its equivalent. They emerge from this transformed to a new wavelength, and are amplified in this form by the intermediate-frequency amplifier to any extent that is deemed necessary. They then encounter the second detector, after which they are magnified by an audio-frequency amplifier of perfectly standard type until they can be passed on to the output valve and the loud speaker. There is no particular reason why the frequency-changer should not be preceded by a stage or two of ordinary high-frequency amplification if desired; with the magnification split up in this way between two different frequencies it would be possible to attain an overall magnification of several million times without risk of instability. This extra amplification is, however, not usually necessary.

The tuning of the intermediate-frequency amplifier in a practical receiver is not variable, as in the experimental circuit of Fig. 3, but is fixed permanently at some wavelength chosen by the designer of the set. Tuning is accomplished by so adjusting the frequency of the oscillations generated in the frequency-changer that the frequency difference between them and the signal to be received is equal to the frequency for which the intermediate amplifier is designed.

In addition to the local oscillator, it is necessary to have a detector valve to rectify the composite wave (*c* in Fig. 2) so that the new frequency (*d* and *e* in Fig. 2) can be extracted from it. If an attempt were made to utilise the simple circuit of Fig. 1, it would be found that when the grid circuit was tuned to the correct frequency for the local oscillation it would be detuned far enough from the signal being received to cause a very serious drop in strength.[1] It is therefore necessary to provide two tuned circuits in place of the one of Fig. 1; tuning one to the signal and setting the other into oscillation at the frequency needed to provide the correct beat note. Sometimes the two circuits, tuned to different frequencies, are attached to the same valve, but it is preferable, unless it is specially necessary to economise in valves, to separate these two functions, using one valve as a detector and one as an oscillator. An arrangement of this kind, which is a typical frequency-changer, is shown in Fig. 5.

Choosing the Intermediate Frequency.

In designing a superhet one is at liberty to choose any value one likes for the intermediate frequency; it has been usual to work at about 100 kilocycles (3,000 metres) or thereabouts. Assuming this value, it becomes neces-

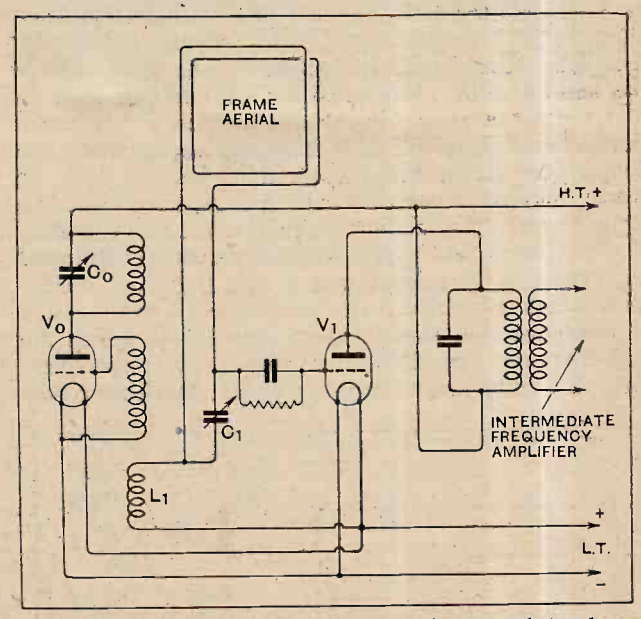


Fig. 5.—The frequency-changer of an American superheterodyne of good repute (the Haynes-Griffin). V_1 is the first detector, and V_0 the oscillator. C_1 and C_0 are the only two tuning controls, yet the set, which employed seven valves, was highly selective. The coupling coil L_1 was used to apply the oscillations of V_0 to the grid of V_1, through the frame circuit.

sary to tune the oscillator to a frequency removed by 100 kc. from that of the signal being received, in order that the beat note may have the correct frequency. It is quite immaterial whether the oscillator is working at

[1] When short waves are being received the percentage distuning is so small, especially if a low I.F. is used, that a single tuned circuit is perfectly satisfactory. See H. B. Dent, "Superheterodyne Short-wave Adaptor," *The Wireless World*, April 23rd, 1930.

The Theory of the Superheterodyne.—

a higher or lower frequency than that of the signal. If the station to be received is working on 1,000 kc. (300 metres), then the required beat will be produced if the oscillator is tuned either to 900 or to 1,100 kc. (333 or 270 metres). Since both these frequencies will be within its tuning range, there will be two separate settings of the oscillator tuning condenser, either of which will bring in the 1,000 kc. station required. In the same way, there will be two alternative positions for every station.

This two-position effect has certain disadvantages, the most obvious being that one cannot be sure, from the reading of the oscillator tuning dial, what station is being received. A more serious drawback is found in the fact that when the oscillator is tuned to, say, 900 kc., it will provide the 100 kc. beat note required for the intermediate-frequency amplifier by interaction with either a signal of frequency 1,000 kc. or with one of frequency 800 kc. There is thus a strong tendency on the part of the receiver to tune in two stations at once, so that means have to be taken to sharpen up the tuning of the frame-aerial circuit to enable signals from one of these stations to reach the grid of the first detector to the complete exclusion of the other. Failure in this respect means that both stations will be heard together. For this reason, and not for the sake of extra amplification, which is more readily available in the intermediate-frequency amplifier, it has often been found desirable to precede the frequency-changer with a stage of tuned high-frequency amplification operating on the original wavelength of the signal.

There are many points of considerable interest and importance in connection with the design of the frequency-changer and of the long-wave receiver which follows it, while the question of the best choice of frequency for the intermediate amplifier opens up a number of rather fascinating possibilities. It is hoped to deal with some of the more outstanding points in later articles, to which the present contribution may be regarded as an introduction.

International Amateur Congress.

The International Amateur Congress held last July in Antwerp was attended by delegates from almost every European country. Mr. H. B. Old, G2VQ, represented the R.S.G.B. It was agreed that the authorities in their respective countries should be urgently requested to allow official delegates from among amateur transmitters to take part in future international radio conferences and that these amateurs should form a consultative committee under the presidency of Mr. K. B. Warner, the secretary of the I.A.R.U.

It was also proposed that further international amateur meetings should be held in 1931 at Rome or Milan; 1932 in Madrid; 1933 in London, and 1934 in Berlin.

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Exclusive Amateur Wavebands.

The delegates also agreed that urgent requests should be made to the authorities that commercial stations should be forbidden to conduct tests on wavebands reserved exclusively for amateur use and that the 3.5 megacycle (85 metre) band should be included among those for amateurs only.

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Calibration Stations.

The services of G5BR and G5YK in the transmission of calibrated wavelengths were cordially recognised, and it was proposed to establish similar stations in Berlin, Paris, and Budapest.

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7 and 14 Megacycle Wavebands.

With regard to the conditions on the 7 mC. waveband, a correspondent in Blackheath finds that the skip-distance after dark is usually between 250 and 400 miles, and that European stations outside this zone can be readily heard. He has also picked up W1FIX, AP7AX (Ramleh, Palestine), and SU8WY (Cairo). The 14 mC. band varies considerably; on some nights it seems absolutely dead, while on others distant stations are heard from North and South America.

TRANSMITTERS' NOTES.

7 Megacycle Vagaries.

A correspondent in Eltham, sending us his experiences while listening for telephony on the 7 mC. waveband, writes that during the last two months the only time he has been able to receive British stations with any strength was between 09.00 and 12.00 B.S.T.; after this they became weaker, and, during the afternoon, he could only hear neighbouring stations in London. From 20.00 till 22.00 B.S.T. stations in Devon, Scotland, and on the Continent, would come in at about R9 signal strength, but fading was very bad, and after 23.00 B.S.T. he found it impossible to hear any telephony.

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New Call-signs.

G2QW F. H. Walters, 5, Whitehorse St., London, E.1.

G2WS W. A. Scarr, 282, Stainbeck Rd., Chapel Allerton, Leeds.

G5GL Alfred Graham & Co., Ltd., Slough.

G5ZC F. J. Clark, 28, Byegrove Rd., Colliers Wood, S.W.19. (Change of address.)

G6NU W. E. Nutton, 42, Richmond Rd., Gillingham, Kent.

G6NG N. E. Haigh, Tanglewood, Newton Hill, Wakefield. (Change of address.)

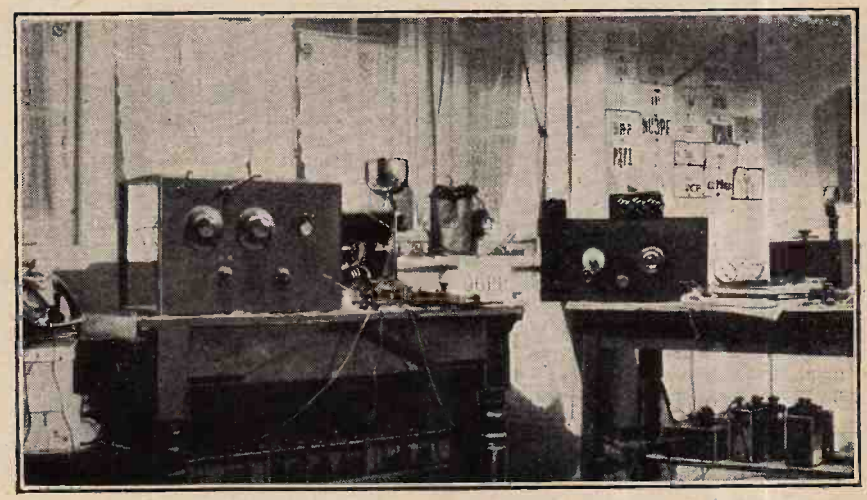
G6VP A. Smith, 12, Ferres Avenue, West Drayton, Middx. (Change of address.)

GI6YW T. P. Allen, 62, Balmoral Avenue, Belfast. (Change of address.)

2AZP L. Sanderson, 104, Croxted Rd., West Dulwich, S.E.21. (Change of address.)

Sudan.

ST6HL and **ST3WT** (Portable) (Ex SU6HL), I. E. Hill, Wireless Section, 4th (B) Squadron, R.A.F., Khartoum, working on 14 and 28 mC. wavebands between ground and aircraft, and will welcome reports.



AN ACTIVE AMATEUR STATION. G 6PP, owned and worked at 54, Purley Avenue, N.W.2, by Mr. M. W. Pilpel, who was last year awarded the "Rotab" Cup, presented by the President of the R.S.G.B., which may be seen in the background. The 7mC. transmitter on the left uses the Hartley circuit with harmonic crystal control. Next to it is a small 14mC. T-P T-G transmitter with the O-V-2 receiver, employing the Reinartz circuit, on the right. The station has been in communication with 38 countries distributed over four continents. The input has never exceeded 5 watts.

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.

A Differential Volume Control.

My receiving set is situated in a rather remote part of the house, its position being determined by the necessity of having it as close as possible to the aerial lead-in, consequently my loud speaker is situated at some distance from the set. I usually listen to the local station, and have arranged my receiver so that the output valve is working well within the limits of its maximum permissible grid swing, even on loud passages of music. I have a variable resistance connected across the terminals of my loud speaker for reducing volume when necessary. When I do reduce volume in this manner, however, I notice a distinct loss of quality, and it has occurred to me that this is due to the fact that when I apply the volume control I am altering the impedance in the plate circuit of the last valve. Is there any way of getting over this trouble, as it is obviously inconvenient to run to the distant receiver every time that I wish to diminish volume? T. P.

If, as we assume, you have arranged matters so that the relationship between your loud speaker impedance and the A.C. resistance of the output valve is correct in accordance with the details given in an article in the May 28th issue of this journal, it is obvious that the method of volume control which you are using will alter that relationship, and quality will suffer accordingly. The difficulty can, however, be overcome in quite a simple manner. It must be remembered that for best results the external circuit impedance must be of such a value that maximum energy transference from the output valve takes place at a frequency somewhere near middle C. The external circuit impedance in your case will not be made up by the loud speaker impedance alone, as the paralleled volume control resistance will exert a modifying effect. As this latter resistance is lowered in value in order to bring about a decrease in volume, the effective external circuit impedance will also be lowered. It is necessary, therefore, to arrange another resistance in such a manner that it compensates for this effect and so preserves the impedance in the external circuit at a more or less constant value. There are several ways of accomplishing this desirable end, but experiment has shown that the method of connection shown in Fig. 1 gives the best results. It will be noticed that the volume control resistance is connected across the loud speaker in a manner similar to that of a potentiometer, the slider connecting to one output lead while the compensating resistance is in series with the other lead. Fortunately, special resistances of this type suitably mounted and of the correct value are now on the market. This method of volume control is by no means perfect, but results from it are greatly superior to those obtained by many of the usual arrangements.

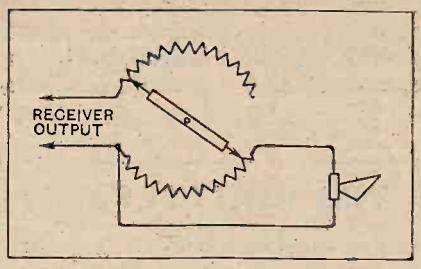


Fig. 1.—A "constant impedance" method of controlling volume.

Coil Inductance.

I have several well-made single-layer solenoid coils (taken from an obsolete receiver), each with 60 turns of No. 26 D.S.C. wire and a diameter of 2½in. Will you please tell me what is the approximate inductance value of these coils? If suitable, it is proposed to use them for a filter circuit. Incidentally, will you refer me to any published instructions for calculating the inductance of coils of this kind so that I may be able to estimate values myself in the future.

M. N. L.

You do not say what is the winding length of your coils; without this information it is impossible to make an accurate estimation of their inductance. However, assuming that adjacent turns are touching, it will be about 180 microhenrys—a low value for use in a filter circuit, but the coils should do fairly well.

Inductance is easily and accurately calculated with the help of the Abac which appeared in *The Wireless World* for November 21st, 1928. These Abacs have since been published in book form.

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Resistance and Impedance.

I have been told that the figures for D.C. resistance usually given for loud speakers are approximately proportional to the impedance of the loud speaker, and can, therefore, be taken as a rough guide to this latter value. Can you confirm this?

R. P. D.

This statement is likely to be misleading, with the exception that loud speakers of what is sometimes known as the high resistance class, merely those having a D.C. resistance of about 2,000 ohms have a much larger impedance than those of the low resistance or 120-ohms class. It is, however, possible to select a number of loud speakers all having approximately the same D.C. resistance which have a widely different impedance value at any given frequency. This fact will be very patent if a study is made of the tables of D.C. resistance and of impedances at various frequencies which were published in our February 5th and 12th, 1930, issues.

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Headphones and D.C. Mains.

Occasionally I like to use phones instead of a loud speaker, but, since converting my set for D.C. mains operation, I have been afraid to connect them to it. I realise that an output transformer or a choke filter with a pair of condensers would meet the case, but there is not much space to spare in the receiver; is there not some other way whereby the phones may be isolated from the mains, which, by the way, are positively earthed?

P. M. S.

It is impossible to connect headphones to your set in such a way that they will be isolated from the mains, unless some auxiliary apparatus be used; this is, of course, on the assumption that the receiver does not already include an output transformer or choke filter.

We suggest that the simplest way of using the phones with safety is to join them, with a fixed condenser of from 1 to 2 mfds. in each lead, across the primary winding of the L.F. intervalve transformer. If your receiver does not include one, very fair results can be obtained by similarly connecting the phones across a coupling resistance, particularly if the resistance has not too high a value. It will hardly be necessary to add that the phones should be disconnected when the loud speaker is used.

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."*

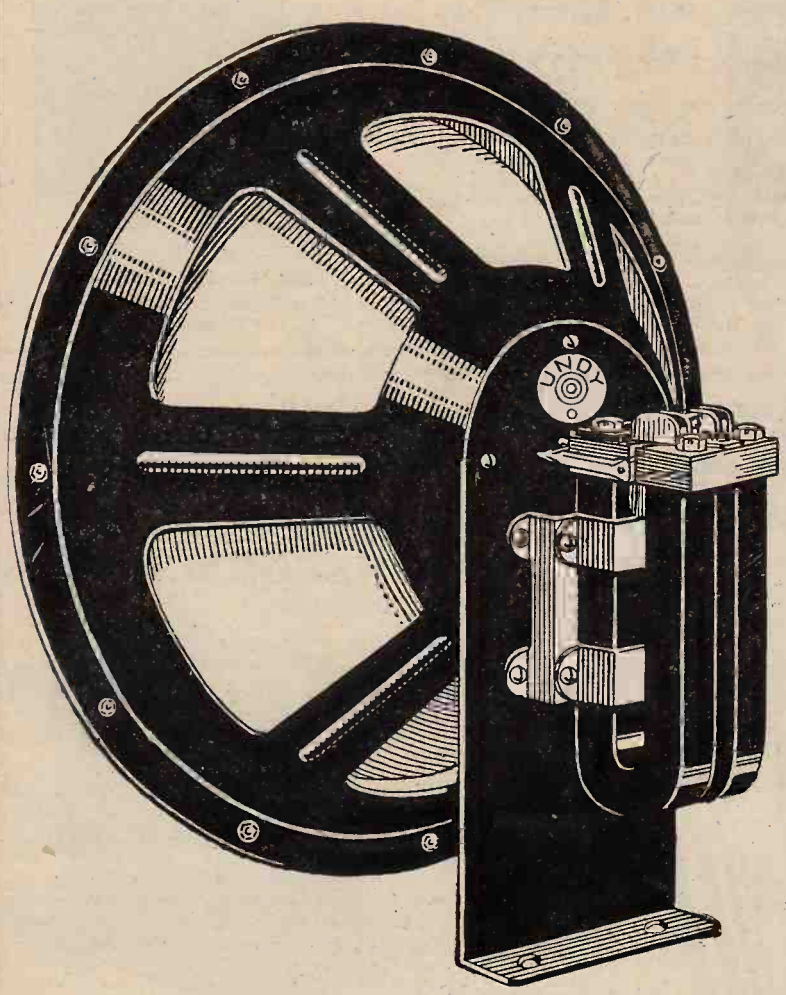
(3.) *Queries must be written on one side of the paper and diagrams drawn on a separate sheet. A self-addressed stamped envelope must be enclosed for postal reply.*

(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.*



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8-Pole Dynamic

THE GREAT SURPRISE *for* THE NEW SEASON.

A Chassis with **8-poles** better than you have as yet seen and heard.

A Chassis which surpasses everything known.

A tone rendering such as you have not yet heard.

Visit your dealer to-day and ask him to show you this marvel.

No harassing "tuning-in" and absolutely true to nature in every tone register.

If you wish to purchase an 8-pole Chassis, there is only

UNDY 8-POLE Dynamic.

A patent has been applied for in all civilised countries to cover the **UNDY** *new 8-pole principle (Patent application No. 11360/30).*

RETAIL PRICES:

Chassis with Unit, 50/-

Cabinet No. 404, the finest Luxury Model - **90/-**
Cabinet No. 404a, Mahogany highly polished **70/-**
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RECEIVERS FOR SALE.

SCOTT SESSIONS and Co., Great Britain : 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

BURNDEPT Latest Screened Four Receiver (S.G. valve, det., L.F., and super power), perfect condition, terminals for gramophone pick-up, 40 stations at full loud-speaker strength; will demonstrate willingly at Muswell Hill; accept £15.—Box 7569, c/o *The Wireless World.* [1554

Receivers for Sale.—Contd.

Receivers for Sale.—Contd.

READ and MORRIS, Ltd., the mains pioneers, who in 1925 equipped the hospital with mains sets, still supreme in all-mains receivers and nnits.

LOW Tension A.C. Eliminators, permanently replacing batteries, now only £5/15; electrolyte condensers, 2,000 m.f., as used in above, 13/-; including postage.

CONSULT Us Before Buying Elsewhere.—Read and Morris, Ltd., 31, Eastcastle St. (facing back of Warings), Oxford St., W. [1450

OSRAM Music Magnet Four, wired, wonderful set for distance, selectivity, volume; cost £11/15, accept £8/10; reason tram interference.—Gorton, 193, Bolton Rd., Walkden. [1581

MARCONI 5-valve 2 S.G. Three 60 volt H.T., two L.T. accumulators, Trickle charger, Aeolian mahogany gramophone fitted Webson M.C. speaker; offers.—Lotimer, Thickwood, Elmstead Lane, Chislehurst. [1579

DUBILIER A.C.3, new May, perfect; £15 or offer, cost £25.—Pelly, Pierhead, Eastbourne. [1576

2 STAGE H.F. Amplifier, wonderful distance getter, perfect condition, ordinary valves and plug-in coils, finest components only by Igranic, Burndept, Gambrell, etc., Resiston panel, either stage used singly or together before any detector; sacrifice half cost price.—Experimenter, 17, Salisbury Rd., Richmond, Surrey. [1572

MARCONI Short-wave Model 34 3-valve Receiver, including valves, coils, leads; cost £22/10 as new, best offer.—99, First Av., Manor Park, E.12. [1565

BURNDEPT 5-valve Superheterodyne, perfect working order and condition, powerful selective set, 2 large heavy duty H.T. accumulators and one L.T.; cost over £100, price £20.—B., South Croft, Burhill, Walton-on-Thames. [1562

FERRANTI Screen Grid Three, Blue Spot, Major chassis, floor cabinet; £12; separate.—Lackford, 26, Cae Gwyn Rd., Greenclose, Cardiff. [1555

OSRAM Music Magnet Four, assembled complete, with or without valves.—Write BM/PXJN, London, W.C.1. [1549

1930 Osram Music Magnet for Sale, complete with valves (Pentode), volume control, choke, filter output; cost £11, take £6.—Allen, 2, Myron Place, Lewisham, S.E.13. [1545

NEW Osram Music Magnet Four, unopened, owner bought all-mains; £8.—Box 7635, c/o *The Wireless World*. [1624

1930 Osram Music Magnet, brand new valves; £5.—59, Atherley Rd., Southampton. [1626

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

OSRAM Music Magnet Four, used once only for demonstration purposes, perfect; £10.—V. Tomkins, 17, Fauconberg Rd., Chiswick, W.4. [1589

1930 Cosser 3S.G., complete with Ecko D.C. eliminator, can be heard any time; £6/10.—Tyson, 48, Battersea Rise, S.W.11. [1591

MULLARD 3-valve Set, 50/-; H.T. eliminator, 100 volts, A.C., output 250v. 50 m.a., £4; Exide L.T., 6-12v. 60 amps., and charge (100 v. A.C.), £2.—22, Porchester Sq., W.2. [1592

FOREIGN Listener's Four, exceptional receiver; £10.—Leighton, Danehurst, Boyle Farm, Thames Ditton. [1594

PAY As You Listen.—All receivers and kits supplied on payment out of income; before deciding, compare my quotation.—R. W. Hillier, 10, Brymer Rd., S.E.5. [1604

NEW Transportable Three; £5/10; guaranteed.—Davidson, 25 Fowler Terrace, Edinburgh. [1597

MEGAVOX Three, with super capacity H.T. batteries and accumulator; also Amplion Lion in oak; £12/10.—Murgatroyd, "Riddlesden," Elm Av., Great Crosby, Liverpool. [1605

UNWANTED Gift.—Osram Music Magnet Four, in sealed carton; £8/10, take £6/15 without valves.—Box 7619, c/o *The Wireless World*. [1621

PHILIPS 4-valve (2511), all electric, 240v., makers' guarantee, with Amplion Lion speaker, as new, total revised list, £43; sell complete for £27/10.—Box 7627, c/o *The Wireless World*. [1614

EDISON BELL 5-valve Portable, as new; cost £17/17, £10.—Phillips, 128, Walford Rd., Sparkbrook, Birmingham. [1607

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

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GRAMOPHONES, PICK-UPS, ETC.

B.T.H. Pick-ups and Tone Arms, cranked; 22/6 each; send for list.—G2VM, 27a, Bridget St., Rugby. [1436

GARRARD Double Motor, new, unused; 25/6; particulars, stamp.—McLellan, 18, Wellington Rd. E.17. [1583

MARCONIPHONE K-7 Pick-up, as new, unused; 45/-.—Cole, 2 St. Aidans Terrace, Birkenhead. [1584

G.E.C. Magnet, 200-260-volt, Universal gramophone motor, used 12 hours; £3.—59, Atherley Rd., Southampton. [1627

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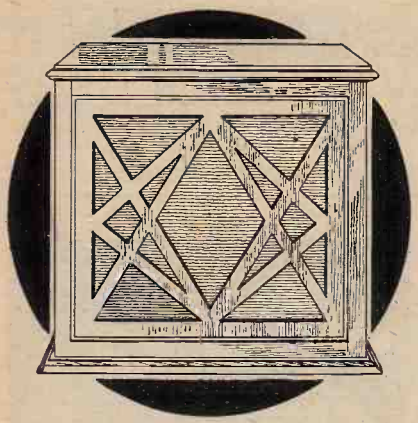

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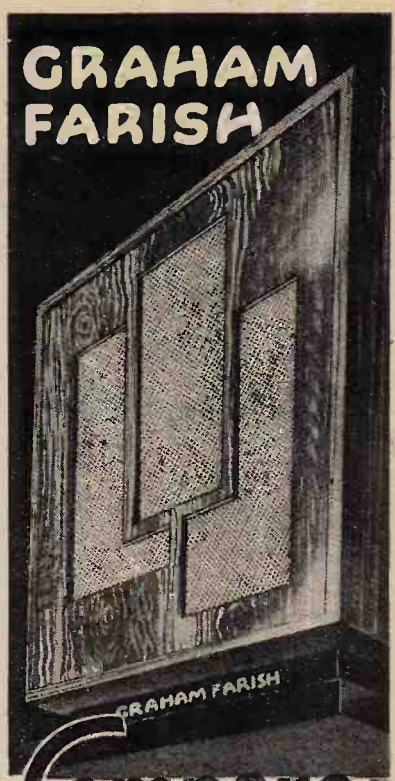

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R.K. Moving Coil Speaker, quite new, 8,000 ohm field, 200-350 volts, 25-40 milliamps., fitted with input transformer, half price, £3/10; also Magnavox 200-volt field in cabinet, £3.—16, Denbigh St., S.W.1. Victoria 7705. [1564

MULLARD Model H Speaker; cost £6/6 last July, accept £3/10; condition guaranteed as new.—Adams, Cluny, Swanage, Dorset. [1570

BLUE Spot Moving Coil Speaker, 6-volt model, with transformer, as new; £4.—Haring, Field Lane, Letchworth. [1622

GREAT Exchange Offer.—We will send you a latest type cabinet cone speaker in exchange for your old horn speaker or surplus radio parts; send P.C. for particulars.—Grosvenor Electrics, Broadway Chambers, Ilford. [1606

AMPLION Lion L14 Speaker, 6 months old; first offer over £2/10 secures.—Scholey, 331, Spring Bank West, Hull. [1601

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3.5 Megacycle Crystals; 17/-; control without reaction.—Smith, Bryn Rodyn, Colwyn Bay. [1476

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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

OSRAM 2 H.F., P610, Cossor, 210 R.C., 410 H.F., Mullard, P.M., I.L.F., 4/- each; P.M.256, 7/-.—I. Davies, Brynmynach Farm, Ystradmynach, Glam. [1546

VALVES, coils, screen, baseboard and all parts Everyman Four; £4; 3.6 mfd. 600-volt T.C.C., 6/- each.—R., 1, Priory Rd., Barking, Essex. [1610

P.M.22, 15/-; P.M.5X, 610L.F., 4/- each (all new); P.M.256, 4/-.—Head, Playden Cottage, Missenden, Bucks. [1593

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M.C. Speakers, pick-ups, cone speakers, microphones, transformers, etc.; send for list.—G2VM, 27a, Bridget St., Rugby. [1435

NOVOTONE, M.C. speakers, transformers, coils, condensers, resistances, chokes, etc.—Write for list, Hopson, 97, Merton Hall Rd., Wimbledon, S.W.19. [1547

BAKER'S 6v. M.C. Speaker, £2/10; H.I. transformer 240v. 50c. 400-0-400 and 5.5 C.T. by Parnuko, £2/5; Pye 32 hy choke, 7/-; Ultra horn speaker, 7/6; 2 Ormond 0.0005 S.L.F., 2/6 each; all the above in good condition, valves, emission guaranteed; L.S.5A., 10/-; P.M.16, new, 12/6; R.C. 610, new, 5/-; P.M.5X, P.M.5B., 4/-; D.E.5B., 61A, 61B, 62, R.C.610, 2/6 each; Mullard 100,000 ohm and 250,000 ohm, wire wound, 2/6 each; R.I. heavy current P.P. input transformer, 15/-.—Brown, 173, Union St., Dunstable. [1548

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EXPERIMENTAL Surplus. — Components, Morse printer, high class relay, 4-valve D.C. set and gramophone motor.—Box 7612, c/o *The Wireless World*. [1559

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REGENTONE Eliminator, W.2A., £4/15; Ferranti A.F.6, 20/-; Polar condensers, 0.0005 drum dials, 9/6.—115, Southwood Rd., Eltham, S.E.9. [1566

EXACTLY as New, Ferranti A.F.5, 18/6; Weston 301 milliammeter, 0-25, C.Z., 30/-; Lissen, 37/6; pick-up and tone arm, 25/-; B.T.H. rotary converter, 12U—600—80 mA., cost £20, £5/5; L.S.5, 12/6; Mazda S.G.215, 12/6; 1in. spark coil, 5/-; 3 days' approval, tons more, list.—Matthews, "Claremont," Tudor Av., Chelmsford. [1567

WESTINGHOUSE Rectifier, style A.3, 15/-; 2 Varley L.T. chokes, 15/- each; after 7 p.m.—C. H. Brundle, "Ely Lodge" St. Faith's Rd., West Dulwich. [1568

FERRANTI Trickle Charger, 230v. 50 cycles, perfect, 32/6; multi range set, new, with case and leads, £7/7; also portable, new, with case and leads, 150v., 7½v., 30 m.a., 37/6.—73, Crown St., Rochdale. [1573

2-VALVE Set, British components, 20/-; reliable A.C. eliminator, output 30 m.a., at approximately 130v., 30/-.—Conner, 1, Elm Walk, Raynes Park, S.W.20. [1577

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

MARCONI M.C. Speaker, 6v. field, 50/-; Ferranti A.F.5C and O.P.3C, £2 pair; Igranic R.C. amplifier, 30/-; write for list of other parts.—Box 7631, c/o *The Wireless World*. [1617

MULLARD H.T. Unit, 110v., 25/-; 10 Lewcos C.T. coils, 35-400, 20/-; B.S.P.5 and B.S.P.20, 4/-; 2 sets 11 Burndept coils, 25-400, 20/- each.—Box 7626, c/o *The Wireless World*. [1613

FOR Sale.—Ferranti O.P.1, output 11/6; Brown pick-up, 7/6; 2 Celestions, C12, £3 each.—Barlow, 20, Coningham Rd., Shepherd's Bush. [1603

BLUE SPOT, chassis, cabinets, 25/-; Ferranti, A.F.3, 10/-; R.I. super transformer, 12/6; ditto output transformer, 12/6; Ormonde cone and chassis, 10/-; other components on application.—Grange Cottage, Lindfield. [1602

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SURPLUS, perfect.—Telsen Radiogrand, 5/6; P.M.4, 3/6; S.G.215, 3/6; many others; list free.—Lowson, Watling Rd., Bishop Auckland. [1588

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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.

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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

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DIMIC Coils in Sets of Three state type and price.—Box 7633, c/o *The Wireless World*. [1619

MULLARD Argola Senior Specified Components Wanted; state price and condition.—Box 7632, c/o *The Wireless World*. [1618

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

GUARANTEED Repairs by Experts.—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 repaired by experts, rewound and overhauled for 4/-, post free.—Walters, 1, Dunn's Terrace, Lower Compton, Plymouth. [1586

YOUR Transformer Rewound or Repaired and Returned Promptly; 3/6, post free.—James, 190, Bitterne Rd., Southampton. [1599

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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 Ter., S.E.23. [1488

6V. M.C. Speaker, 5-64in. gap, for pick-up; sell 30/-.—28, Addiscombe Av., Croydon. [1587

SNAPPY Part Exchange Bureau; send list of your goods, stating new requirements, for our quotation.—8, Blue Hall Mansions, W.6. [1585

FERRANTI S.A.I. Chassis, 230v. 50 cycles, quite new, for Paillard induction motor, similar supply; cash adjustment, 73, Crown St., Rochdale. [1574

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INSTRUCTIONS in Morse, day or evenings; easy terms.—Telegraph School, 29, Talfourd Rd., Peckham, S.E. [1575

CORRESPONDENCE Courses of Instruction in Wireless.—Write for free particulars to the Correspondence Course Dept. of the R.M. College, 26-27, St. Mary St., Cardiff. [1553

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EARN Big Money in the Wireless Trade! Become a trained salesman and radio expert. A short training enables you to qualify for a really big job with good salary, ending in an introduction to prospective employers. Write P.C. for syllabus of special 6-weeks' course of instruction in the evenings, commencing shortly.—Dept. T.C.3. The London Telegraph Training College. Ltd., Morse House, Earl's Court, S.W.5. (Est. 34 years.) [0342

EXCEPTIONAL Opportunity for Ambitious, capable man with knowledge of import, export and world's trading markets; electrical, radio and component experience essential; Kingston district.—Write Box 7570, c/o *The Wireless World*. [1551

WANTED, wireless electrician, with some knowledge of car equipment and magnetos; state experience and wage.—Skinner, Sleaford. [1578

RADIO and Gramophone Salesman Wanted for New Shop in Kent; write, stating age, experience and wages required.—Box 7614, c/o *The Wireless World*. [1569

LABORATORY (amplifiers, etc.) in N.W. London has Vacancy for Junior (18 to 20) for Construction and Wiring of Experimental Apparatus; must be quick and neat worker with knowledge of wireless circuits; starting wages, 35/-.—Box 7547, c/o *The Wireless World*. [1544

WORKS Manager for Works in Birmingham, with experience of mass production in electrical and wireless apparatus; state age, full particulars of experience, salary required, and whether disengaged.—Box 7625, c/o *The Wireless World*. [1612

WANTED, youth's for set making and wiring purposes, in South-East London radio factory.—Write, stating experience, age and wages required, to Tannoy Products, Dalton St., West Norwood, S.E.27. [1611

SITUATIONS WANTED.

PUBLIC School Boy, 18, with one year's training in radio repairs and set building, seeks post with first class firm.—Box 7610, c/o *The Wireless World*. [1557

YOUNG Man, 27, desires position, anything, marine operating experience.—Box 7611, c/o *The Wireless World*. [1558

POSITION Required, controlling service department, thoroughly experienced in handling wireless repairs and keeping department up to date; company must be progressive.—Box 7630, c/o *The Wireless World*. [1620

WIRELESS Mechanic, 29, desires situation, London, good class manufacturers, 8 years' experience, sound technical knowledge.—Box 7629, c/o *The Wireless World*. [1616

EX-MARCONI Operator, 7 years' sea service, London B.Sc. honours, desires position testing or similar work; initial salary secondary consideration if work offers scope advancement.—Box 7628, c/o *The Wireless World*. [1615

BOOKS, INSTRUCTION, ETC.

FREE: Inventor's Guide on Patents.—T. A. A., 253, (W), Gray's Inn Rd., London, W.C.1. [6373

"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

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The Wireless World

4D

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Wednesday, October 8th, 1930.

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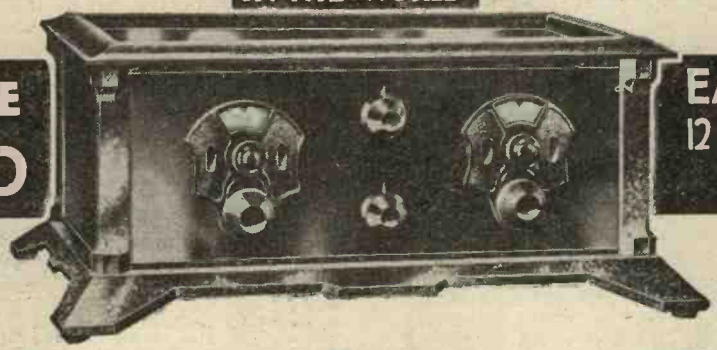

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Are International Relays Wanted?

EVIDENCE goes to show that the interest in foreign reception is greater to-day than ever it has been, even when we make full allowance for the percentage increase in the number of listeners.

We have always contended that one of the principal charms of broadcast reception lies in the ability of the listener to pick and choose his programmes and wander from place to place at home or on the Continent at will.

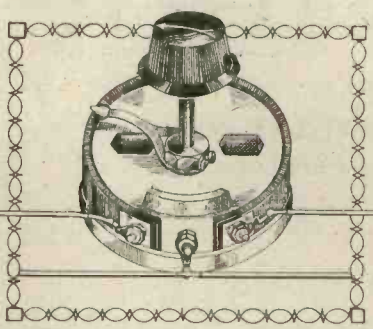
If the old policy of the B.B.C.—that of insisting that reception of the local programme was all the listener needed—had been pursued, then by now the time would have probably arrived for telephone wires to take the place of the ether in the distribution of programmes, and wireless would no longer have been needed as the link, except where wires to individual houses could not be arranged.

But the public has decided that the old B.B.C. policy would not hold good. Interest in foreign reception, in particular, has guaranteed the future of the wireless set, and put wired wireless as a substitute on the shelf for many years to come. But to-day the B.B.C. is harping back to the old policy in so far as the idea of international relays is concerned. By all means let the B.B.C. relay those programmes which are beyond the reach of the vast majority of listeners, such as transmissions of interesting events across the Atlantic, but we think the B.B.C. should act very cautiously in the matter of retransmission of those Continental programmes which so many listeners can to-day receive direct on their own sets, perhaps better than when relayed by the B.B.C. and with the advantage that they can choose the station.

We understand that to obtain lines for a good Continental relay is a very expensive matter for the B.B.C., and, in the circumstances, we believe that it is not worth while when direct reception is so good. The B.B.C. has long since abandoned the idea of catering first of all for the crystal user, and now it seems that it might also be well to consider if the user of an unselective valve set should not to-day be relegated to the same ranks as the crystal user. We do not mean by this to imply that we wish to penalise these listeners, but we feel they should not expect to be spoon-fed just for the reason that their apparatus, for the want of minor alterations or improvements, has not progressed with the times. A receiver which is selective enough to give satisfactory reception of stations under the Regional scheme without mutual interference is, generally speaking, capable of receiving programmes from several of the more powerful Continental transmitters both on the long and short waves. Any motorist of to-day is entitled to resent a hold-up of traffic due to the presence of five-mile-an-hour old crocks on the road. We do not want the B.B.C. to devote energy and money to pampering the old crocks by giving them what they are quite able to provide for themselves.

In This Issue

Volume Control



Merits and Failings of the Various Methods Explained.

By C. WHITEHEAD.

AMONG the problems which confront the designer of a receiving set or electrically reproducing gramophone the difficulty of arranging a satisfactory method of volume control is one of the most awkward. The perfect volume control must have the following attributes:—

(1) Its inclusion must in no way modify the overall frequency response of the amplifier. Thus, if associated with the L.F. stages there must be no change in the quality of the output by way of suppressing or augmenting particular audio frequencies.

(2) A wide range in the change of volume must result. A cutting down to at least one-tenth of the original volume is desirable, and in general the volume control should provide a complete fade-out of the signal.

(3) The device used must provide a smooth control so that it can be operated without audible evidence of its use beyond that of changing the volume. There must be no scraping, rustling or clicking, and at no point must there be a sudden increase or decrease of volume. The change of volume as judged by the ear must, as far as possible, be spread out uniformly over the range of the control.

It is proposed to review some of the methods which have been used and suggested from time to time, and to see how near these various arrangements approach the ideal and the extent to which they fulfil the conditions just defined. Of the various available methods a broad classification may be made, so that the various types fall under one of the three following headings:—

(1) Pre-detector methods in which the volume control is applied to the H.F. amplifier.

(2) Post-detector methods in which the control is introduced into the L.F. amplifier.

(3) Control of both the H.F. and L.F. stages, an arrangement which is often desirable in a long-range quality receiver of generous design.

It is obvious that volume control must be applied to the L.F. amplifier when the detector valve and its following stages are to be used for gramophone reproduction. It may be mentioned that the desirable method of volume control which is arranged to regulate the amount of input to the detector may have an effect on the quality obtained. The behaviour of the detector as regards introducing distortion is largely a question of supplying its grid with the correct signal potential. This point has, however, been omitted in what follows, as it is really a separate problem.

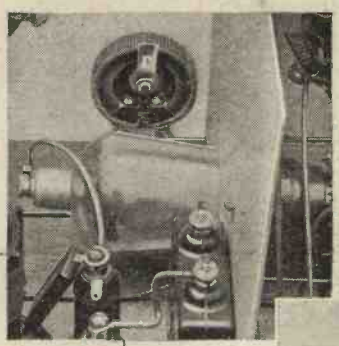
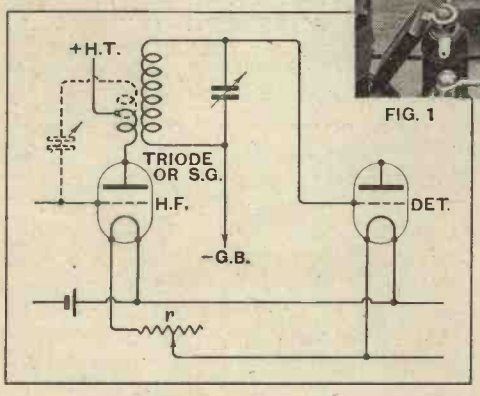


FIG. 1

Fig. 1.—Regulation of H.F. amplification by series filament resistance.



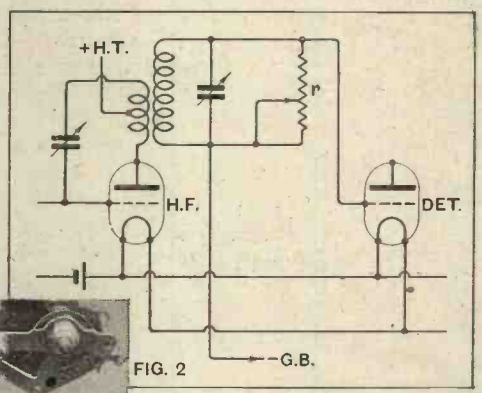


FIG. 2

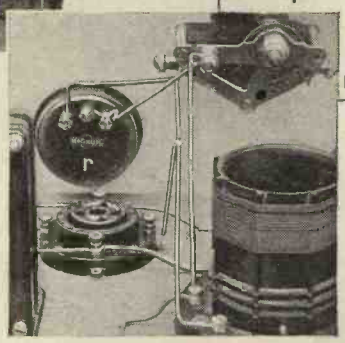


Fig. 2.—Variable shunt across the tuned circuit as a means of controlling the input voltage to the detector.

Pre-detector Methods.

The inclusion of a volume control before the detector becomes necessary only where the H.F. input is large and implies, therefore, the inclusion of an H.F. amplifier or the possible working of a set close to a transmitting station. The first, and possibly the most

Volume Control.—

straightforward arrangement of H.F. volume control is that shown in Fig. 1, and consists of the inclusion of a filament rheostat in the L.T. supply of the first H.F. valve. This method is particularly simple, and in modest sets may be considered entirely satisfactory. If applied, however, to a highly selective H.F. stage, such as that produced by a neutralised triode and a tuned circuit which includes a good coil, the effect of reducing the filament current may be that of increasing the selectivity. In any case a noticeable effect on quality results due to the change in the A.C. resistance of the valve with variation of its filament current. Reproduction therefore, tends to become lowered in pitch, though this is compensated for by the general reduction of sound level and the non-linear effect of the ear with various sound intensities.

The second method is that shown in Fig. 2. As a volume control, this method is perfectly unobjectionable, though it may under certain circumstances possess disadvantages in other directions. The volume control resistance is arranged as a shunt across the tuned circuit, and in consequence regulates the H.F. voltage developed. Such an arrangement has been applied to an intermediate stage in a superheterodyne receiver, and is particularly effective in that it serves also as a method of stabilising. Values must be carefully chosen, however, or otherwise this method of volume control becomes none other than a regulation of regeneration. Modifications of this method are shown in Figs. 3 and 4. In one case a series resistance is introduced into the tuner circuit, the effect being precisely similar to the fitting of a variable shunt resistance as shown in Fig. 2. While the maximum value of the shunt resistance may be of the order of 250,000 ohms, the series resistance of Fig. 3 may have a maximum value of 100 ohms. The other arrangement shown in Fig. 4 regulates the bias applied to the valve, and as the negativeness increases the volume falls. This method gives satisfactory results when applied to a single H.F. stage using a neutralised triode.

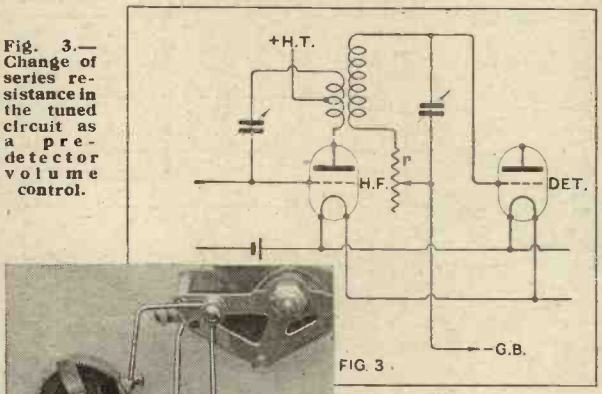


Fig. 3.—Change of series resistance in the tuned circuit as a pre-detector volume control.

FIG. 3.

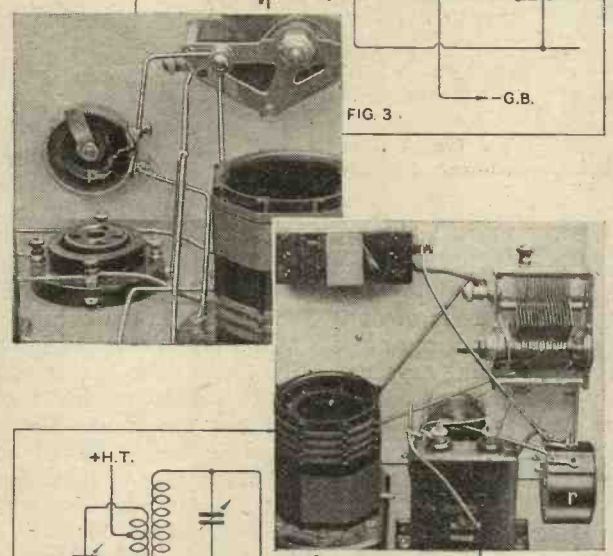


FIG. 4

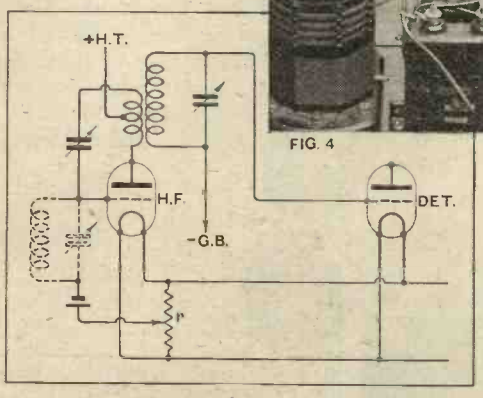


Fig. 4.—Control of grid potential which regulates the H.F. amplification.

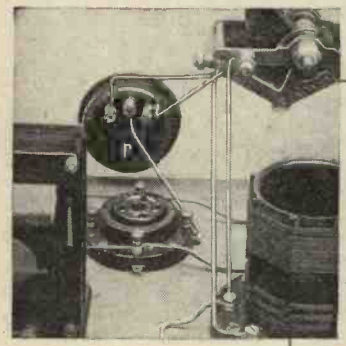
It must not be overlooked, however, that underbiasing of the H.F. valve at once limits its signal handling properties, while overbiasing results in rectification, both conditions producing the effect of flatness of tuning. Increase of grid bias is a method commonly introduced as a volume control in mains-operated screen-grid H.F. stages, and, in view of the criticism that can be levelled against other methods, this arrangement must be considered one of the most satisfactory.

The third method under this heading is the H.F. potentiometer (Fig. 5) connected across the tuned circuit and arranged to regulate the signal input passed on to the following stage on the detector. The obvious merit of this circuit is that operation of the volume control does not materially affect the working of the H.F. amplifier, so that it does not suffer by way of increase in selectivity with resultant sideband cutting. It must not be overlooked that this method does, to some extent, control regeneration. Practically all methods of H.F. volume control are, however, subject to this criticism, and a decline in the tendency to oscillate as the volume control is turned towards the position of zero cannot be regarded as a serious objection. Change in the tendency to oscillate results from a reduction in the detector load on the H.F. circuit. If used between two H.F. stages the loading again becomes reduced as the potentiometer contact is moved towards zero so that a receiver can, in fact, be brought to a critical condition of sensitiveness by using the control first as a regulation of reaction and then as an adjustment of volume. Examples of the use of the H.F. potentiometer are to be found in the Megavox receiver described some while ago, and in the more recent Band Pass Four. Depending upon the dynamic resistance of the tuned circuit, the value of the resistance to be used must be selected. Although it may be thought that a very high value of resistance is desirable, experience reveals that 50,000 ohms is a satisfactory value, and particularly is this true where the preceding stage incorporates a screen-grid valve.

Before turning to the control of volume in the L.F. amplifier, it may be mentioned that there is a growing tendency to regulate the voltage input as delivered by

Volume Control.—

the aerial. The obvious method is that of introducing a small series connected condenser in the aerial lead. An advantage of this arrangement is that the voltage is not decreased by increase of damping, and, in fact, assuming the use of a neutralised triode H.F. stage, the tuning may become excessively sharp. The smaller the condenser, the more its impedance to the H.F. current circulating in the input tuned circuit, and in applying this method one must select a condenser of small zero capacity, or otherwise



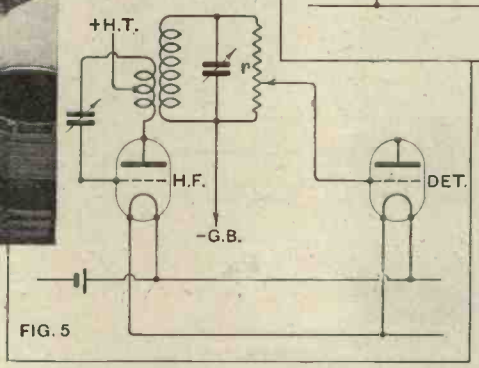


FIG. 5

Fig. 5.—A satisfactory method of pre-detector control in which a potentiometer is used across the tuned circuit.

insufficient reduction of signal strength results when tuned to a nearby transmitting station. It is obvious that change of the series aerial capacity as a means of volume control may demand change of tuning capacity, and the decline in the signal may result partly from detuning. Some correction can be made in this direction by using a differential condenser in the aerial circuit so that the capacity of the aerial may remain as far as possible constant. While at first sight it may be thought possible to maintain the aerial capacity at a fixed value by the use of a differential condenser a small change is unavoidable, this being readily revealed from a calculation of the series-parallel values of this differential condenser, as its moving plates are swung between the two fixed sections from zero to maximum.

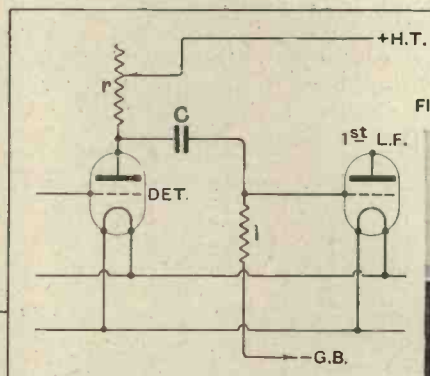
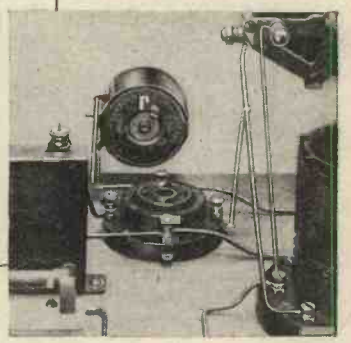


FIG. 6

Fig. 6 — Control by adjustment of anode resistance.



Post-detector Methods.

Assuming that volume control is not only introduced for the purpose of regulating the output of the loud speaker to the requirements of the listener, but also to perform the more important function of avoiding valve overloading, it becomes necessary to introduce control as early as possible in the train of valves. H.F. volume control assists in the regulation of the potential fed to the grid of the detector, so that it may be neither too little nor too great, either condition tending, perhaps, to give rise to detector distortion. Having fed the detector with its required voltage for distortionless rectification, attention is turned first to the adjustment of the ultimate signal and next to a regulation of the voltages passed on by the L.F. stages, so that no valve is required to accept a greater signal than that

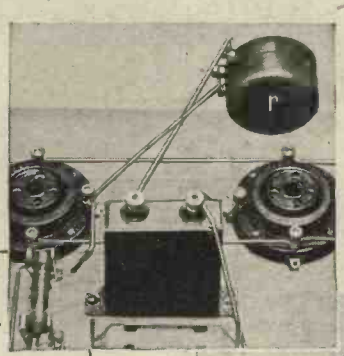


Fig. 7.—Regulation of input to first L.F. valve by forming a grid potentiometer by a resistance connected in the grid lead.

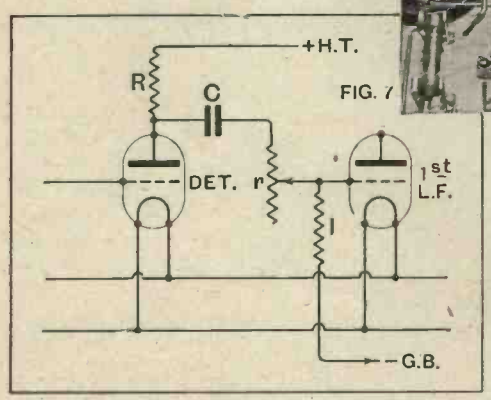


FIG. 7

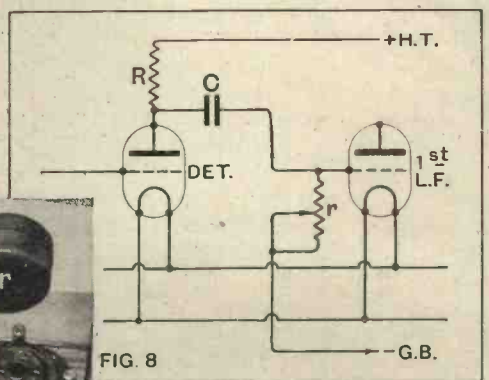


FIG. 8

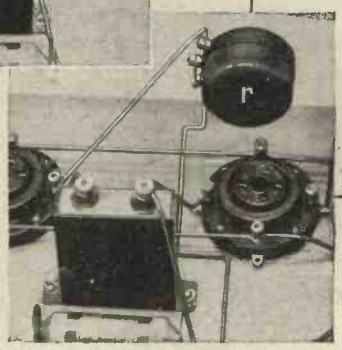


Fig. 8.—Variation of grid leak resistance as a means of volume control.

Volume Control.—

which it can handle without distortion. While it may seem obvious that any form of L.F. volume control should immediately follow the detector, it may happen in a generous amplifier that volume control may be applied to more than one of the L.F. stages. Provided that the control is properly designed, it is, of course, seldom that a second one, in a later stage, will be required, though the use of a partial control in each stage may not be without advantage. When more than one L.F. control is used, it is worth noting that when an increase in volume is required the control nearest the input end of the amplifier should be operated first. Conversely, when decreasing volume adjustment is first made at the output end. In the following notes reference is only made to the use of a single volume control as applied to a normal broadcast receiver with a modest output stage.

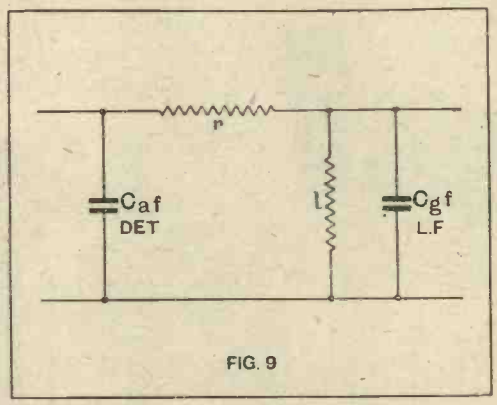


FIG. 9

Fig. 9.—The equivalent circuit of a resistance-coupled L.F. stage showing the effects of resistance change and their relation to the reactance values of the valve capacities.

Variable resistances forming part of the intervalve coupling immediately following the detector may be suggested as methods of controlling volume, but are objectionable in several ways. For instance, a resistance may be connected in the anode circuit, as shown in Fig. 6, so that the amplification falls with reduction in its value. In using such an arrangement noisy operation invariably results owing to the fact that the resistance is carrying the anode current to the valve.

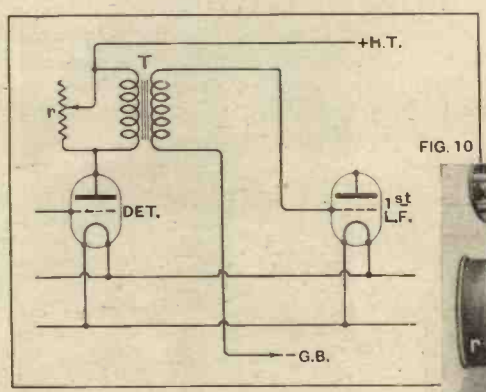
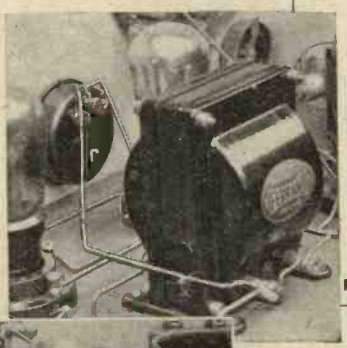


FIG. 10

Fig. 10.—Adjustment of volume by a variable shunt on a L.F. transformer primary.

Slight irregular variations in contact resistance as the slider is moved along the resistance element are amplified in the succeeding stages, and may give rise to a rustling sound as the control is operated. Next one might consider connecting a resistance in the grid lead to the following valve, as shown in Fig. 7. This is probably one of the worst systems of volume control. It forms, with the grid leak, a potentiometer regulating the potential applied to the grid of the succeeding valve. The resistance of the leak cannot be much under 0.25 megohm, so that to obtain a range in volume of only 2 : 1 the value of the resistance would need to be 2 megohms. A resistance of this value in conjunction with the input capacity of the valve and stray capacities in the wiring would constitute a filter circuit, and a reduction in volume would be accompanied by loss of the upper audio-frequencies.

In Fig. 8 is shown a method of volume control depending on a change in the resistance between grid and filament. This is an undesirable arrangement, for as the value of the resistance is reduced it becomes comparable to, or even less than, the reactance of the coupling condenser C at the lower audio-frequencies, and in consequence a marked falling off in the bass results as the volume is reduced. Fig. 9 represents the equivalent circuit of the couplings between the detector and L.F. valves, and



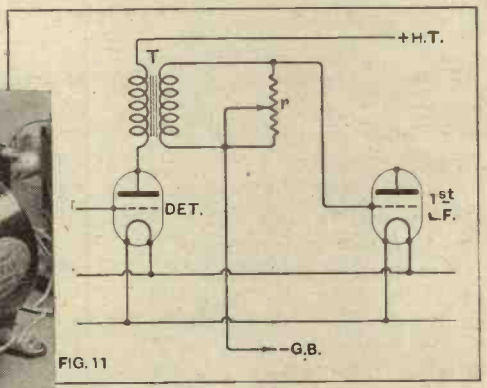


FIG. 11

Fig. 11.—Shunt across the secondary of a L.F. transformer controlling its voltage output.

makes clear the effects of change of resistance as compared with the reactance of the paths provided by valve capacity, the values of which vary with frequency. Applying the use of a variable resistance to volume control in association with an L.F. transformer, mention is first made of the use of a variable shunt across the transformer primary or secondary (Figs. 10 and 11). Modern intervalve transformers are designed to work with a specific load, and their frequency-response characteristics are only as stated by the makers, provided that they work in conjunction with this load. The effect of an increase in load such as would result from a reduction in the value *r* is that of reducing the effective impedance of the transformer. As this reduction in impedance affects the lower

Volume Control.—frequencies first the result of the operation of this volume control is that a reduction in the strength of the bass occurs as the volume is reduced.

Consequently, there is only one permissible method of control left to be considered, and that is the use of a high resistance potential divider. This may be applied in various ways, and although by no means free from pitfalls, can invariably be arranged to give satisfactory results.

Dealing with the resistance-coupled stage first, Fig. 12 shows an undesirable method of application. It is open to the same objection as that given for Fig. 6, in that it may be noisy in operation. It is not very easy to see at first why this should be so, since the tapping apparently carries no D.C. The explanation is that as the tapping is moved along the resistance the D.C. potential applied across C varies, and this gives rise to small charging or discharging currents into or out of C *via* the tapping. This current varies irregularly owing to the varying contact resistance of the slider, and these irregular variations are amplified in the succeeding stages, giving evidence of the operating of the control by a rustling noise from the loud speaker. It is mentioned, however, that a well-constructed and continuously variable wire-wound resistance probably does not cause very serious trouble. The method can, however, be used quite successfully if the variable resistance *r* is by-passed by a choke L (Fig. 13). By this means the D.C. voltage drop across the choke is negligible.

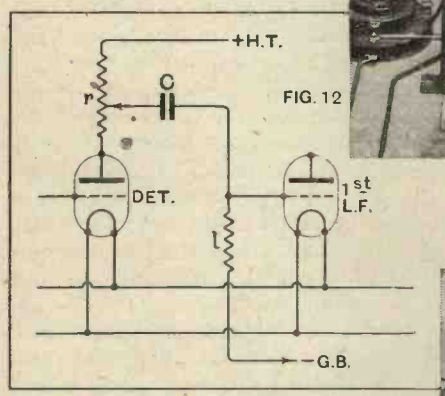
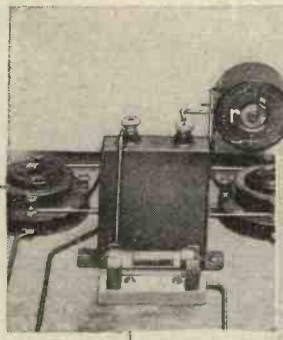


FIG. 12

Fig. 12.— Anode resistance arranged as a potentiometer in a resistance-coupled stage.



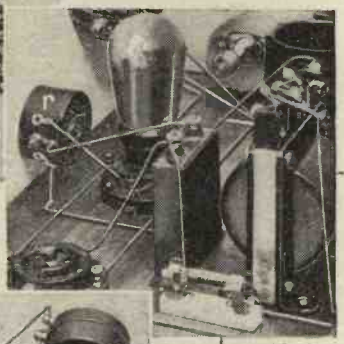


Fig. 13.—The volume control in this case passes but little of the anode current, resulting in a noiseless control.

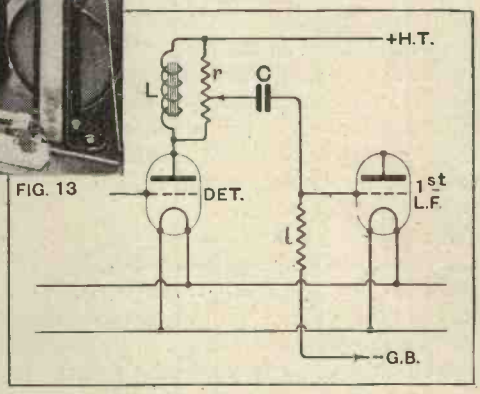


FIG. 13

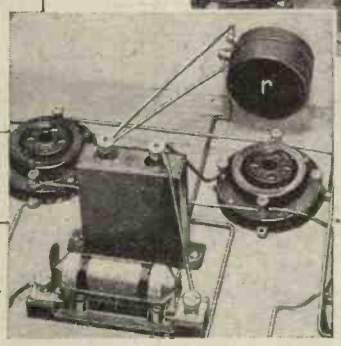


FIG. 14

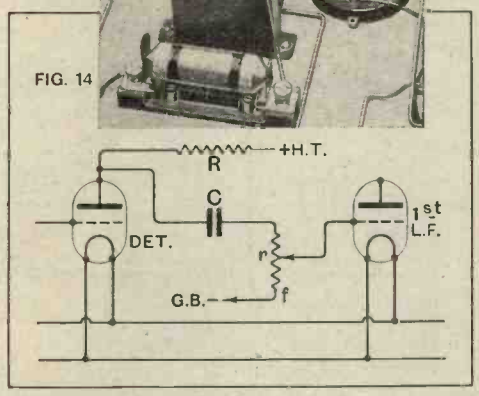


Fig. 14.—Grid leak used as a potentiometer method of volume control.

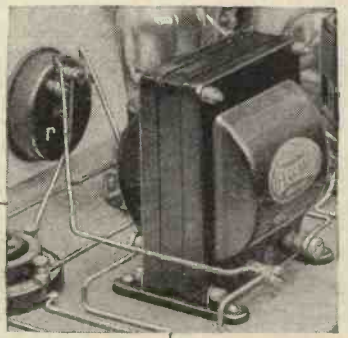


FIG. 16

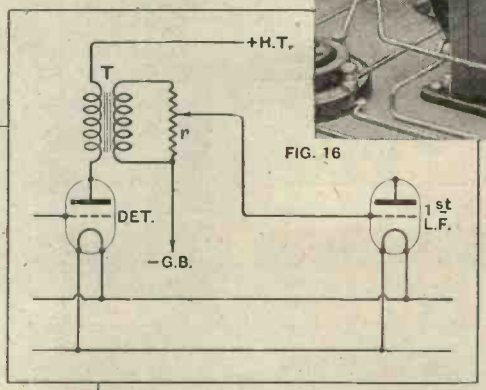


Fig. 16.—Potentiometer control of the output from the intervalve transformer.

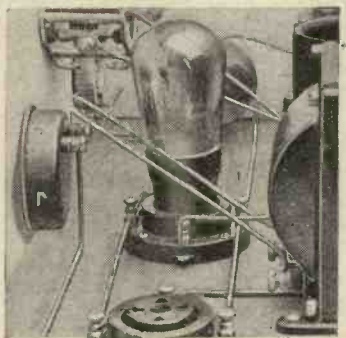


Fig. 15.—An intervalve transformer with a potentiometer-regulated primary.

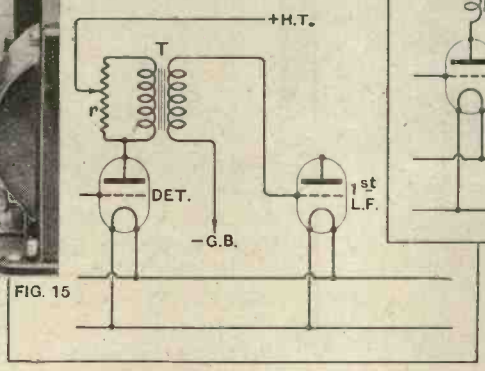


FIG. 15

Volume Control.—

Suitable values may be taken as 80 to 100 henrys in respect of the choke when passing a current of 2 to 5 mA., 0.1 mfd. for the coupling condenser, 1 to 2 megohms for the leak, and values up to 250,000 ohms for the resistance. The valve might have an A.C. resistance of about 10,000 ohms.

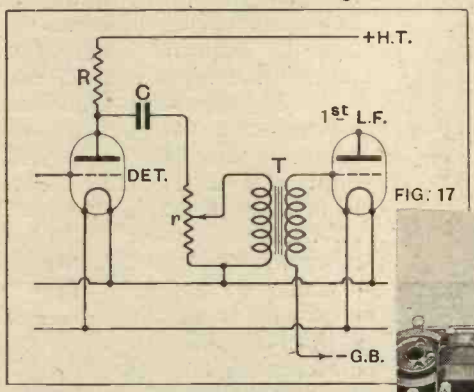


FIG. 17

Fig. 17.—Filter-fed transformer with potentiometer-controlled primary.

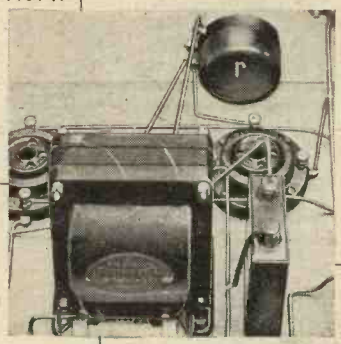


Fig. 14 shows another alternative. In this case the leak *r* is in the form of a potentiometer, so that either a resistance or a choke may be used in the anode circuit of the valve. The limiting factor in this case is the fact that *r* must not be excessive or otherwise the portion of the resistance which remains in circuit near the minimum volume position (*f*) will act as a filter tending to suppress the higher audio-frequencies, as already explained. Suitable values may be taken: R, 50,000 ohms or an inductance of 50 to 80 henrys at 2 to 5 mA.; C, 0.25 mfd.; *r*, values not exceeding 0.25 megohm. The valve may have an A.C. resistance of about 7,500 ohms. Turning now to the transformer-coupled stage, as shown in Figs. 15 and 16, it will be obvious without explanation that a tapped potentiometer input associated with the primary of the transformer, as shown in Fig. 15, is quite unsuitable. Consequently, a resistance on the secondary may prove satisfactory, provided that the valve, resistance and transformer are properly chosen. This forms a good method of control, being absolutely noiseless in operation, assuming a well-made potentiometer is adopted, while the frequency characteristic is not modified to any appreciable extent as the control is operated and regulation is, moreover, provided from maximum to zero. It is, however, necessary to guard against two possible mistakes. First, *r* must not be too high on account of the possibility of the low-pass filtering effect, and, secondly, it must not be too low on account of its possible effect upon the transformer characteristics, the increase in load causing a loss of bass. An alternative arrangement possessing the same advantages and limitations is shown in Fig. 17. Apart from the volume control portion the merits of this scheme are well known.

The only point now remaining for discussion is the question of range of volume, i.e., the ratio between maximum and minimum loudness. It is well known that the relationship between acoustic output and audibility is by no means a linear one. Roughly, the audibility is proportional to the logarithm of the acoustic output, and the acoustic output, in its turn, is proportional to the square of the voltage across the speaker terminals.

If we have a volume control potentiometer giving a resistance ratio of 100 : 1, the resulting acoustic output ratio is $100^2 : 1 = 10{,}000 : 1$, and the audibility ratio = 4 : 1, the necessity for a very wide range of input variation is therefore apparent. Generally a potentiometer of usual construction will give 100 : 1 ratio, but if it is especially desired to cover a very wide range of audibility with a single volume control, the use of a "graded" resistance element in the potentiometer is advisable. When one of these "graded" potentiometers is in use, care should be taken that it is connected the right way round, otherwise it will be worse than a "straight" element. Fig. 18 shows the correct and incorrect ways of connecting a graded potentiometer. To avoid complication, the necessary H.F. stopping and decoupling devices are not shown in the diagrams. In summarising one would press the need for pre-H.F. volume control, and, in spite of criticism, one might be tempted to use either the variable condenser or H.F. potentiometer method. When control is applied to the L.F. amplifier in association with an intervalve transformer, the best method becomes that of a potentiometer connected across the intervalve transformer secondary. Should the transformer be filter-fed with resistance and condenser, as is now customary, the potentiometer may be associated with the primary, or, better still, connected across the secondary in the same way as if the transformer is connected in the anode circuit.

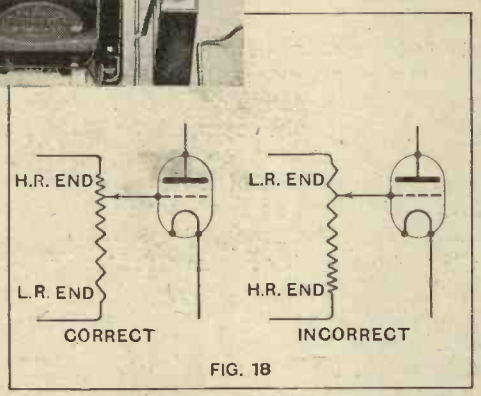


FIG. 18

Fig. 18.—The use of a graded track potentiometer in order to produce convenient variations of output.

Unbiased.

By FREE GRID.

The Radio Show —A Lament.

AT the risk of being accused of repeating what has been said every year by every journal, wireless or otherwise, I feel I must record my opinion that the Wireless Show, which closed its doors on September 27th, was—as well as being the biggest—far and away the best that has ever been staged. Not only were the valves, components and sets far better from the technical point of view, but the outward appearance of the sets and, above all, their price, were infinitely more satisfying. Having said this, however, I feel that there are certain aspects of the Exhibition which cannot be allowed to pass without comment.

Adopt the rôle of the superior and languid youth.

The chief criticism I have to make is concerning technical information—or, rather, the lack of it—available at the various stands. With one or two notable exceptions, the stand attendants, salesmen, "engineers," or whatever else they choose to call themselves, appeared to be adopting the rôle of the superior and languid youth whom one meets at the Motor Show, but without the real information which you can usually extract—extract is the right word, for one has to work like a dentist to get it—from the aforementioned young men if you go about it in the right way. I include the valve manufacturers in particular, as there may be some excuse for the complete-set vendors; for, after all, the man who wants to buy a complete receiver usually wants a musical box only and cares little or nothing for the technical whys and wherefores; in the case of valves, however, things are very different, and one ought to expect a little real technical knowledge.

My particular grouse is over the type of valve curve which has been advocated in the technical columns of this paper during the past few months. My efforts to obtain these or, indeed, any technical assistance in the matter at all were in vain. In some cases the person to whom I addressed my enquiries thought he had "heard of them at some time or another, but anyway they were no good, and it was merely a journalistic stunt"!! In others attempts were made by suitably attired sirens to fob me off with a bag of "literature."

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Hats Off to Genius.

Although, as I have already intimated, technical wisdom is not quite so necessary in the case of the vendor of complete sets, surely all salesmen should know what the various knobs and terminals are for? As an instance that this elementary knowledge is not universal, I should like to quote an experience of my own—one of a type which I have found out was by no means peculiar to me or, indeed, to the particular stand concerned. My attention was attracted by a remarkably fine-looking all-mains transportable, the performance of which, judging by the reputation of the firm in question, is probably as excellent as its appearance. The presence of a small socket in the back of the instrument rather puzzled me, and so, venturing to interrupt a graphic account of how his horse did not win at Doncaster the other week, I asked a very superior person all about it. "That," he replied with an air of omniscience, stooping condescendingly to ignorance, "is for connection to the mains." As I could plainly see the double socket mains connection lower down, I ventured to point this out to him. But he was a foeman worthy of anybody's steel, for he immediately asked me: "Have you not heard of the three-wire system?" I had. "Well," said he rapidly extemporising, "that socket is for the third wire." I silently removed headgear in tribute to real genius and passed on. I found out afterwards, by the way, that the socket was for an optional earth connection.

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Short-wave Shortcomings.

I noticed that in spite of the increased interest taken in short-wave reception as the result of the Empire Broadcasting campaign which has at last borne fruit (good old *W.W.*!!), relatively few short-wave receivers were exhibited. I confidently think, however, that this state of affairs will be remedied next year. D.C. receivers this year are not only available, but can be had in transportable form. So far as I can recollect, there was not a single all-D.C. set shown at the exhibition last year, and, of course, it is only two years since the first all-A.C. receiver appeared, and a clumsy contraption it was, too.

In one or two instances I noticed that the grid bias battery has been retained by manufacturers of all-mains receivers. In my opinion, this is the weak link in some otherwise excellent receivers. It is true that the grid battery needs renewing only about once in every six months, but nevertheless I make so bold as to prophesy that even then it will be forgotten by many people, to the great detriment of the life of their valves. It may be argued that loss of quality will draw people's attention to this fact, but it must not be forgotten that the falling off in quality will not be sudden, but on the other hand will be so very slow and insidious that it will not be noticed by many people until their valves have been irretrievably ruined. There is no reason for the retention of the grid battery in an all-mains receiver put forward by a manufacturer—it is quite different in the case of the experimenter's set where valves may be changed.

Notes on THE BAND PASS FOUR

Adding a Gramophone Pick-up. Using D.C. Mains. Greater Sensitivity.

By W. T. COCKING.

WHEN building a multi-stage receiver such as the Band-Pass Four it is never wise to depart from the original specification, for in nearly every case there is a reason, and sometimes an important reason, for the choice of a component, and for its position in the set. There are, however, certain modifications which may be carried out without affecting the performance of the receiver, and without introducng either instability or a lack of sensitivity.

Perhaps the most important of these modifications is the introduction of a gramophone pick-up, and while this can easily be carried out in the present design there are undoubtedly pitfalls for the unwary. As the power stage directly follows the detector it is necessary to convert the power grid detector into an ordinary low-frequency amplifier. This necessitates care, for the switching arrangements must be in the high-frequency circuits of the receiver.

As stated in the previous article[1] describing the set there must be some 12 volts peak across the primary of the intervalve transformer in order fully to load the push-pull power stage, and although the amplification factor of the AC/HL valve is 35, the actual stage amplification with the 20,000-ohms coupling resistance is only about 21 times. The pick-up, therefore, must be capable of putting 0.57 volts peak on the grid of the AC/HL valve. This necessitates a fairly sensitive pick-up, but there should be no difficulty in choosing one which will give the required output, and which also has a good frequency characteristic, from among those recently reviewed in this journal.[2]

The grid of the usual indirectly heated cathode valve should not be less negative than – 1 volt; the AC/HL valve, therefore, must have a minimum bias of 1.57 volts. The H.F. stages are normally biased to 1.8 volts by a current of 18 mA. flowing through a 100-ohms resistance, and the simple connections of Fig. 1 immediately suggest themselves for the pick-up. It will be seen that the grid return lead is taken to negative H.T., and the grid bias is due to the voltage drop across the H.F. biasing resistance. The bias voltage will not be equal to the normal H.F. bias of 1.8 volts, since the total current will be reduced by biasing the AC/HL valve; it will be about 1.7 volts, which is ample to avoid grid current.

Space can easily be found beneath the baseboard for the decoupling resistance R of 0.25 meg. and the decoupling condenser C of 1 mfd., and the most convenient place for them is just underneath the detector valve-holder. Two terminals for the pick-up connections can be mounted on a small ebonite strip held by brackets to the back of the right-hand screening box, in exactly the same manner as the aerial and earth terminals are attached to the front of the first screening box. The single-pole change-over switch, which *must* be of the low-capacity type and of small dimensions, should be mounted as near to the grid terminal of the detector valve-holder as possible.

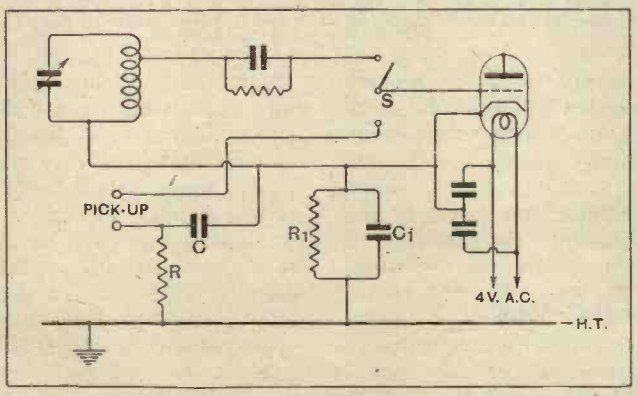


Fig. 1.—A simple method of adding a gramophone pick-up. R and C are the decoupling resistance and condenser of 0.25 meg. and 1 mfd. respectively, while R_1 and C_1 are the normal H.F. biasing resistance of 100 ohms and the by-pass condenser of 2 mfd.

When using the pick-up care should be taken to turn the volume control to minimum, and to tune the set to a wavelength upon which there is no powerful local transmission. If these precautions are not taken the local station may force its way through the set and cause interference with the gramophone reproduction. The sole objection to this method of adding a pick-up is the necessity for keeping the cathodes of the two H.F. valves heated, for it is their anode current which is relied upon for the provision of the full grid bias voltage. It is thought that this is not a serious objection, since the current consumption is low. If desired, however, the more complicated arrangement of Fig. 2 may be used, but care must be taken to see that the switch S_2 is placed in a position such that the filament

[1] The "Band-Pass Four." June 25th and July 2nd, 1930.
[2] "Gramophone Pick-ups Tested." March 26th and April 2nd, 1930.

Notes on the Band Pass Four.—

wiring of the set is not lengthened; in particular, it must not be placed near to the detector valve, as this would probably introduce hum. The switch S_1 must, of course, be placed close to the detector as in the former arrangement, and it must be remembered that there would be a grave risk of trouble from hum if a single switch were used to replace the two indicated.

Alterations to the H.T. rectifying circuit, as distinct from the smoothing circuit, should not affect the performance, provided that there is a potential of 256 volts, at the 62 mA. required by the set, across the terminals of the 4-mfd. condenser. The substitution of a Westinghouse H.T.1 metal rectifier for the U.8 valve would necessitate a specially wound mains transformer. The output of this rectifier is a little less than that of the U.8 valve specified, being about 230 volts at 62 mA., and the reduction in voltages will make itself felt chiefly in a slightly reduced power output. This reduction is not likely to be serious, however, and quite satisfactory results should be obtained.

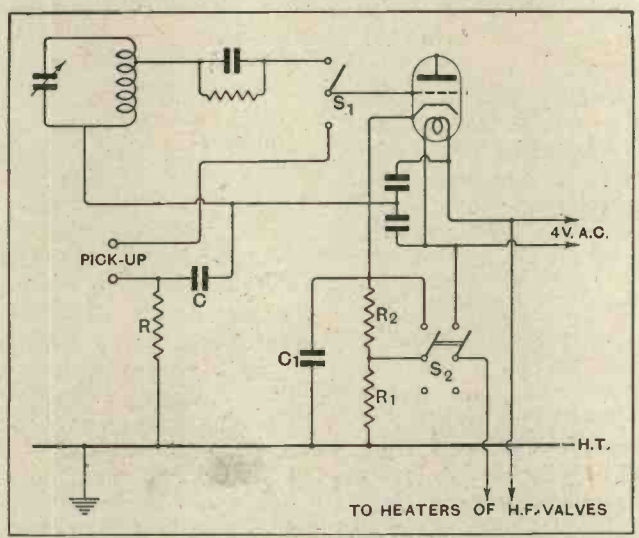


Fig. 2.—The method of adding a pick-up when the H.F valves must be switched off. The resistance R is 0.25 meg.; R_1 is the normal bias resistance of 100 ohms and R_2 is 400 ohms. C and C_1 are respectively 1 mfd. and 2 mfd.

The same remarks apply to those who wish to use D.C. mains for the H.T. supply and a four-volt accumulator for the low tension. A pair of P.X.4 valves may be substituted for the P.625 valves in the push-pull stage to secure uniformity in the L.T. supply; to avoid extensive alterations to the grid bias arrangements and probable trouble from motor boating, however, it would be wise to substitute dry batteries for the normal free grid bias arrangements.

Modifications for D.C. Mains.

With some mains extra smoothing equipment may be needed, but since the mains transformer and rectifier are not required there is plenty of space available for any necessary additions. The greatest difficulty likely to be encountered with D.C. mains working will be due to the low voltage available for the power detector, and it is probable that it will be unsatisfactory with mains of lower voltage than 240. Incidentally, care must be taken in the operation of the set from D.C. mains as, if the positive be earthed, the screening boxes and all metal parts will be at the full mains voltage, and there will be a grave risk of shock. In any case, a 1-mfd. condenser must be inserted in both the aerial and earth leads in order to comply with the I.E.E. regulations.

At the present time the use of power grid detection with H.T. voltages of less than 240 volts cannot be recommended; the output with lower voltages is limited, and is certainly insufficient fully to load a pair of P.X.4 valves. Experimental work is being carried on with a view to evolving an intervalve coupling which will allow the use of power grid detection with anode voltages of from 150 to 200 volts, and when this has been done there is no reason why the power grid detector should not work satisfactorily upon low-voltage D.C. mains.

In general, it is unwise to change from the valves specified by the designer, and this is particularly true of those specified for the H.F. stages. The Mullard S4VA, a test report on which recently appeared in these pages,[3] would appear to be suitable for the Band Pass Four. Little, if any, greater amplification can be expected, however, and there is some risk of introducing instability, which can be cured in the manner indicated below. It must not be forgotten, if these valves be used, that it will be necessary to change the values of the anode-circuit volt-dropping resistance, the screen-grid potentiometer, and the H.F. grid-bias resistance.

The H.F. circuits are normally adjusted so that, with the volume control at maximum; the set is near the oscillation point, but does not actually oscillate at any point within the tuning ranges. When the alterations mentioned above have been made it may easily happen that instability sets in or else one of the circuits has in some way become slightly damped, and the set is too stable. This may also be found even when the original specification has been strictly adhered to, owing to slight variations in individual components and their placing in the set. Tappings are provided on the anode-circuit coils to meet these cases, and it is by their adjustment that the set is, under all conditions, brought into its best operating condition.

In all there are some twenty-seven different

TABLE I.

Position.	1st H.F. Anode Coil.	2nd H.F. Anode Coil.	Detector Grid Lead.
1	Full coil	Full coil	$\frac{2}{3}$ coil
2	Full coil	$\frac{2}{3}$ coil	$\frac{2}{3}$ coil
3	$\frac{2}{3}$ coil	Full coil	$\frac{2}{3}$ coil
4	$\frac{1}{2}$ coil	Full coil	$\frac{2}{3}$ coil
5	$\frac{2}{3}$ coil	$\frac{2}{3}$ coil	$\frac{2}{3}$ coil
6	$\frac{2}{3}$ coil	$\frac{2}{3}$ coil	Full coil
7	$\frac{1}{2}$ coil	$\frac{2}{3}$ coil	$\frac{2}{3}$ coil
8	$\frac{1}{2}$ coil	$\frac{2}{3}$ coil	Full coil
9	$\frac{1}{2}$ coil	$\frac{1}{2}$ coil	$\frac{2}{3}$ coil

[3] "A New A.C. Screen Grid Valve." July 2nd, 1930.

Notes on the Band Pass Four.—

ways in which these tappings may be connected, and each will give a different degree of stability and amplification. A few of the more important positions are given in Table I for the medium-wave band and in Table II for the long-wave band; they are arranged in their approximate order of stability, beginning with the least stable arrangement. It should

TABLE II.

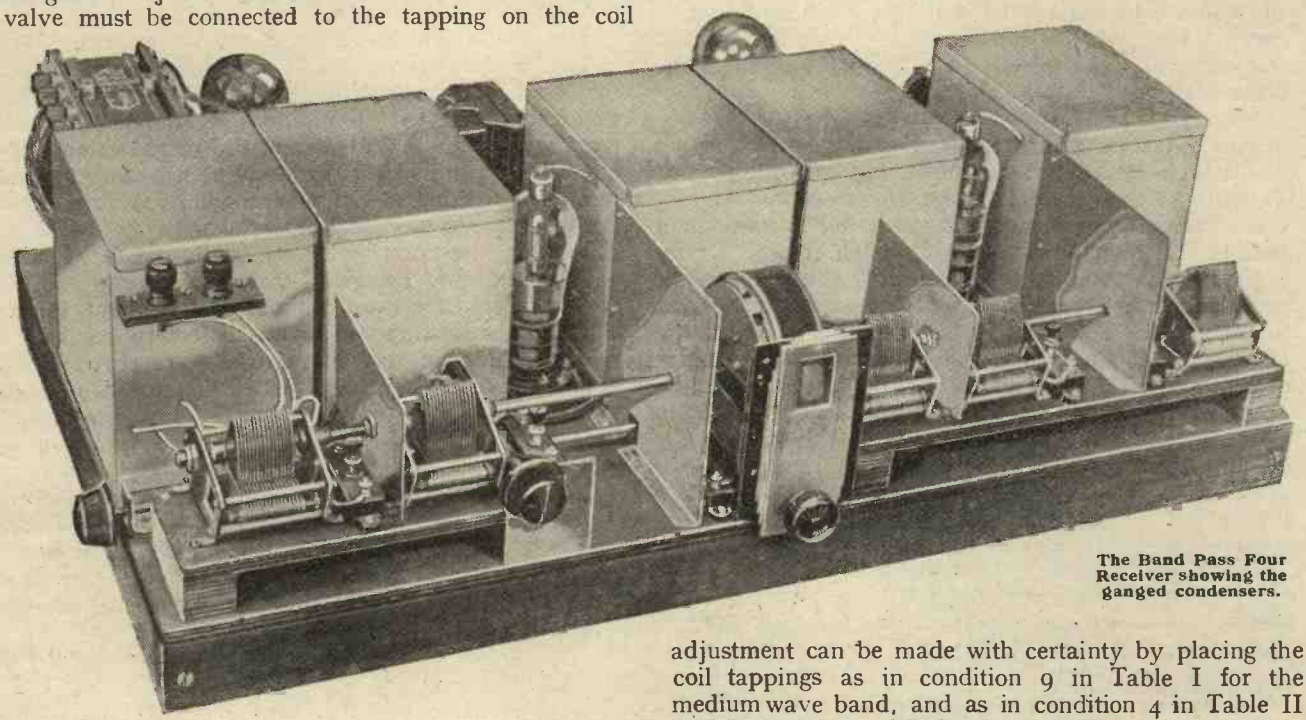
Position.	1st H.F. Anode Coil.	
	Tapping.	Connections.
1	Full coil	Reversed.
2	Full coil	Normal.
3	Tapping	Reversed.
4	Tapping	Normal.

be noted that the tapping positions are indicated by the amount of the coil to be included in the anode circuit of the valve. As an example, the tapping designated "⅔ coil" means that the anode lead of the valve must be connected to the tapping on the coil which is two-thirds of the way from the low-potential end of the coil. Similarly, the "normal" connections for the long-wave coil are those given in the original article, and the phrase "tapping, reversed connections" means, leave the anode lead joined to the tapping, and reverse the connections to the outer ends of the windings.

There are three conditions of satisfactory adjustment for the Band Pass Four, and which of these is chosen will naturally depend upon the builder's preferences in the matters of ease of control, ease of adjustment, quality, range, and selectivity. Each of these three adjustments gives a different "feel" to the set, and since it is the sensitivity which is chiefly affected it is convenient to designate them as "low," "high," and "normal" sensitivity.

Low Sensitivity.

The adjustment for low sensitivity is by far the easiest, and it results in the attainment, under all conditions, of the best possible quality from the set. The circuits are a long way from the oscillation point, and the tuning is by no means critical. The range of the set, however, is considerably less than that obtainable with either of the other adjustments, and the sensitivity is only sufficiently great to give full loud speaker reproduction from a few of the stronger Continental stations, such as Radio Paris, Hilversum, Kalundborg, Rome, Toulouse, etc. Owing to this reduced amplification this adjustment can only be recommended to those who desire the best possible quality with high selectivity and a limited number of alternative programmes. The adjustment can be made with certainty by placing the coil tappings as in condition 9 in Table I for the medium wave band, and as in condition 4 in Table II for the long-wave band.



The Band Pass Four Receiver showing the ganged condensers.

High Sensitivity.

The adjustment for maximum sensitivity is equally simple, and consists in placing the anode leads as in conditions 1 in both tables. This adjustment gives, under all conditions, the maximum range and selectivity, but at the expense of quality. With the volume control set at maximum the anode-circuit tappings are so placed that the receiver oscillates at all settings of the tuning dial. Oscillation can be controlled by means of the volume control, which, in addition to its proper sphere, is used as a control of regeneration. It will

Notes on the Band Pass Four.—

be seen that by adjusting the control so that the set is nearly, but not quite, oscillating the maximum range is secured.

Under these conditions the band-pass filters no longer retain the sidebands, and the quality is little better than that given by more normal tuning circuits. The full quality can be obtained, however, by placing the volume control in a position such that the set is not close to oscillation. Briefly, this sensitivity adjustment allows of the attainment of high quality with low sensitivity, and of ordinary quality with high sensitivity, merely by the adjustment of the volume-control knob. It will be seen, therefore, that if a certain loud speaker strength be required from all stations the quality will depend upon the strength of the transmitter, and, within limits, the stronger the station the better will be the quality.

This adjustment can be recommended for those who want to get the most out of the set, and who do not mind a little more trouble in tuning. Oscillation must always be avoided or the set will radiate quite as badly as any of the old single-valve sets. The quality with the volume control turned well down will be about as good as that with the low-sensitivity adjustment, while the sensitivity and selectivity will also be of the same order.

Normal Sensitivity.

This adjustment aims at securing all the advantages of the high-sensitivity adjustment, but with the circuits so adjusted that oscillation can never occur. At best this is a compromise, and the sensitivity is lower than that of the high adjustment, although it may closely approach it. As might be expected, the adjustments necessary to arrive at this condition are more difficult to carry out. The ideal to aim at is so to adjust the anode-circuits tappings that, with the volume control at maximum, the set is nearly, but not quite, oscillating at all points within the tuning ranges. It will usually be found impossible completely to attain this condition, and there will be a slight falling off in sensitivity at one or both ends of the tuning range. The tapping positions for this condition were given in the original article as two-thirds on each coil (condition 5 in Table I), and this will usually be approximately correct.

Ganging Changed by Alteration in Tapping.

To obtain the best results a certain amount of experimenting is necessary, but this can quickly be carried out if the following procedure be observed: Set the tappings for condition 5. If the set be unstable try condition 6; if it be still unstable try condition 7, and so on. On the other hand, if the set be too stable try condition 4, and so on. The various conditions in the tables are arranged in their approximate order of stability, but in one or two cases the difference is so small that slight variations between different sets might upset the order of stability.

This is the best adjustment for good all-round results, and can be recommended to those who want a receiver which, in addition to giving first-class quality with high selectivity, is highly sensitive without requiring any care in operation to avoid oscillation.

The adjustment of the ganging was discussed at length in the original article, and little more need be said about this. It must be borne in mind, however, that alterations to the positions of the anode-circuit tappings will affect the ganging to a slight extent; and after altering these tappings it will be necessary to readjust the equalising condensers. Similarly, if any alteration be made to the aerial the ganging of the first tuned circuit may be upset and need readjustment. It must not be thought, however, that the ganging will be greatly upset, for even without readjustment the set will usually continue to give satisfactory results. It is only when the very finest results are required that it becomes necessary to pay attention to such details as these.

A New Session.

Each year the Radio Exhibition heralds the opening of the wireless club season, though some of the more enterprising organisations are already under way before Olympia opens its doors.

Actually a few energetic clubs maintain their activities throughout the summer, finding that field days and occasional lectures during the heat waves help to retain the interest of members and guarantee a good start for the winter.

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Birmingham Stalwarts.

Prominent among the all-the-year-round clubs is Slade Radio (Birmingham). During the past summer, frequent meetings have been held and visits paid to places of wireless interest. On a recent Saturday a party of twenty members were conducted over the London Regional station at Brookmans Park, every detail being clearly explained by the B.B.C. engineers.

The winter programme includes lectures, demonstrations of the latest apparatus, debates, outings to places of interest, and several social functions. Full particulars can be obtained on application to the Hon. Secretary, 110, Hillaries Road, Gravelly Hill, Birmingham.

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For Bristol Enthusiasts.

The Friday evening lectures of the Bristol and District Radio Society, which proved highly popular last year, are to be continued as before in the Geographical Lecture Theatre of the University of Bristol.

"Radio Record," an instructive film presented by Messrs. Ensign, Ltd., was shown at the opening meeting, held on Friday, October 3rd. The meetings will be held weekly at 7.15 p.m., the first quarter of an hour being devoted to discussion.

Hon. Secretary, Mr. S. T. Jordan, 1, Myrtle Road, Cotham, Bristol.

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Meetings Twice a Week.

The Kentish Town and District Radio Society has opened its winter session. Meetings are held twice weekly, on Tuesdays and Fridays at 8 p.m. Keen members are cordially welcomed.

The Brookmans Park station was visited by an interested party on a recent Saturday afternoon.

Hon. Secretary. Mr. A. H. Sartain, 40, Harrington Street, Regent's Park, N.W.

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Elementary Lectures.

Wireless beginners in the N.E. district of London have an opportunity to increase their technical knowledge by means of a series of weekly lectures on elementary radio to be given at 7.45 p.m. on Fridays at the Dalston Literary Institute under the auspices of the London County Council. The lecturer is Mr. Robert W. Minter, A.I.E.E.

Particulars can be obtained on application to the Head of the Institute, Mr. R. H. Roberts, Dalston County Secondary School, Colvgrstone Crescent, Dalston, E.8.

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An Invitation.

Secretaries of wireless clubs are invited to send in syllabuses and reports of meetings for publication. Photographs are welcome.

CLUB NEWS.

FORTHCOMING EVENTS.

WEDNESDAY, OCTOBER 8th.

Muswell Hill and District Radio Society.—At 8 p.m. At Tollington School, Tetherdown, N.10. Lecture: "Elementary Principles of Radio," by Mr. Leonard Hartley, B.Sc., A.I.C. (First of a series of four lectures.)

North Middlesex Radio Society.—At 8 p.m. At St. Paul's Institute, Winchmore Hill, N.21. Lecture: "Wavemeters, by Mr. L. C. Holton.

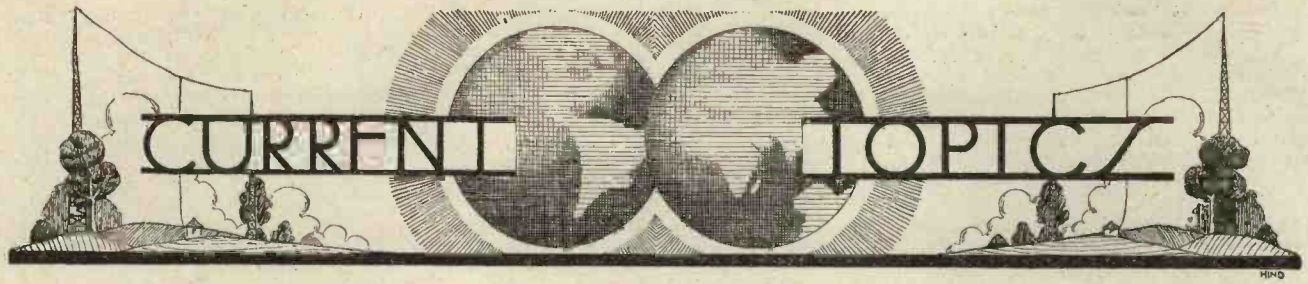
THURSDAY, OCTOBER 9th.

Kensington Radio Society.—At 8.30 p.m. At 20, Penywern Road, Earl's Court, S.W. Lecture: "Recent Improvements in Valve Manufacture," by Mr. Parr (of the Cosmos Lamp Works, Ltd.).

Slade Radio (Birmingham).—At 8 p.m. At the Parochial Hall, Broomfield Road, Erdington. Review of Olympia Radio Show.

FRIDAY, OCTOBER 10th.

Bristol and District Radio Society.—At 7.30 p.m. (Discussion from 7.15 p.m.). In the Geographical Lecture Theatre, University of Bristol. Lecture: "Wireless, its Progress and History," by a representative of the G.E.C.



Events of the Week in Brief Review.

SUPER-STATION FOR IRELAND.

What will probably be the most powerful broadcasting station in Western Europe is shortly to be erected in the Irish Free State. We are in a position to announce that the Saorstat Government has placed a contract for the erection of a 60-kilowatt transmitter with Marconi's Wireless Telegraph Co., Ltd.

The site has not yet been fixed, but will probably be in the neighbourhood of Athlone. The wavelength will be 413 metres.

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WIRELESS AND WINE.

Radio-Beziers, the French broadcasting station, re-opened on September 29th after an interval of silence. Situated in the French wine district, the station is to feature talks on subjects of interest to wine producers and wine consumers.

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FRENCH RADIO EXPORTS DOWN.

French official statistics show that the exports of wireless products fell considerably during the summer, the figure for June being half that of the same month in 1929 and the lowest recorded since December, 1928.

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BELGIANS PAY UP.

At least 100,000 Belgian listeners will, it is hoped, have taken out receiving licences by the conclusion of the first year's administration by the new National Institute of Broadcasting. The Committee joyfully announces that the tax receipts are mounting satisfactorily.

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OLYMPIA SHOW COMPETITION.

As we write these notes we learn that the entry forms for *The Wireless World* Olympia Show Competition are arriving in large quantities at the editorial offices, and some few days still remain before the closing date for forms to be posted.

It is not expected that it will be possible to announce the result of the ballot for two or three weeks because the task of sorting out the votes and ascertaining the winners in each class must necessarily take a considerable time. Meanwhile, we hope that every reader has participated in the ballot and will send in his form in good time if he has not already done so. The results will be announced as early as possible in *The Wireless World*. The prizes will be awarded, and subsequently it is again our intention to review the winning apparatus in the pages of this journal.

BROADCASTING AT 11 P.M.!

When a landlord complained last week at Lambeth County Court that his lodger's wireless set was working between 11 and 12 at night, Deputy Judge McCleary expressed surprise. Counsel, according to a newspaper report, said he thought there were foreign station broadcasts at that hour.

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FOR CLUB SECRETARIES.

"The Theory, Design and Operation of Gramophone Pick-ups" is the title of a new lecture, prepared by Messrs. Burndept, for delivery before radio societies. The lecture, which deals in particular with the Burndept Needle Armature Pick-up, can be followed by a demonstration.

All interested should communicate with Mr. W. D. Oliphant, B.Sc., Research Dept., Burndept Wireless (1928), Ltd., Eastnor House, Blackheath, S.E.3.

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PUBLIC 'PHONE TO JAPAN?

We learn that new directional equipment is being erected at the G.P.O. wireless station at Rugby in preparation for radio telephony tests between this country and Japan. A Post Office official informed *The Wireless World* that arrangements for the tests were fully discussed with Dr. Inada, Japanese Minister of Posts and Telephones, on his recent visit to England, and that preliminary experiments may start in a few weeks' time.

Should the tests prove successful a public service will be opened with Japan similar to the existing transatlantic service.

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FOR MANCHESTER STUDENTS.

Wireless is included in the programme of winter courses arranged by the Manchester Municipal College of Technology.

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THE STENODE RADIOSTAT.

We learn that a licence to manufacturers under the Stenode Radiostat patents is being issued by the British Radiostat Corporation, and we believe that the royalty has been fixed at 27s. 6d. per set.

At the cabled invitation of the Radio Manufacturers' Association of America, the Stenode Radiostat is to be demonstrated at the Chicago Radio Show on October 20th, and Dr. James Robinson, the inventor, accompanied by Mr. Percy W. Harris, are sailing for America this week to arrange the demonstration.

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NEW "SUPERHET." BOOM IN AMERICA.

The lowest prices in the history of American radio prevailed at Radio World's Fair, which has just closed after a successful week's run in the Madison Square Garden, New York.

GERMANY'S "BROADCASTING HOUSE." An aerial view of the new giant headquarters in Berlin of the German Broadcasting Company. The novel form of the building is typical of the daring architectural experiments common in Germany to-day.

Refinements rather than basic changes marked the majority of the receivers on view, writes a correspondent. The trend towards the superheterodyne was very noticeable. With their production all centred in Camden, N.J., described as "the new radio hub of the world," the Radiola, Victor, General Electric, Westinghouse and Graybar firms all offered superheterodynes. Newcomers in the superheterodyne field are the Grigsby-Grunow and Atwater Kent Companies.

There are now nearly fifty makers of "midget" sets, while at least a dozen manufacturers are offering car radio installations.

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COMPULSORY RECEPTION.

From December 31st next a Royal Decree, postponed to permit the manufacture of sufficient apparatus, will require all Italian non-passenger ships of less than 1,600 tons gross to carry a wireless set capable of receiving the Rome weather forecasts within a radius of 625 miles.

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A MENAGERIE BROADCAST.

"You are at this moment in the central cage of the Pezon Menagerie" was the announcement which recently thrilled listeners to the Radio P.T.T. Nord station at Lille. For three-quarters of an hour the programme consisted of the snarls, grunts, and other vocal efforts of a company of lions, tigers, leopards, wolves, hyenas, and bears. Our Paris correspondent reports that the item was accepted as an agreeable contrast to a recent concert by canaries.

The microphone, it is stated, had a narrow escape from the jaws of the lion, Sultan.

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TESTS FROM NORMANDY.

Tests with a new broadcast transmitter of 600 watts aerial output are taking place daily at Caen (Normandy), usually in the mornings between 11 and 1 o'clock, on a wavelength of 329 metres. British listeners are invited to send reports to Emissions Radio Nord-Ouest, poste de Caen, 59, rue St. Martin, Caen, France.

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TWO RECORDS.

At a time when records are being smashed in every sphere of human activity, from tree sitting to attendances at radio shows, France steps forward with two more claims, writes our Paris correspondent. France has suddenly realised that it possesses not only the highest aerial in the world (Eiffel Tower), but the highest wireless station, the latter being that situated in the Pic du Midi, at a height of nearly 3,000ft.

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BLINDED SOLDIERS AND WIRELESS.

In the Fifteenth Annual Report of St. Dunstan's for the year ended March 31st, 1930, sincere thanks are offered to the many Wireless Clubs, traders, and individuals who have helped blinded soldiers throughout the country to secure, install, and maintain wireless sets in their homes.

The report describes the efforts which are being made to make the lives of war-blinded men happy and useful.

DEADLY WORDS.

"Though the building, presumably, harbours thousands of deadly kilowatts, at only one spot do they seem not adequately leashed, and that is in the B.B.C. exhibit. At that point alone you are warned of high voltage. . . ."

Thus wrote a Birmingham journalist who visited the Olympia Radio Show, evidently unaware that the total power output of the B.B.C. amplifier supplying all the loud speakers did not exceed a kilowatt and a half!

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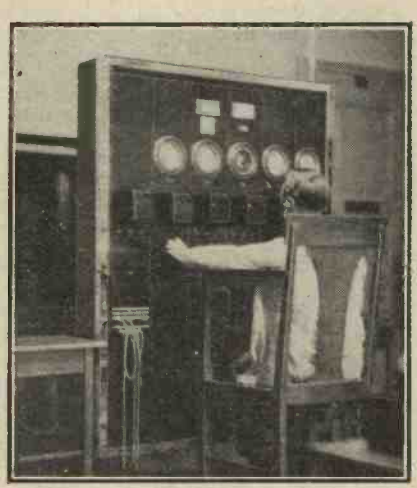
KDKA IN KILOWATT CONTEST.

With KDKA, Pittsburgh, about to go on the ether in after-midnight tests with 400 kilowatts of power, Station WGY, Schenectady, revealed plans to resume its experiments with 200 kilowatts in similar tests when it recently applied to the Federal Radio Commission for a renewal of the experimental licence of W2XAG,



THE WIRELESS CHAIR. A corner of the control room at Budapest, showing the chair specially constructed to facilitate manipulation of the dials. Note the high arm.

the auxiliary of WGY, writes our Washington correspondent. The superpower would be resumed on the frequencies of 550, 660, 790, 1,150, and 1,500 kilocycles. The 400 kilowatts of KDKA and the 200 kilowatts of WGY are the highest power, so far as any records reveal, ever attempted by any broadcasting stations in the world.

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VALVES FOR ASTRONOMERS.

A new valve which, it is stated, can accurately detect a variation of as minute a current as 63 electrons per second has been developed by the General Electric Company of America.

Prof. Joel Stebbins, director of the Washburn Observatory, is using two of these low-grid current valves with a quartz photo-electric cell to indicate the position, intensity and spectrum of remote stars. It is possible, according to the Professor, to make nearly all astronomical observations photo-electrically, rather than visually or photographically, with decided advantages in rapidity and sensitivity.

QUANTITATIVE ANALYSIS OF TELEVISION.

"Some Developments in Television Based on Quantitative Analysis" is the title of a lecture to be given this evening (Wednesday) by Mr. J. H. Owen Harries at the opening meeting of the Television Society's winter session. The meeting will be held at 7 o'clock at University College, Gower Street, London, W.C.1.

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THE FERRY 'PHONE.

A new use for wireless telephony has been found by the Canadian National Railways. The train ferries operating between the mainland at Tormentine, New Brunswick, and Borden, Prince Edward Island, convey passenger coaches and freight cars. Although the distance covered is not great, weather conditions frequently lengthen the time required for the passage. To maintain communication with the ferries at all times, the company has installed two small 100-watt wireless telephone transmitters and associated receivers. The ship sets are operated by remote control from the captain's cabin.

TRANSMITTERS' NOTES.

7- and 14-Megacycle Wave-bands.

Mr. Robert Holmes (G6RH) sends us his observations on recent short-wave working from his station at Allerton, Liverpool. Conditions generally are still very bad, and though there is plenty of work on the 42-metre band, very few distant stations are heard. The 21-metre band is, he says, nearly always blank, though he has been in communication with CT2AA at Fayal, Azores, and on Saturday, September 13th, with W1BUX and W1BSM in Massachusetts at 22.00 and 23.05 B.S.T. After 23.30 on that night all the distant stations seemed to disappear but several Belgian amateurs came in at unusual strength, especially ON4FE from Antwerp. Mr. Holmes asks if any others observed these peculiar conditions on that wave-length.

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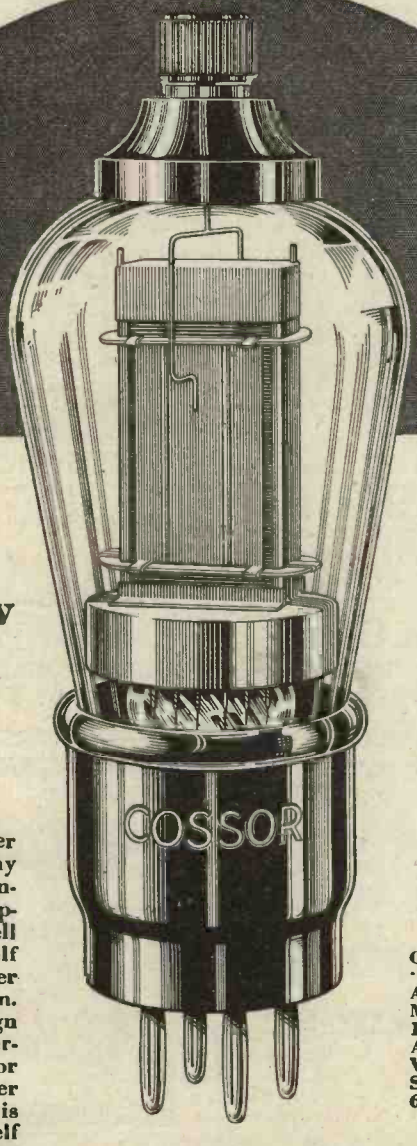
The R.S.G.B. Trophies.

The "Rotab" Cup, presented in 1926 by Mr. Gerald Marcuse for annual competition, has this year been won by Mr. Frank Miles (G5ML). This Trophy is awarded to the member who has accomplished some important long-distance transmission, or who has carried out, on behalf of the Society, some duty which has furthered its progress. The Wortley Talbot Cup, presented in 1928 by Dr. Wortley Talbot, has been won by Mr. Cecil Runeckles (SU8RS). The Powditch Transmitting Trophy is awarded to Mr. J. W. Matthews (G5LL), and the Receiving Cup to Mr. J. W. Hamilton (BRS 310) for 10-metre test held during this year. The Somerset Cup, presented by Mr. E. T. Somerset for short-wave working, has been won by Miss Barbara Dunn (G6YL). The Committee Cup is awarded to Mr. W H. Winchcombe (G6ZH).

Highest actual amplification!



—due to its abnormally low inter-electrode capacity

The effective H.F. amplification per stage that can be obtained in any Screened Grid Set is largely controlled by the inter-electrode capacity of the S.G. Valve. It is well known that the lower the self capacity of the valve the greater its effective stage amplification. Important features in its design and construction permit the inter-electrode capacity of the new Cossor 215 S.G. to be reduced to the order of .001 micro microfarads. This is substantially lower than the self capacity of any other Screened Grid Valve on the market. It follows, therefore, that this new valve permits a big increase in effective amplification. In fact, results are obtained which, a year ago, would have been considered quite impracticable.

Cossor 215 S.G. 2 volts, ·15 amp. Impedance 300,000. Amplification Factor 330. Mutual Conductance 1·1 m.a/v. Normal working Anode Volts 120. Positive Voltage on Screen approx.) 60. Price 20/-

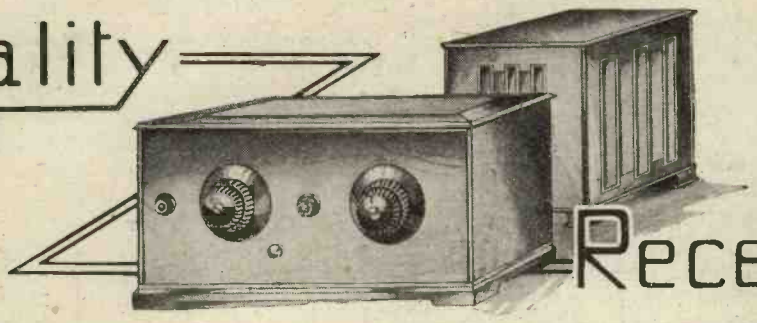
THE NEW COSSOR 215 S.G.

GREATEST *EFFECTIVE* STAGE GAIN

A. C. Cossor Ltd., Highbury Grove, London, N.5. 6261

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

Quality Reception



The Correction of Defects in the Receiving Set.

By JOHN HARMON.

(*Continued from page 372 of previous issue.*)

IF we abandon the use of reaction, and replace it by high-frequency amplification, and if, in addition, we eliminate audio chokes and voltage transformers by the use of resistance-capacity coupling in the audio amplifier, we can improve the reproduction of transients considerably. But the inductive and resonant loud speaker which is in universal use to-day offers a serious bar to further improvement. So well is this fact recognised that there is a distinct tendency to arrange for broadcasting programmes to be as free from transients as possible. The frequency with which the smooth and strongly rhythmic music of Bach is performed in the studio, as compared with the neglect of the works of Wagner, with their abrupt changes of mood and thunderous effects, may be traced to this cause.

The production of theatrical noises has been carefully studied at Savoy Hill, and it appears that in all cases the actual noise must be replaced by a device which gives a simpler and less abrupt air disturbance We must not shatter the listener's illusions by giving away these secrets, but one typical example may be cited as it is rarely called for: this is the imitation of the sound of a lawn mower or reaping machine by the rotation of an egg whisk! The reader can try this for himself, and will no doubt agree that there is a ridiculous similarity between the sounds.

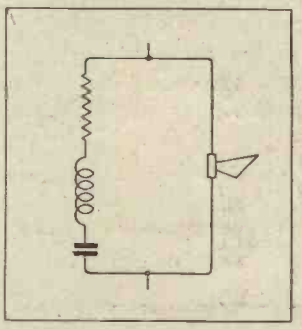


Fig. 9.—A tuned series circuit in parallel with a loud speaker reduces its emission over a frequency band.

We must now come to grips with the remedies which can be administered to unsatisfactory sets, and we shall find it best to begin with the output end and work backwards, since the performance of each stage is governed by the input supplied to it by the preceding stage.

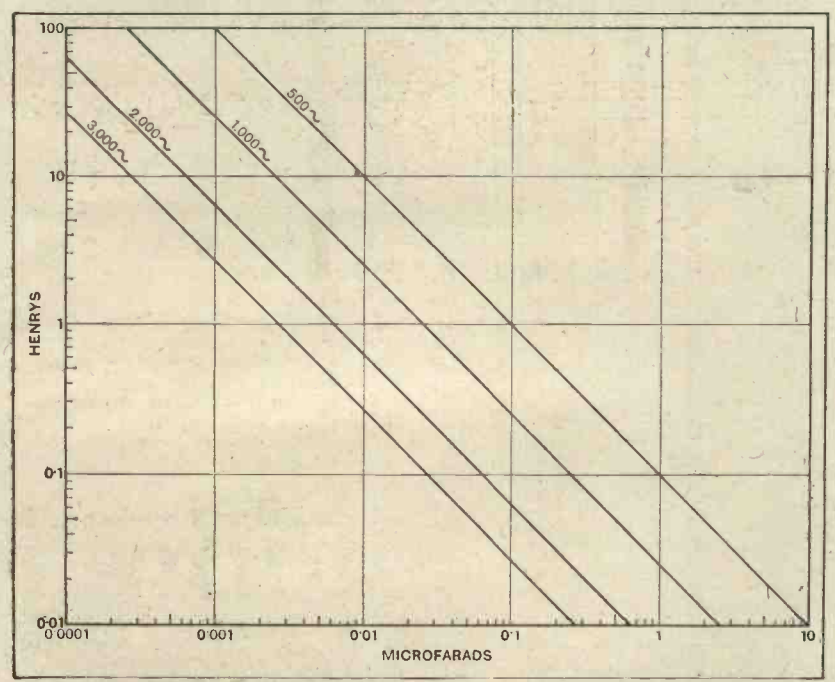


Fig. 10.—This chart gives values of inductance and capacity required to tune to any one of the frequencies indicated. Thus 0.1 henry with 0.015 mfd. tune to 1,000 cycles.

The Loud Speaker.

The loud speaker is the weakest link in the wireless chain in that it introduces more distortion than any other single component.[4] Usually, the low and high frequencies are attenuated, and often a lack of damping produces a peak somewhere about 1,000 cycles in the upper soprano register. The obvious cure for this state of affairs is to by-pass this region by a tuned circuit inserted in parallel with the speaker, and as this is a matter of importance we shall go into it in detail.

If, as in Fig. 9, we insert a series circuit tuned to 1,000 cycles, its

[4] We apologise in advance to Messrs. Smith, Jones, and Dobinson, whose loud speakers are not only perfect but actually improve on the original music.

Quality Reception.—

impedance at that frequency is that of the resistance alone since the coil neutralises the condenser, while at other frequencies the impedance may be quite large. The frequency at which the speaker blasts or sounds excessively loud should first be found by striking the corresponding note on the piano. Then from Fig. 10 a choice can be made of inductance and capacity which tune to this frequency. Thus at 1,000 cycles we may choose one henry and 0.015 mfd. The value of the series resistance can be chosen to suit the circumstances, i.e., the sharpness of the cut-out required. Fig. 11 shows the variation of impedance with frequency of such a series circuit. The curves correspond to a one-henry coil with a capacity to tune to 1,000 cycles, and the numbers attached to the curves indicate that the ratio of the series resistance to the reactance of the coil 1,000 cycles is 1, 0.4, 0.2, 0.1 or 1/15. Since reactance $= 2\pi fL = 2\pi \times 1{,}000 \times 1 = 6{,}280$ ohms; if we choose a resistance 0.1 times this value the resistance will be $6{,}280 \times 0.1 = 628$ ohms, and the impedance on tune will accordingly be 628 ohms, as shown for the peak of the 0.1 curve in Fig. 11. At 2,000 cycles or 500 cycles the impedance rises to 10,000 ohms, and has a negligible effect in shunting a 2,000-ohm speaker.

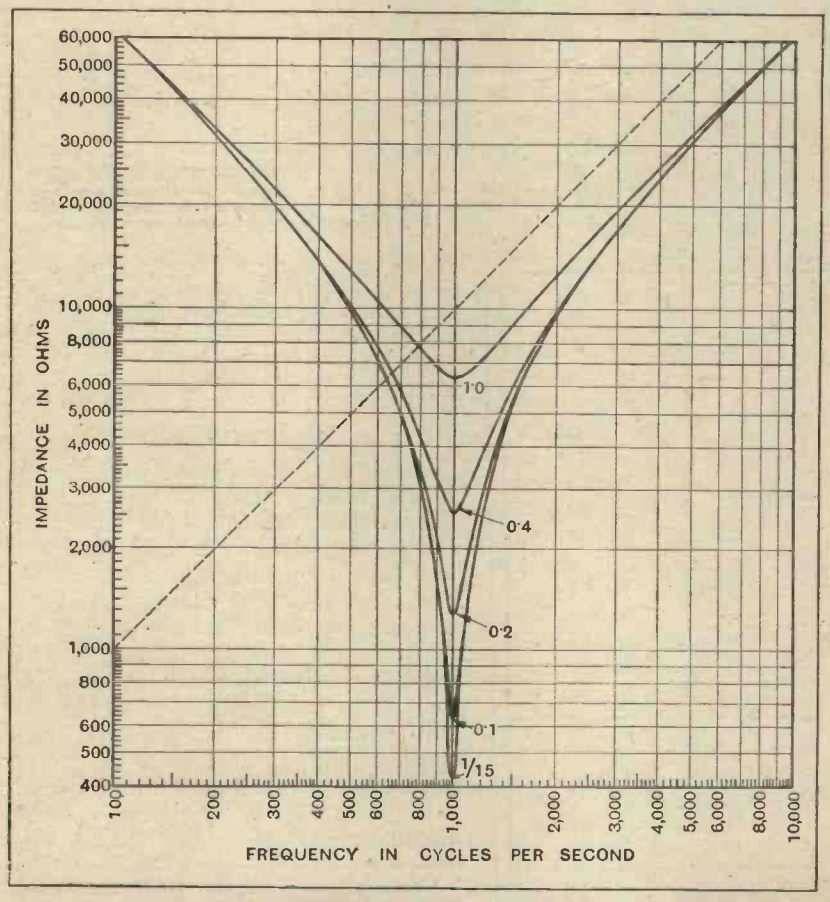


Fig. 11.—Impedance v. frequency for the tuned circuit of Fig. 9. The curves refer to a one henry-coil tuned to 1,000 cycles, with values of resistance/reactance as marked on each curve. The curves can be displaced to suit other values of inductance and tuning frequency, as explained in the text.

If we choose a coil of 2 henrys the reactance is doubled, and if we keep to the same ratio of resistance to reactance the whole curve should be displaced upwards by an amount equal to the distance between 1 and 2 on the vertical scale. Accordingly, by copying the curves on tracing paper we can displace them to fit any reasonable value of reactance and resistance. Thus with a low-impedance speaker we might require a 0.1 henry coil: in this case the curve must slide downwards by a distance equal to the distance between 1 and 10 on the vertical scale. This brings the curves off the squared diagram, but the same result can be attained by leaving the curves in position and dividing the vertical-scale numbers by 10.

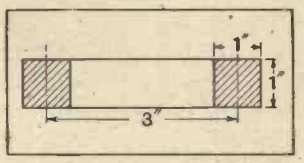


Fig. 12.—Dimensions for a suitable former on which to wind the air-core choke described in the text.

If the one-henry coil is to be tuned to, say, 2,000 cycles, the curves should be displaced parallel to the dotted line till the peaks rest on 2,000 cycles. All reactance of values will then be doubled as the formula indicates should be the case.

A suitable air-cored coil can be wound on the circular former shown in Fig. 12. The resistance and inductance obtained when different wire gauges are used to fill the winding space are calculated from "Radio Data Charts" and are given in the table.

The last column shows that the resistance is a small fraction of the reactance, and an added resistance is necessary to broaden the absorption band. The 0.12 henry coil is suitable for low-impedance speakers, while the 0.8 henry coil is of the right order for high-impedance speakers.

Inductance Calculation for Iron-cored Coils.

When an iron-cored coil is used, the core being built up from Stalloy stampings, the inductance is given by the formula

$$\text{Henrys} = 1.3 \times \left(\frac{n}{100}\right)^2 \times \frac{b}{l} \times t$$

where n = number of wire turns.
b = breadth of stamping (Fig. 13) in inches.
l = length of mean magnetic path (Fig. 13) in inches.
t = thickness of built-up core in inches.

Thus for a No. 4 stamping $b = 1''$, $l = 9''$, hence if 300 turns are put on $L = 1.3 \times 3 \times \frac{1}{9} \times 1 = 1.3$ henrys when the core is built up to a thickness of $1''$.

Fig. 14 illustrates four ways of

Quality Reception.—

coupling the speaker. The first method of direct connection is to be utterly condemned since the D.C. valve current will upset the balance of the reed and pull it towards the stop: chattering may thus be caused when the amplitude of vibration becomes large at low frequencies, and the unbalance will cause unsymmetrical vibration and introduce harmonics. Besides, the impedance of the speaker is probably smaller than that of the valve, so that the power transformation is not efficient. Transformer coupling with the primary in the plate circuit gets rid of all these difficulties and is the method most commonly used. The iron core should be built up from stampings, at least No. 4 size, to avoid magnetic saturation due to the direct current. Low notes will be lost if the volume of iron is insufficient. Stalloy should be used for this transformer in preference to the new nickel-steel alloys, which are easily saturated by D.C., but are quite suitable for diagrams (c) and (d) in Fig. 14, where no D.C. component exists.

TABLE OF INDUCTANCE WINDINGS.

Wire Diameter in Inches (S.S.C.).	Turns.	Yards.	D.C. Resistance in Ohms.	Henrys.	Reactance at 1,000 Cycles.	Resistance / Reactance.
0.036	1,560	390	9	0.12	760	0.012
0.022	4,000	1,000	65	0.80	5,000	0.013
0.018	5,800	1,450	140	1.7	10,000	0.014
0.0124	11,700	2,900	580	6.8	43,000	0.014

D.C. current in the transformer primary is eliminated when choke-condenser coupling is used, but it must be remembered that the choke itself must be large enough to avoid magnetic saturation. This coupling is an attractive one for the experimenter since the speaker and transformer are cut off from the H.T. supply and so can be experimented with safely.

Push-pull transformation gives the best quality of all: the magnetic effects of the D.C. components cancel out in the primary, and in addition the curvature of the lower bend of the characteristic of one valve is compensated by the opposite curvature of the upper bend of the other. The absorption circuit of Fig. 11 can be used when required with any of these coupling schemes since it is simply connected across the terminals of the loud speaker.

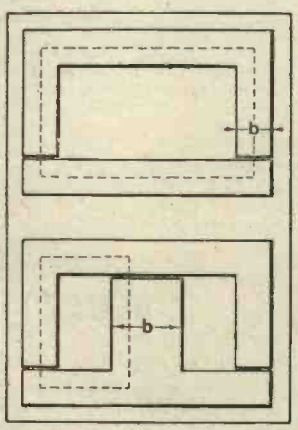


Fig. 13.—Two types of stampings used for iron cores. In each case (1), the mean magnetic path, is shown in broken lines, while (b) is the breadth of stamping to be used in the formula.

If the speaker should give excessive reproduction of high frequencies the absorption circuit can be tuned to a higher pitch and will deal with the matter effectively, but a simpler method is to connect a condenser across the speaker terminals. Values between 0.02 and 0.05 mfd. are suitable for a 2,000-ohm speaker.

In the rare case of excessive reproduction of low notes the best method is to reduce the low-frequency input to the grid of the power valve by using a smaller grid condenser than usual.

The Power Valve.

The purchase of a milliammeter for insertion in the plate circuit of the power valve is well justified. Not only

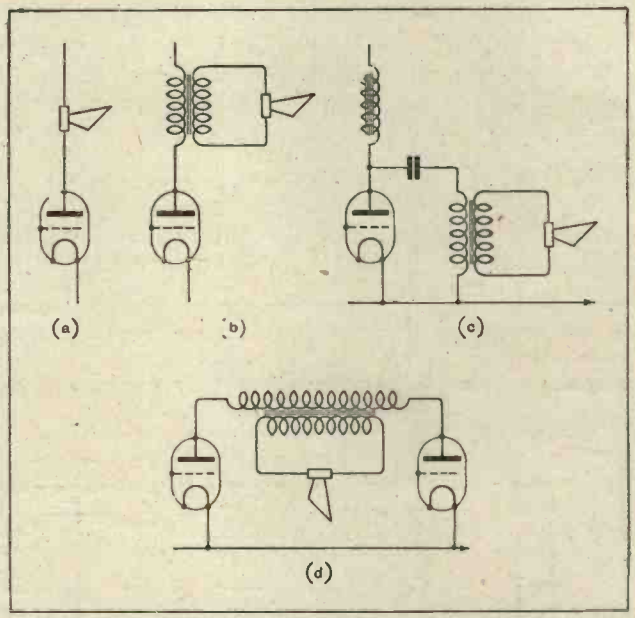


Fig. 14.—Types of loud speaker coupling. (1) direct connected. (2) transformer coupled. (3) choke-capacity coupled. (4) push-pull transformer coupled.

does it give timely warning of the need to recharge the H.T. and L.T. batteries, but the slightest overloading is at once proclaimed and the correct value of grid bias made manifest. Since the grid of the power valve is not in *direct* connection with the preceding stage, but either inductively connected through a transformer or capacitatively through a condenser and grid leak, the oscillations impressed on the grid swing symmetrically above and below the undisturbed value of the grid potential, and hence if the valve is working over the straight part of its characteristic curve the swing of plate current will also be symmetrical. Accordingly, the average current as read on the plate meter should remain constant.

When the valve is overloaded this symmetry is destroyed and the needle flickers. Moreover, the direction in which the needle first moves at the beginning of a flicker indicates the state of the grid bias; if the bias is insufficient the top of the grid swing is cut off when it reaches the filament voltage, owing to grid current, so that the top of the plate current swing is also cut off, and the average current decreases. If the bias is excessive the negative grid swing reaches the curved parts of the characteristic where the plate current is smaller, so that the average current increases. The correct bias is found by adjustment till flicks occur on the average as often to the right as to the left.

Quality Reception.—

It is easy to adjust the whole receiver so that the power valve is the first to overload; a steady plate current then indicates that the set is working within its capacity.

Pentode *versus* Triode.

The introduction of the pentode power valve has made it possible to cut out a stage of intermediate L.F. amplification and so to feed the power valve directly from the detector. This economy, however, is not without drawbacks from the point of view of quality; these arise from the peculiar characteristic curves of the pentode and the distortion produced by them.

The curves of a triode (Fig. 15) are sensibly parallel and equally spaced straight lines over a considerable length, and with a suitable plate load the working point moves along a line such as AB. It is easily seen that for equal changes of grid potential equal changes of plate current occur, so that no distortion results.

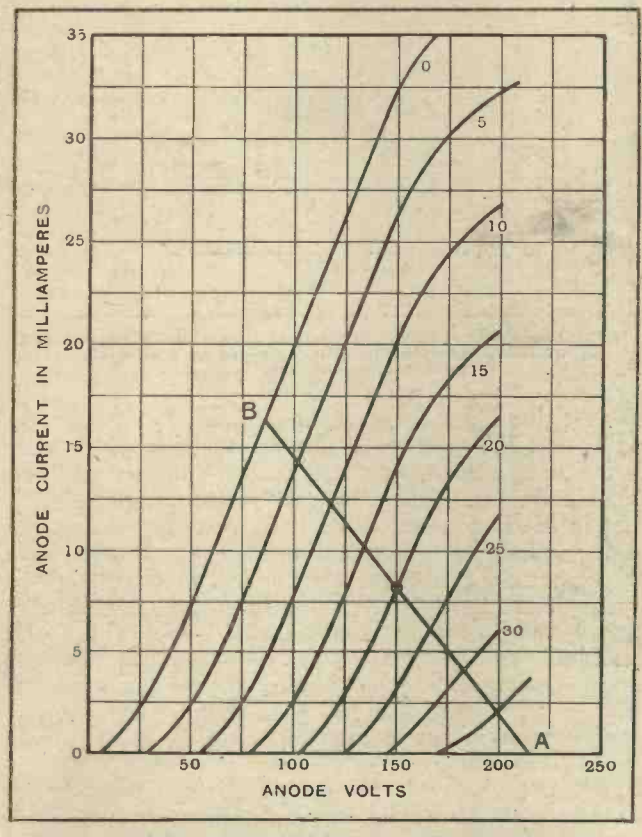


Fig. 15.—Triode characteristic curves. With 150 plate volts, 20 volts grid bias and a resistance load of 8,000 ohms thrown in the plate circuit through a transformer, the dynamic characteristic is the thick line. It is clear that the plate current follows the grid swing without distortion.

In the case of the pentode (Fig. 16) the characteristics are curved from the origin up to the value of the supply voltage, and straighten out beyond this point. The working line AB intersects many of the characteristics where they are strongly curved, and it is plain that the change in plate current is no longer proportional to the grid swing over the whole of the working line, and hence distortion arises. The distortion, however, is not severe since it produces only a slight flattening of the current swing equivalent to the introduction of about 5 per cent. of a third harmonic, and may

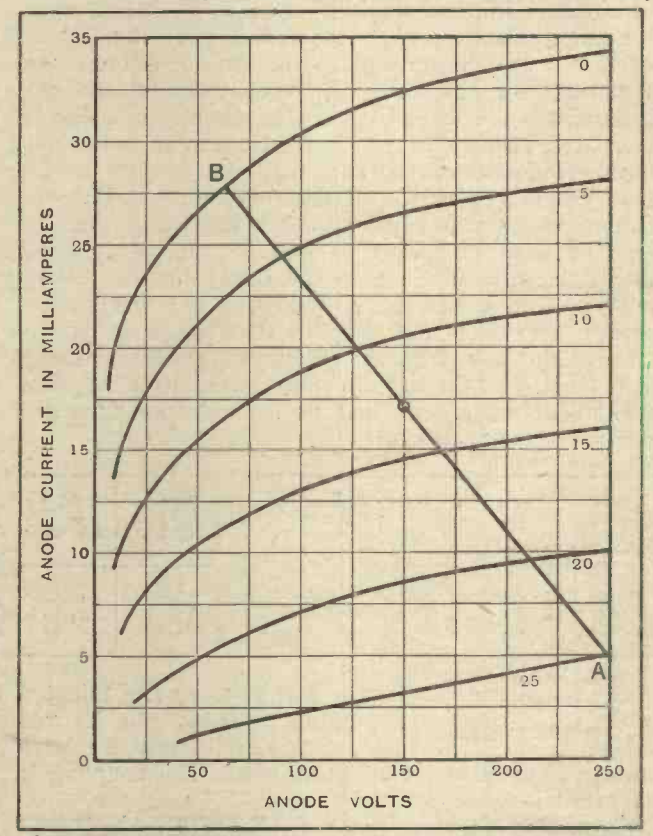


Fig. 16.—Pentode characteristic curves. Under the same conditions as in Fig. 15, but with 12.5 volts grid bias, the change in plate current for a given change in grid potential becomes smaller as the grid potential approaches filament potential and so distortion results.

be considered negligible compared with the errors associated with the average loud speaker. In a search for the best possible quality, however, we must remember that this distortion does actually exist.

(*To be continued.*)

o o o o

BOOKS RECEIVED.

Alternating Current Bridge Methods for the measurement of Inductance, Capacitance and Effective Resistance at Low and Telephonic Frequencies, by B. Hague, D.Sc. Second edition revised and enlarged. Pp. 391+XVI, with 112 diagrams and illustrations. Published by Sir Isaac Pitman and Sons, Ltd., London, price 15s. net.

Guide to Wireless (fifteenth edition), compiled by G. J. Dale, of the Saxon Radio Co., Blackpool. A handbook which, while dealing mainly with the apparatus and components of this firm, contains much useful advice to novices in the choice and equipment of receiving stations, including a three-valve receiver for wavelengths from 14 to 550 metres. Pp. 96, with numerous illustrations and diagrams. Price 1s., post free.

Ralph Stranger's Wireless Library for the "Man in the Street." No. 8, Wireless Waves. No. 9, Wireless Communication and Broadcasting. No. 10, Modern Valves. No. 11, How to Understand Wireless Diagrams. No. 12, Selection of Wireless Signals. Each number pp. 64, with numerous illustrations and diagrams, price 1s. Published by George Newnes, Ltd., London.

BROADCAST BREVITIES

By Our Special Correspondent.

Warehouse Calling.

Studio No. 10, which I was privileged to visit a few days ago, suggests to a passer-by a derelict fire station converted into a night club. If he were to follow one of those dress-suited figures past the deserted wharves and through the red doors of a corner warehouse, the inquisitive visitor would find himself in the largest broadcasting studio in Britain, if not in the world.

oooo

A Flood of Light.

The colour scheme—green and yellow—helps to give a sense of vastness to the new "studio," which is bathed in a flood of light from ninety-six 100-watt lamps.

oooo

Crisp Echo Effect.

Many listeners who heard the preliminary broadcast on Friday last by Jack Payne and his dance orchestra will have noted the crisp echo effect, not unlike that which we associate with the Grand Hotel, Eastbourne. This is partly due to the undraped walls, consisting merely of painted brick, and to the unusual height of 30 feet from the carpeted floor to the draped ceiling.

oooo

Four Microphones.

Provision is made for four microphones. The extensions are taken to the A amplifier in a small room adjoining the studio and thence by private line, about 500 yards in length, to the control room at headquarters.

oooo

An "O.B." Triumph.

Although Studio No. 10 is regarded almost as an annexe to Savoy Hill, the arrangements are in the hands of the "O.B." Department. They have done their job well in transforming a dungeon into a palace in less than five weeks.

oooo

Twelve Months.

Considering the price per acre of inlaid linoleum and carpets cut to fit, it is a pity that the new studio is to be dismantled in twelve months' time, when Broadcasting House is opened.

The thoughtful listener may ask whether the output of the orchestra of 114 players will make such a difference in his loud speaker as to warrant the expense.

oooo

Noisy Loud Speakers.

The oscillation nuisance was once the main theme for fiery correspondence received by the B.B.C. Nowadays more letters deal with the noisy loud speaker.

From time to time tactful pleas are made at the microphone, but these seem merely to provoke the retort that the Englishman's home is his castle or, rather, his concert hall.

oooo

Troubles of the Semi-detached.

The B.B.C. can hardly be expected to sympathise violently with those who suffer through the broadcasting enthusiasm of their neighbours. If, as Savoy Hill must wish, we all listened all the time we should never hear the neighbour's set.

The loud speaker has come to stay, and those who are unable to preserve a detached attitude in a semi-detached villa should quarrel with the builders, not the B.B.C.

oooo

A Fortune Waiting.

Builders are now offering startling inducements to prospective purchasers of

"STUDIO NO. 10." This photograph of the converted warehouse was taken under the southernmost arch of Waterloo Bridge. With a floor area of 4,000 square feet, the studio is probably the largest in the world.

their houses. Who will be the first builder to produce party walls "guaranteed sound-tight"? A fortune awaits him.

oooo

News for Northern Listeners.

Many listeners in the North will like to know what are the plans for broadcasting in their region during the winter months. This information will be forthcoming on October 18th at 7 p.m., when the North Regional Director will speak on the programmes.

Empire Broadcasting.

From the Prime Minister himself we have already learnt that Empire Broadcasting is included in the agenda of the Imperial Conference. But we may be sure that the discussion will take a different form from that at the recent conference of delegates from the Colonies.

Unlike the Colonies, the Dominions are not thirsting for entertainment of any sort so long as it comes from the Old Country.

oooo

The Dominions Won't Pay.

The Dominion delegates will show financial rather than artistic concern over the Empire broadcasting proposals. On reliable authority I learn that suggestions will be put forward for a *quid pro quo* arrangement as regards programmes, in preference to any system of payment.

oooo

The Case of Australia.

It is not difficult to appreciate the Dominion point of view. Australia, to take an example, enjoys good programmes of her own, and her licence-holders would be entitled to ask whether the luxury of receiving beam relays from England would be worth an addition to the already stiff annual licence fee of 24s.

oooo

Manchester Show Broadcast.

The North Regional evening programme on October 14th consists of an orchestral concert from the seventh Manchester Radio Exhibition at the City Hall, Manchester. The artists are the Northern Wireless Orchestra, conducted by T. H. Morrison, and Dorothy Donaldson (soprano). The music will be of a popular nature, and of particular interest is Saint-Saëns' very amusing piece, "Le Carnival des Animaux."

oooo

A Broadcast Banquet.

In addition to the Prince of Wales's speech at the League of Nations Union banquet on October 30th, the relay from the Guildhall will include the speech of Lord Grey of Fallodon, the chairman.

The banquet is in honour of the delegates from the Dominions and India attending the Imperial Conference and the British and Dominion delegates to the eleventh Assembly of the League of Nations.

oooo

Opera in the Studio.

When Puccini's opera, "Madame Butterfly," was first produced at the Scala, Milan, it was greeted with howls of derision. It has since been received everywhere with enthusiasm.

Percy Pitt will conduct the broadcast performances on October 16th and 17th, Elizabeth Nelvi taking the title rôle.

oooo

Wireless Described.

Despite the prevailing impression that the British public is advancing in radio knowledge, the B.B.C. received a letter last week which began:—

"I shall try and give you a description of my wireless. A quantity of wires are enclosed in a box; on the front of this box there is an accumulator with figures from 0 to 180. . . ."

MANCHESTER RADIO SHOW.

LIST OF EXHIBITORS—SEE PLAN OPPOSITE.

The Seventh Annual Wireless Exhibition, organised by "The Manchester Evening Chronicle," will be opened to-day (October 8th) in the City Hall. The following List of Exhibitors, together with the Plan on the opposite page, will provide readers attending the Show with a suitable Guide to the Stands. The Exhibition remains open until Saturday, October 18th.

ALLIED Newspapers, Ltd., (3 & 4)
Withy Grove, Manchester.

BAKER'S Selhurst Radio, (110)
89, Selhurst Rd., South Norwood, London, S.E.25.
Beardsall & Co., Ltd., W. E., (2)
Victoria Bridge, Manchester.
Belling & Lee, Ltd., (7)
Queensway Works, Ponders End, Mddx.
Bernard Jones Publications, Ltd., (11)
58, Fetter Lane, London, E.C.4.
British Electrical Instrument Co. (127)
British Talking Pictures, (129)
Brederson, A., (105)
11, Northampton Sq., Goswell Rd., London, E.C.1.
Brown Bros., Ltd., (55)
265, Deansgate, Manchester.
Brown, Ltd., S. G., (39)
Western Ave., N. Acton, London, W.3.
Brownie Wireless Co. of Great Britain, (37)
Ltd., Nelson St. Works, Mornington Crescent, London, N.W.1.
Burndept Wireless (1928), Ltd., (17)
Eastnor House, Blackheath, London, S.E.3.

CELESTION, Ltd., (41)
London Rd., Kingston-on-Thames.
(Also Audition Room No. 1.)
Chloride Electrical Storage Co., Ltd., (27)
Clifton Junction, nr. Manchester.
Clarke & Co. (M/c.), Ltd., H., (40)
Atlas Works, Old Trafford, Manchester.
Cole, Ltd., E. K., (44)
Ekco Works, Southend-on-Sea.
Collie & Co., J. H., (121)
10, Canning Place, Liverpool.
Competitions—Radio Show Contest. (71 & 72)
Concerton Radio & Electrical Co., Ltd., (67)
256/7, Bank Chmrs., 329, High Holborn, London, W.C.1.
Continuous Gramophones, Ltd., (84)
Continuous Works, Hoe St., Walthamstow, London, E.17.
Coranto Cabinet Co., (70)
122, Leaf St., Stretford Rd., Manchester.
Cossor, Ltd., A. C., (30)
Cossor House, Highbury Grove, London, N.5.

DUBILIER Condenser Co. (1925), Ltd., (15)
Ducon Works, Victoria Rd., North Acton, London, W.3.
Dulcetto-Polyphon, Ltd., (79)
2-3, Newman St., London, W.1.
Dunhams, Ltd., (100)
Bellerophon Works, New Wharf Rd., London, N.1.

EAGLE Engineering Co., Ltd., (108)
Eagle Works, Warwick.
Econasign Co., Ltd., (104)
137, Victoria St., London, S.W.1.
Edison Swan Electric Co., Ltd., (28 & 29)
1a, Newman Street, London, W.1.
Ensign, Ltd., (62)
88, High Holborn, London, W.C.1.
Epoch Radio Manufacturing Co., Ltd., (103)
3, Farringdon Ave. London, E.C.4.
Ever-Ready Co. (G.B.), Ltd., (18)
Hercules Place, Holloway, London, N.7.

FERRANTI, Ltd. (51, 52 & 114)
Hollinwood, Lancs.
(Also Audition Room No. 4)
Fonteyn & Co., Ltd., (9)
2, 4, 5, & 6, Blandford Mews, Baker St., London, W.1.
Formo Co., (32)
Crown Works, 22, Cricklewood Lane, London, N.W.2.
Fuller Accumulator Co. (1926), Ltd., (96)
Woodland Works, Chadwell Heath.

GARNETT'S, (76)
Islington Grove Works, Salford, Manchester.
Garnett Whiteley & Co., Ltd., (25)
Mill Lane, Old Swan, Liverpool.
General Electric Co., Ltd., (48)
Magnet House, Kingsway, London.
(Also Audition Room No. 3)
Manchester Depôt: Victoria Bridge, Manchester.
Gramo-Radio, Ltd., (118)
Commercial Works, Church, Accrington.
Gripso Co., The, (109)
32, Victoria St., London, S.W.1.

HALLIWELL. (88)
Hardman & Co., Ltd., (48)
The Baum, Rochdale.
Harlie Bros. (Edmonton), Ltd., (113)
Balham Rd., Lower Edmonton, London, N.9.
Hobday Bros., Ltd., (95)
21, Great Eastern St., London, E.C.2.
Hollingdrake & Son, Ltd., Henry, (58)
65, Prince's St., Stockport.
Hyde. (122)

IGRANIC Electric Co., Ltd., (49)
147, Queen Victoria St., London, E.C.4.
Imperial International. (97)
Impex Electrical, Ltd., (120)
538, High Rd., Leytonstone, London, E.11.

JUNIT Manufacturing Co., Ltd., (69)
2, Ravenscourt Sq., London, W.6.

KALISKY (Aldgate), Ltd., (10)
75, Aldgate High St., London, E.1.
Kolster-Brandes, Ltd., (21)
Cray Works, Sidcup, Kent.

LECTRO-LINX, Ltd., (111)
254, Vauxhall Bridge Rd., Westminster, London, S.W.1.
Lissen, Ltd., (12 & 13)
Worple Rd., Isleworth, Mddx.
London Electric Wire Co. & Smiths, Ltd., (68)
7, Playhouse Yard, Golden Lane, London, E.C.1.

MAINTEN Manufacturing Co., Ltd., (90)
22, Gray's Inn Rd., London, W.C.1.
Majestic Distributors (M/c.), Ltd., (94)
2, & 4, Victoria Bridge Rd., Manchester.
Marconiphone Co., Ltd., (38)
210/212, Tottenham Court Rd., London, W.1.
McMichael, Ltd., L., (53)
Wexham Rd., Slough, Bucks.
Moores & Co., J., (8)
Ravald St. Works, Salford.
Mullard Wireless Service Co., Ltd., (45 & 46)
Mullard House, Charing Cross Rd., London, W.C.2.

NATIONAL Accumulator Co., Ltd., (92)
50, Grosvenor Gdns., London, S.W.1.
New London Electron Works, Ltd., (80 & 81)
East Ham, London, E.6.
Northern Steel & Hardware Co., Ltd., (101)
1-3, Southgate, Deansgate, Manchester.

OLDHAM & Son, Ltd., (42)
Denton, Manchester.
Ormond Engineering Co., Ltd., (64)
Ormond House, Rosebery Ave., London, E.C.1.

PARTRIDGE, Wilson & Co., (23).
217a, Loughborough Rd., Leicester.
Pertrix, Ltd., (36)
Britannia House, 233, Shaftesbury Ave., London, W.C.2.
Philips Lamps, Ltd., (19 & 20)
Philips House, 145, Charing Cross Rd., London, W.C.2.
(Also Audition Room No. 2)
Potter & Co., Ltd., H. B., (60)
Station Buildings, Rochdale.
Pye Radio, Ltd., (50)
Radio Works, Cambridge.

RADIO Instruments, Ltd., (83)
Purley Way, Croydon.
Radio Loud Speakers, Ltd., (73)
Cranmer Works, Cranmer Court, High St., Clapham, London, S.W.4.
Rawson, H. C. (Sheffield and London), Ltd., (26)
100, London Rd., Sheffield.
Redfern's Rubber Works, Ltd., (33)
Hyde, Cheshire.
Rialtoif Radio, (117)
13-14, Golden Sq., London, W.1.
Richardsons, (77)
24, St. John St., Deansgate, Manchester.
Ritherdon & Co., Ltd., (98)
Bolton.
Roberts, John, (119)
1-3, Bridgewater Viaduct, Knott Mill, Manchester.
Rothermel Corporation, Ltd., (75)
24-26, Maddox St., London, W.1.
Rowley, Ltd., Thos. A., (126)
59, Skinner Lane, Dean St., Birmingham.

SCOTT & Co., Ltd., G. L., (102)
Morris House, 60-66, Rochester Row, London, S.W.1.
Selectors, Ltd., (6)
206-207, Bedford Av., Slough Trading Estate, Slough, Bucks.
Siemens Bros. & Co., Ltd., (59)
Woolwich, London, S.E.18.
Sifam Electrical Instrument Co., Ltd., (116)
Bush House, Aldwych, London, W.C.2.
Six-Sixty Radio Co., (54)
17-18, Rathbone Place, London, W.1.
Sovereign Products, Ltd., (65)
52, Rosebery Av., London, E.C.1.
Squire, F., (115)
24, Leswin Rd., Stoke Newington, London, N.16.
Standard Battery Co., (61)
184-188, Shaftesbury Av., London, W.C.2.
Stott, J. E., (107)
15, Clare Hill, Huddersfield.

TELSEN Electric Co., Ltd., (31)
Miller St., Birmingham.
Trader Publishing Co., Ltd., (1)
Salisbury Sq., London, E.C.4.
Triotron Radio Co., Ltd., (78)
91, Great Russell St., London, W.C.1.
Tungsram Electric Lamp Works (Gt. Britain), Ltd., (35)
72, Oxford St., London, W.1.
Tutills, Ltd., (14)
7-9, Swan St., Manchester.

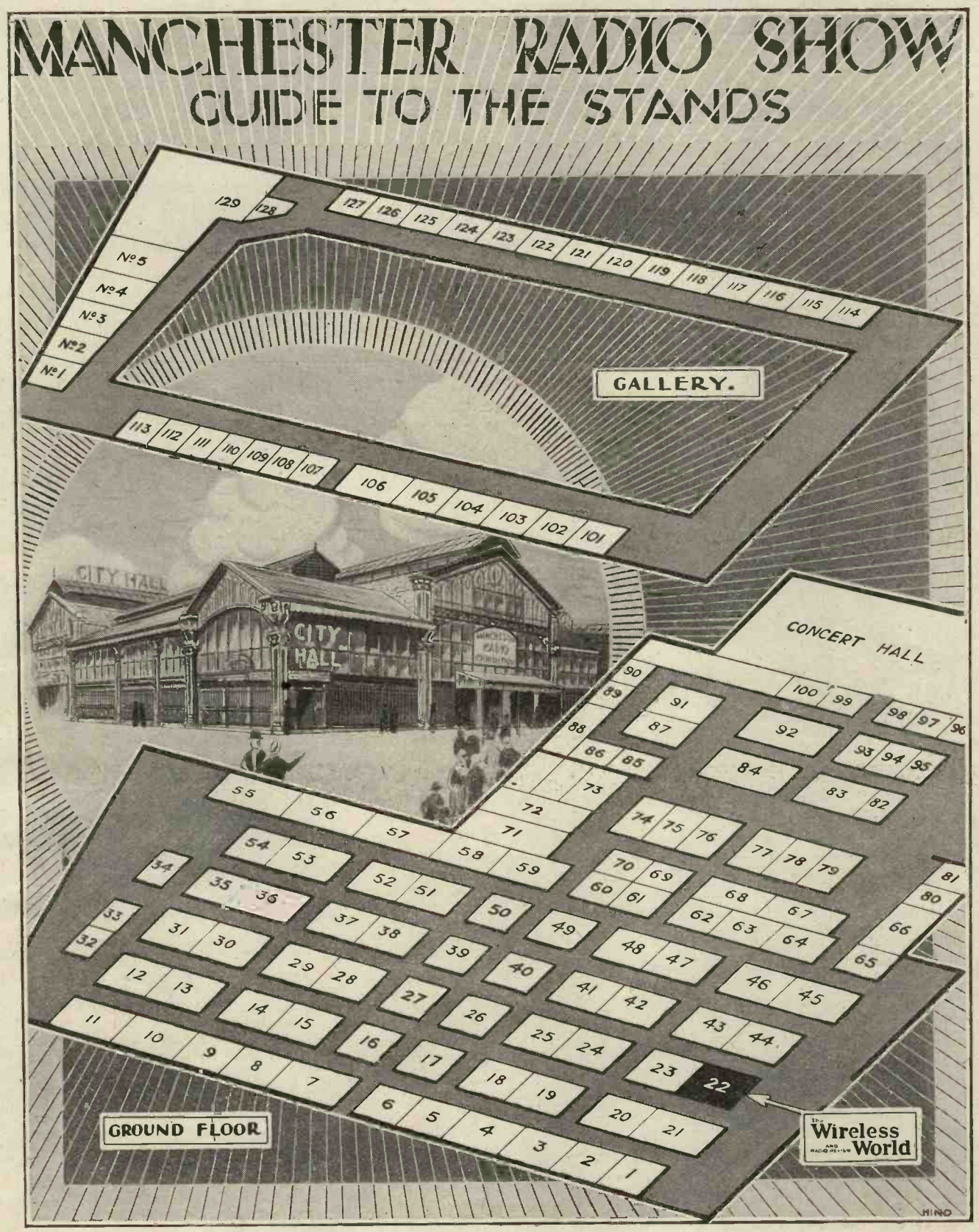
ULTRA Electric, Ltd., (74)
661-663, Harrow Rd., London, N.W.10.
Umello, Ltd., (93)
12, Doughty St., London, W.C.1.
Universal Electric Supply Co., Ltd., (85 & 86)
4 and 8, Brown St., Manchester.
Universal Gramophone & Radio Co., Ltd., (87)
Ryland Rd., Kentish Town, London, N.W.5.

VANDERVELL and Co., Ltd., C. A., (43)
Warple Way, Acton, London, W.3.
Varley (Oliver Pell Control). (56 & 57)
103, Kingsway, London, W.C.2.

WARD & Goldstone, Ltd., (16)
Frederick Rd., Pendleton, Manchester.
Watmel Wireless Co., Ltd., (5)
High St., Edgware, Middlesex.
Wellworth Wireless Co., (63)
8, Withy Grove, Manchester.
Westinghouse Brake and Saxby Signal Co., Ltd., (66)
82, York Rd., London, N.1.
White and Co., Ltd., J. C., (82)
49, Bridge St., Manchester.
Wilkinson. (106)
"The Wireless World," Iliffe & Sons Ltd., (22)
Dorset House, Tudor St., London, E.C.4.
Wright & Co., (124)
15, North John St., Liverpool.
Wright and Weaire, Ltd., (34)
740, High Rd., Tottenham, London, N.17.

MANCHESTER RADIO SHOW

GUIDE TO THE STANDS



WIRELESS WORLD

LABORATORY TESTS

A Review of Manufacturers' Recent Products.

EAGLE H.T. BATTERY.

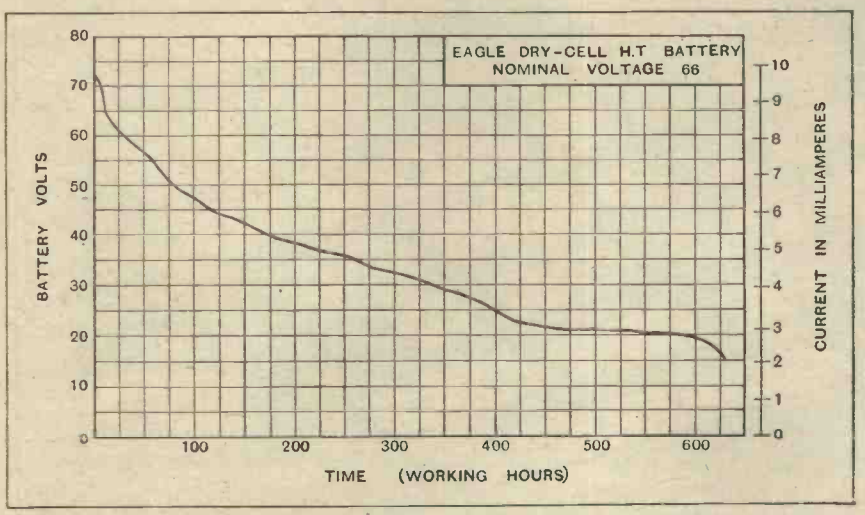
These batteries are made by the Eagle Engineering Co., Ltd., Eagle Works, Warwick, the manufacturers of the well-known "Chakophone" components and receivers. The sample tested was a standard capacity 66-volt unit, for which the maximum economical discharge rate is of the order of 8 mA.

Eagle 66-volt standard capacity H.T. battery.

In accordance with our usual practice, the periods of discharge were interspersed by similar periods for recuperation, but in the curve prepared the rest periods have been omitted, and only the actual working hours shown.

Owing to the terminal voltages being somewhat higher than the nominal value, the initial current through the loading resistance was 9.7 mA. This value was maintained for a very short period only, and during the first 100 hours showed a comparatively rapid decline. At no time during the test did the current attain a steady value and maintain it for any definite period. Thus there is no well-defined cut-off point, and, as will be seen from the curve, the voltage fell at a fairly uniform rate throughout the useful life of the battery. If we decide that its working life terminates when the voltage per cell drops to 0.9, it would give 175 hours' work, assuming the initial discharge to be of the order of that shown here. Most batteries can be kept in commission until the E.M.F. of the cells drops to 0.75 volt, and under these conditions the Eagle Standard 66-volt battery would survive for 280 hours. Of course, it would be necessary to provide a "boosting" battery to raise the voltage to that required to operate the set satisfactorily.

The price of the 66-volt unit is 7s. 6d., and there is available also a 90-volt battery at 11s. 9d., and a 99-volt unit at 13s. 6d. These are of the same type and of standard capacity.



Discharge curve of the Eagle 66-volt standard capacity H.T. battery.

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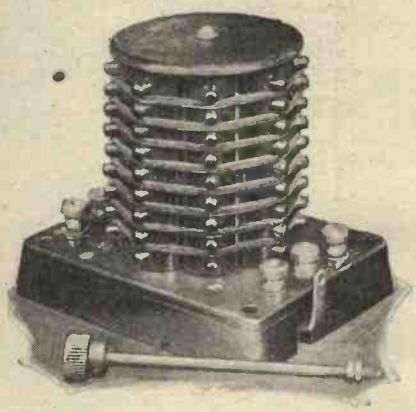
WATMEL DUAL RANGE TUNER, Type 31.

In the Watmel dual range coil special pains have been taken to nullify, so far as a compact assembly will permit, the effect of an idle long-wave coil when receiving on the medium broadcast waveband. The tuned coils are sectional wound, moulded bakelite ribs being used to space these from the aerial and reaction windings, which are carried on a paxolin tube $1\frac{3}{4}$in. in diameter. The secondary consists of eight sections, with the two end sections wound in the opposite direction to the remainder of the coil.



Watmel universal dual range tuner, Type 31.

With the switch set for medium-wave reception, each half of the long-wave coil is connected in parallel with its respective end section, the mutual inductance being negative. For long-wave reception the two end sections are inoperative, and the long-wave coil, consisting of the six middle sections only, is in use. The idle end sections, being wound in the opposite direction to the main portion of the coil, introduce no appreciable "dead end" effect A centre tapping is available on both ranges.

The wave-change switch is housed in the hollow base, with the actuating lever protruding through one end. Two

Laboratory Tests.—
operating rods of different lengths are provided, thus enabling the units to be mounted close to the panel, or set back to allow space for the tuning condenser to be interposed.

A practical test showed that sensitivity depends largely upon reaction when the unit is used in a simple 0-v-1 set; the selectivity is generally good, the two Brookmans Park transmissions being easily separated in the northern suburbs of London. Long-wave reception is equally good, and reaction is smooth on both wavebands, a reaction condenser of 0.0003 mfd. being amply large for all purposes when a leaky grid detector is adopted.

When tuned by a 0.0005 mfd. condenser, the wave range covered is from 223 metres to 565 metres, and 582 metres to 2,140 metres on the medium- and long-wave bands respectively, using an aerial of average size.

The makers are Watmel Wireless Co., Ltd., Imperial Works, High Street, Edgware, and the price of the unit is 17s. 6d.

o o o o

EDISWAN E.S.75 POWER VALVE.

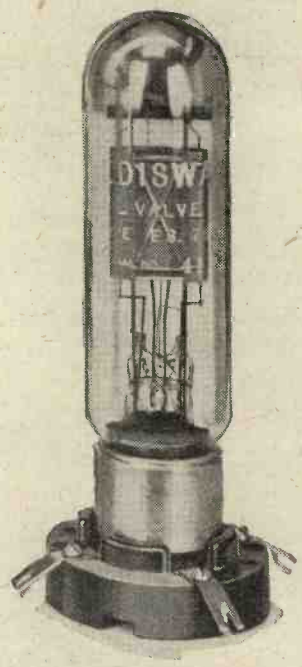
This valve has been developed especially for use in public address amplifiers and similar type equipment where a big output is demanded. It will deliver 25 watts of undistorted power with 1,000 volts H.T., the maximum safe anode dissipation being 75 watts.

A special dull-emitter filament, rated at 10 volts and taking 3.25 amps., is fitted, and the vacuum is of an abnormally high order. The bulb, stems and "pinch" are constructed from specially prepared heat-resisting glass, and it is claimed that this ensures a long working life.

The electrodes are of the familiar "flattened" type, mounted vertically in the bulb, but, of course, far more robust and executed on far more generous lines than in the average super-power output valves. Relative displacement between the electrodes is prevented by anchoring each to a stout bridge piece located under the dome of the glass envelope.

At 1,000 volts H.T. and with optimum grid bias the A.C. resistance is of the order of 2,000 ohms, and the amplification factor 5; the mutual conductance under amplifying conditions being accordingly 2.5 mA. per volt.

It has been deemed necessary to adopt a bayonet type fitting, which follows closely American practice, in place of the usual pins and socket holder. In keeping with the valve, it is built on generous lines, and consists of a massive bakelite moulding carrying stout phosphor bronze springs, which make sure contact with the four stubby pins on the base of the valve. Massive soldering tags complete the assembly.



Ediswan super-power valve, type E.S. 75. The maximum anode voltage is 1,250, and the maximum anode dissipation 75 watts.

The valve is made by the Edison Swan Electric Co., Ltd., 1A, Newman Street, Oxford Street, London, W.1, and the price is £12. The special base costs 12s.

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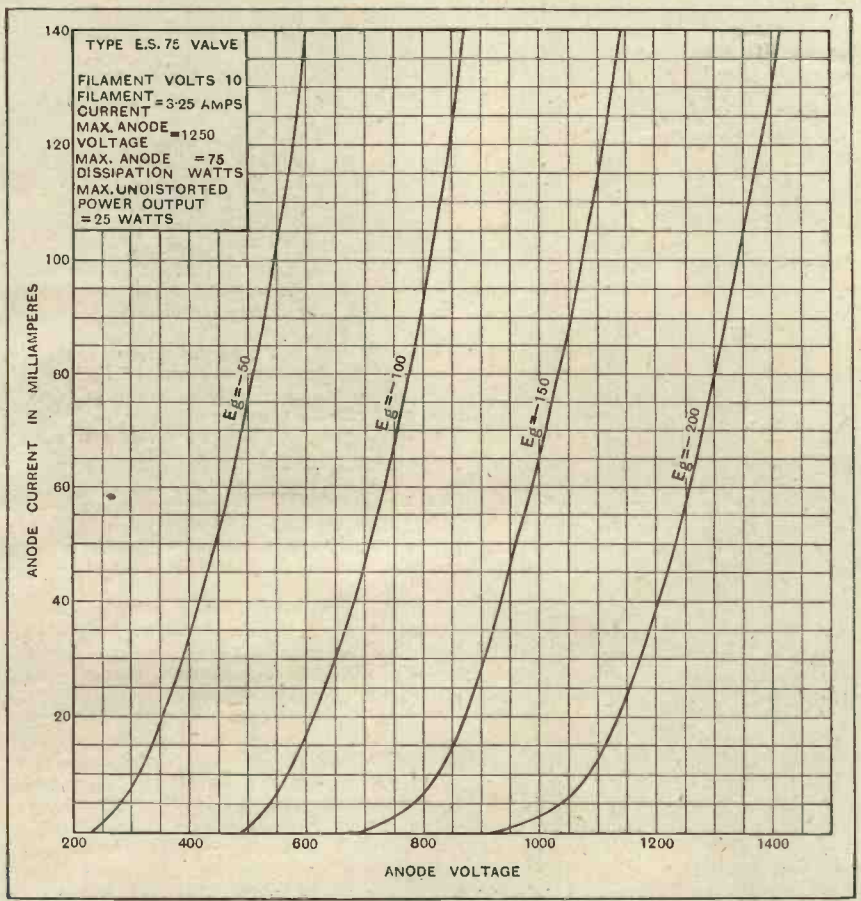


Anode volts-anode current curves of the Ediswan E.S.75 super-power valve. Under amplifying conditions the A.C. resistance is 2,000 ohms, and the amplification factor 5; the mutual conductance being 2.5 mA/volt.

CATALOGUES RECEIVED.

Benjamin Electric, Ltd., Tariff Road, Tottenham, N.17. — 24-page illustrated catalogue of Benjamin components.

o o o o

The Telegraph Condenser Co., Ltd., Wales Farm Road, North Acton, London, W.3.—Illustrated catalogue of mica dielectric, paper dielectric, and electrolytic type condensers for use in wireless circuits. Smoothing condensers tested to 15,000 volts D.C. are included.

o o o o

Burne-Jones and Co., Ltd., Magnum House, 296, Borough High Street, London, S.E.1.—Descriptive folders and broadsheet dealing with Magnum Universal Three, A.C. mains receiver, radio gramophones and components.

o o o o

Brockie, Haslam and Co., Temple Bar House, 23, Fleet Street, London, E.C.4.—Descriptive booklet dealing with the "Grassman" moving-coil loud speaker.

o o o o

Wingrove and Rogers, Ltd., Arundel Chambers, 188-9, Strand, London, W.C.2.—Illustrated folder and 24-page catalogue of Polar condensers and components.

Letters to the Editor.

The Editor does not hold himself responsible for the opinions of his correspondents.

Correspondence should be addressed to the Editor, "The Wireless World," Dorset House, Tudor Street, E.C.4, and must be accompanied by the writer's name and address.

MYCALEX.

Sir,—We have had our attention drawn to your issue of August 20th, 1930, in which, on page 167, there is an article relating to Mycalex by Mr. W. H. F. Griffiths.

We are very much concerned to see that to this very valuable invention there should be attributed a defect, which is *purely one of manufacture.*

The material upon which the tests in question were made has evidently been obtained from Germany. We regret to say that the production there was not in accordance with the requirements for this highly specialised product, which necessitated a special construction of furnace and press to obtain the results eliminating the defect of soft crust or skin, to which Mr. Griffiths refers.

Our London factory has been equipped with a plant capable of producing a perfect product, and we shall be pleased to place at the disposal of anybody desiring to test this samples of our present production.

E. H. KINNARD, Managing Director,
Mycalex (Parent) Co., Ltd.

ACCUMULATOR CHARGING.

Sir,—Some considerable time ago you were good enough to publish a letter of mine on the subject of accumulator charging.

From personal experience—and from what I hear from friends all over England—things do not seem to have got any better than they were two or three years ago.

As the manufacturers of wireless receivers are now giving instruction to their agents in the repair and maintenance of their products, would it not be possible for the manufacturers of accumulators to do the same for *their* agents?

I quite realise that the answer will be: "But we never appoint an agent unless he knows his job," but I could quote very many instances (my own in particular) where the recognised agents for first-class batteries have no more been able to charge (electrically!) H.T. batteries than they have been able to fly to the moon.

I give you two cases in point.

1. When it was suggested that a small charge for a long time was much better than a big charge for a short time, the answer came pat:—

"But I would never get through all my work if I was to do that."

2. It had actually to be explained to one electrician (?) that "point 5 amp." was not the same as 5 amps. He was putting a charge of 5 amps. into a 5,000 milliamp. H.T. battery!

And there are still many of us who live so far out "in the wilds" that there are no mains available.

As my last letter to you caused so much unpleasantness between the local garage owners and myself, I beg to sign, without any clue as to name or district. "H_2SO_4."

POWER DETECTION.

Sir,—I am glad to see, in various recent articles in *The Wireless World*, that the writers have realised that (so long as it is called "*power* detection") grid rectification gives less distortion than anode bend

Messrs. Denman and Brereton, in your issue of July 30th, for example, say that they began to investigate the possibilities of the indirectly heated valve as a grid detector, with good results.

I should like to state that as far back as 1928, at which time I was in charge of the Technical Department of Graham Amplion, Ltd., I was aware of the superiority of grid rectification. In the spring of 1929 I proved it quantitatively and embodied it in the design of the Amplion standard set. In August of that year I submitted to *Experimental Wireless* a short article proving the point, which, unfortunately, was not published till July, 1930; and in Fig. 4 of that article I gave three sample rectification curves, two of A.C. valves and one of the 6 v. 0.1A directly heated type; the latter is almost identical with the curve in Fig. 1 of Messrs. Denman and Brereton's article, except that I took it up to 2 v. input only.

In September of 1929, I again dealt with the matter in a pamphlet describing the Amplion Standard sets. This was only semi-technical, but I again explained that the grid rectifier there used gave only 2 per cent. second harmonic as against 7 per cent. for the best anode bend I had found; and I also exploded the myth of excessive "top cut-off." Further, I remember an interview between Mr. Denman and myself—somewhere about July or August, 1929—in which, after some discussion on other matters, I gave him full details of the valves I was using (Mullard 164 V), and the arrangements which gave me pure rectification; if I remember rightly it was at that time his intention to use Kirke diode rectification for the South Kensington set, and the discussion arose because I stated my view that it was unnecessary.

Therefore, until someone puts in a prior claim, I hold that I was the first in this country to find that grid rectification, properly arranged, is superior to anode bend. It was discovered independently and at about the same time as in America; but I have no knowledge as to priority as between the two countries.

It may be of interest to set out very briefly the conditions for good-quality grid rectification:—

(1) The valve must be of low impedance; the type very popular to-day, of Ra=7-9000, μ=12-16, is satisfactory. Indirectly heated valves are better than filament valves, but the latter can be used.

(2) Plenty of anode voltage must be used—at least 150 v. and preferably 180-200, and the anode current must be kept well up—say 5-7 mA. for the above type.

(3) The anode coupling resistance must be kept low; 10-15,000 ohms is a suitable value for the above valves.

(4) To avoid top cut-off, both leak and condenser must be small; 0.00005-0.0001 μF. and 0.1-0.25 MO are suitable values; and a filter must be used in the anode circuit, not simply a by-pass condenser.

(5) The amount of H.F. and L.F. amplification must be arranged to keep the detector input within certain limits; the optimum input is such as to reduce the detector anode current to about $\frac{2}{3}$ or $\frac{3}{4}$ of its value in the absence of input.

Marconi House, London. P. K. TURNER.

SPECIAL B.B.C. TRANSMISSION.

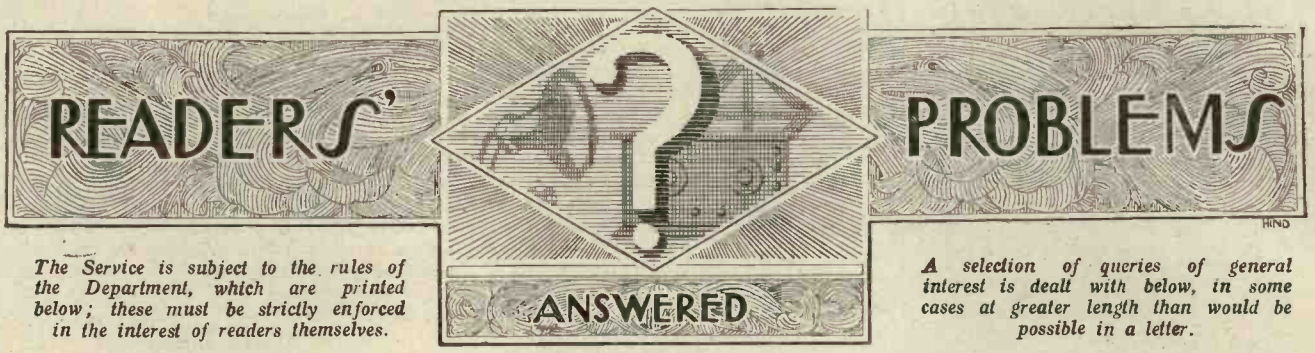
Sir,—In the description of the new Science Museum receiver in the issue of August 6th reference is made to a special B.B.C. transmission on June 4th for the purpose of obtaining a modulation-amplitude curve showing the overall performance of the whole receiver.

It is unfortunate that this special transmission was not advertised beforehand, as many of us would have liked to take similar curves for our own receivers; a Moullin voltmeter across the loud speaker terminal is the only addition to the receiver required.

Is it too much to hope that the B.B.C. will repeat this transmission at intervals? It should surely not be beyond possibility to find, say, one hour a month for technical transmissions. I would suggest that, say, every three months each station should give such a transmission, outside the usual programme hours if necessary; the other two months might have some other type of transmission if desired. But, above all, it is necessary that these transmissions should be well advertised long beforehand; they might even be fixed a year in advance and advertised.

C. R. COSENS.

Cambridge.



The Service is subject to the rules of the Department, which are printed below; these must be strictly enforced in the interest of readers themselves.

A selection of queries of general interest is dealt with below, in some cases at greater length than would be possible in a letter.

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

Coil Length and Diameter.

After reading the article entitled "Tuning Coils and Winding Data," I have decided to rewind the medium-wave inductances of my H.F.-det.-2 L.F. receiver, but am in a quandary as to what diameter to choose for the new coils. I presume that this dimension should be as great as possible, but, unfortunately, there is not very much room available in the set, and I am afraid that a greater diameter than 2½in. will be out of the question. There is space for coils of fairly considerable winding length: diameter is my chief trouble.

Do you consider that it would be worth while to increase the size of the screening boxes so that 3in. diameter coils could be accommodated? J. C. T.

We rather think that you have overlooked the fact that the "goodness" of a coil is not entirely determined by its diameter. On referring to the article which you mention it will be found, for example, that a winding 3in. in diameter and 2½in. in length will have a minimum dynamic resistance rather less than that of a coil of, say, 2½in. in diameter and 3½in. in length. Consequently, in this case the coil of smaller diameter is the better of the two.

It seems likely that, by applying the published information in this article to the best advantage, with due regard to the space available in your set, you will be able to find a suitable winding which does not necessitate any alteration to your screening boxes.

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Comparative Tests.

I have been trying to make comparative sensitivity tests—without direct measurement—of two long-range receivers. Although this would appear to be easy enough, it seems very difficult to avoid errors, and I should welcome a few hints. Both sets are designed for working on an outside aerial, and switches have been arranged to change over the batteries. T. McD.

Even when a complete equipment of measuring instruments is available, it is fatally easy to reach an incorrect conclusion; still more is it difficult to make a fair comparative test by aural means, as the matter is complicated by the fact that the ear does not long retain its impressions. Changes from one set to the other should be made quickly, and it is all to the good that you have arranged for switching over your batteries.

A weak signal of constant strength is essential; these tests should always be made in the daytime, as night signals are liable to fading. Alternatively, a very short aerial can be used, but here, again, there are pitfalls; if one of the sets has normally a weaker aerial coupling than the other, its H.F. input will be disproportionately reduced. In any case, the short aerial should be sufficiently effective to have a signal pick-up many times greater than the direct pick-up of either set; errors often arise in this way when comparing sets with widely differing screening systems.

If reaction is fitted, it should be set either at minimum or just below the point of self-oscillation; intermediate settings are bound to be responsible for misleading results. It is often a good plan entirely to disconnect the reaction circuits, and, if necessary, to join small fixed condensers between plate and filament of the detector valves to compensate for removal of reaction condenser capacity.

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.*

A Useful Formula.

Can you give me the necessary formula for calculating the ratio of the transformer for use between the output valve and the loud speaker? M. E. J.

The formula is

$$\text{Ratio} = \sqrt{\frac{\text{A.C. Resistance of output valve}}{\text{Loud speaker impedance.}}}$$

It should be pointed out that in the case of the use of more than one valve in the output stage the figure for A.C. resistance, which must be used in this formula, is that for the combined A.C. resistance values of all the valves in the output position.

If valves are used in parallel and they are all of equal A.C. resistance, it is necessary to divide the A.C. resistance of any one of them by the number of valves in use in the output position. If valves are connected in push-pull the values for A.C. resistance for the individual valves must be added together. The impedance figure for the loud speaker should be taken at the frequency of middle C. In most cases this information will not be forthcoming, and it is customary, therefore, to take 200 cycles per second as the basis of calculation.

You will probably remember that in our issues dated February 5th, 12th and 26th, 1930, we gave the impedance figures for a large number of commercial loud speaker units.

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A.C. Valves or an L.T. Eliminator?

I have been successfully operating my 1-v-1 valve receiver for some time from an H.T. battery eliminator, and have now decided to heat my valve filaments from the mains, which are of the A.C. type. I am hesitating, however, whether to purchase A.C. valves or to retain my present valves and use a low tension battery eliminator. I have received very conflicting advice from my friends in this matter, and appeal to you to arbitrate. I should mention that the question of comparative cost must be taken into consideration. B. G.

If possible we should advise you to purchase a filament transformer and a set of A.C. valves. We insert the proviso "if possible" because we have no knowledge of your receiver design. It must be remembered that A.C. valves are more

efficient than other types, and in the case of some receivers screening may be only just sufficient to preserve stability with battery valves, and in such a case uncontrollable oscillation would be the only reward of fitting A.C. valves. It is true that in most cases it is a simple matter to put in extra screening, and probably this is so in your case, but there are some designs which it is almost impossible to modify in this way without the necessity of completely rebuilding. If, therefore, your set is adequately screened, or if extra screening can easily be added, you should use A.C. valves. The advantage of A.C. valves is that they have better mutual conductance than other types.

With regard to comparing the cost of the two methods, we can first rule out the power transformer, since one of these will be required in any case. In regard to the L.T. eliminator, it is necessary to purchase a "filament" smoothing choke and, in addition, an electrolytic condenser, a potential divider and voltmeter, although, of course, a floating battery will get rid of all three of these components. In the other case we have only the expense of the valves to consider, and although, of course, an A.C. screen grid valve, for instance, is by no means cheap, it must not be forgotten that already the life of your existing valves is partly spent, and they will probably have to be renewed at a not-too-distant date.

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Reinartz Rejuvenated.

Can you tell me the proper method of using the differential reaction principle in conjunction with the Reinartz- and Hartley-type circuits? Is there any advantage to be gained by earthing the moving plates of the condenser? P. R. D.

In Fig. 1 (a) is shown the usual connections for using differential reaction with the Reinartz circuit. In Fig. 1 (b) it will be noticed that a different method of connection is adopted so that the moving plates are earthed. The advantage of this method is that hand-capacity effects are usually much less pronounced owing to the fact that the metal shaft of the condenser—which, of course, comes into close proximity to the hand—is definitely earthed. It will probably be remembered that this modification of putting the control condenser at the low potential side of the reaction winding was eventually adopted in the original Reinartz circuit, this new arrangement being then known as the Weagent circuit.

In Fig. 1 (c) will be seen the method of using differential reaction in the case of the Hartley circuit. In this case it is not possible to put the condenser at the low potential end of the reaction winding since, of course, part of the tuning coil itself constitutes the reaction winding and the effect of putting a reaction condenser in series with the tuning coil would be not only to reduce the natural time period of the tuned circuit, but also to bring about a drastic change in tuning every time that a change in the degree of reaction was made.

It should be mentioned that in the case of the Hartley circuit the differential reaction principle is not an unqualified success, adjustment of reaction being rather critical.

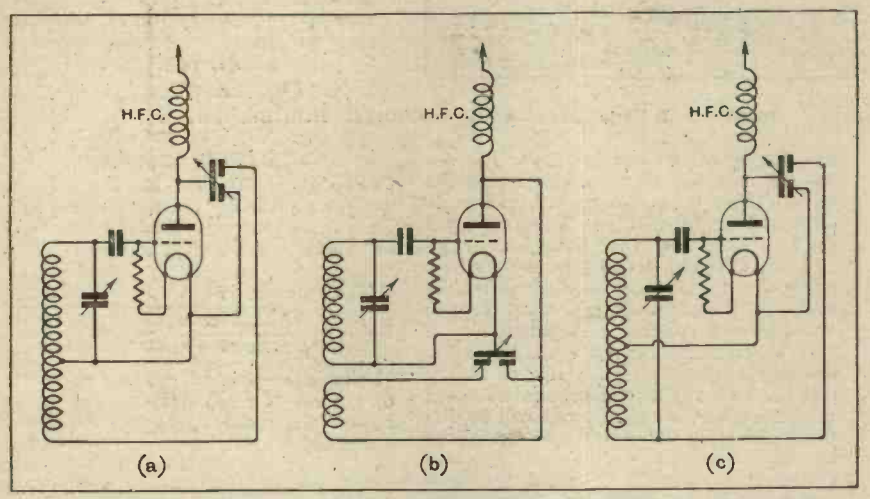


Fig. 1.—Different methods of reaction. (a) Conventional arrangement. (b) A modification to reduce hand effects. (c) A Hartley circuit with differential control.

FOREIGN BROADCAST GUIDE.

BERNE

(Switzerland).

Geographical Position: 46° 57′ N. 7° 27′ E.
Approximate air line from London: 465 miles.
Wavelength: 403 m. Frequency: 743 kc.
Power: 1 kW.
Time: *Central European Time.
** Coincides with B.S.T.*

Standard Daily Transmissions.

10.00 B.S.T. sacred service (Sun.); 12.43 Time signal, weather, concert or gramophone records; 16.00 concert; 20.00 main evening programme; 22.00 news, dance music until midnight (Sundays only).
Woman announcer. Call (phonetic): *Allo! Rah-dee-owe Bairn.*
Opening Signal: Musical box melody as under.

Interval Signal: Metronome.
Announcements are made in the German and French languages.
Closes down with the usual French formula, the German "Gute Nacht" and a few words in the Bernese dialect.

Biasing Difficulties.

For some time past I have been using a detector-L.F. A.C. set for local station reception only. Grid bias for the output valve (an L.S.5A) has been derived from a rectifier unit (Westinghouse type H.T.3) which gives a voltage of 120. *I am only interested in local-station reception, and am redesigning my receiver so that it will give very large volume indeed, and propose to use two L.F. stages, the output consisting of two L.S.5A valves connected in push-pull. My power transformer has a four-volt filament winding which I have hitherto used for supplying the indirectly heated detector and a six-volt winding which I have been using in conjunction with one L.S.5A valve, a* 0.75 *ohm resistance being used in each filament lead. I now propose to use a six-volt valve in the penultimate stage, and to heat its filament from the same winding as the proposed output valves. I wish to know whether you would recommend that I use my existing grid bias unit for supplying the penultimate valve, which will require a grid bias value of* 40 *volts (Mazda P.650), or whether I should take bias for both stages "automatically" by means of a resistance in the common H.T. negative lead.*

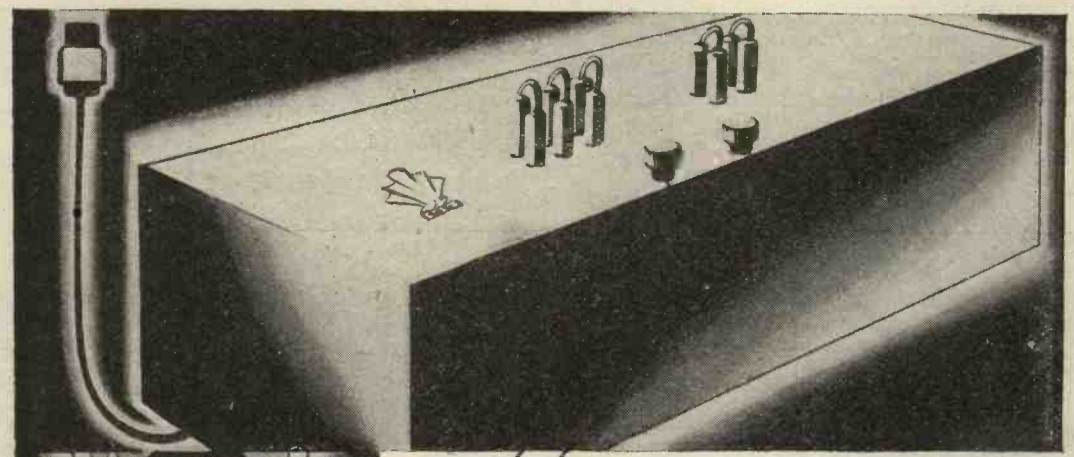
J. R. G. T.

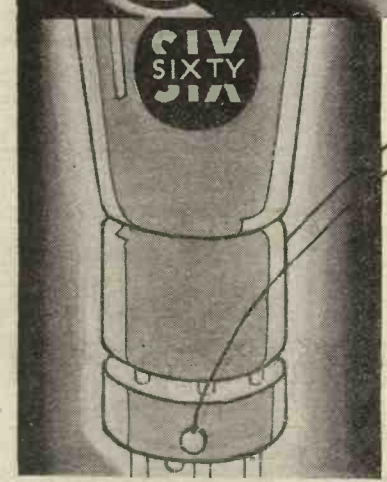
Neither of your proposed methods of obtaining bias is at all feasible. As you apparently have only one filament winding on your transformer you would, if you employed "automatic" bias for both valves, have to use a common bias resistance which might lead to trouble, even if both grid circuits were decoupled. Apart from this, however, it must be remembered that in order to give the correct bias to the L.S.5A valve at 400 volts H.T. you would have to drop 112 volts across the biasing resistance. This would mean that there would only be 288 volts left for H.T. supply to the L.S.5A valves, as we scarcely think it likely that your power transformer gives an output of between 500 and 600 volts, as it would have to do if your scheme were to be effective. This trouble would not, of course, be removed by employing the grid bias unit to supply the penultimate valve only.

The best solution is to use the grid bias unit for supplying the output valves, and to obtain grid bias for the penultimate valve by means of a voltage-dropping resistance. In any case, you have ample volts to spare for this valve.

Make your Battery Set all-electric

The Six-Sixty A.C. all-mains conversion equipment is suitable for practically any battery operated receiver.





No internal wiring alterations. Equipment includes specially selected Six-Sixty A.C. valves—and Six-Sixty 4/5 pin valve holder adaptors.

Yes, we know how you feel about it—this question of scrapping a perfectly satisfactory battery set in order to change to all-mains—so we have produced the Six-Sixty all-mains conversion equipment. To start with, you need to alter nothing of the construction of your set—the special Six-Sixty valve-holder adaptors make your present valve-holders fit the 5-pin valves supplied. Then you are buying a unit, in the fullest sense, an eliminator and a set of specially selected A.C. valves, built by *one* manufacturer to co-operate and work perfectly together.

The Six-Sixty Unit can be supplied to operate from any A.C. house mains. H.T. tappings of 50, 75, 100, 120, 150 and 200 volts are provided and G.B. tappings of 1.5, 3, 4.5, 8, 15 and 20 volts, any three H.T. or two G.B. values being available simultaneously. Grid Bias is on the ultra modern automatic principle—all risk of overloading eliminated. The dimensions (13 x 5½ x 4) of the complete equipment are not larger than your present batteries—an important point—and the H.T. leads need never be removed from the set when once inserted. Isn't that what you've been waiting for? Of course it is—but why wait any longer?

Price: A.C. Mains Conversion Equipment complete from £8 : 5 : 0
Mains Unit (H.T., L.T. and G.B.) only ... ... £6 : 6 : 0

Write for leaflet giving particulars of complete range, including new Six-Sixty Valves, Six-Sixty Cone Speaker Assembly and Cone Speaker Paper, Six-Sixty Turntable, Six-Sixty Valve and Set Tester, Six-Sixty Valve Adaptors, Six-Sixty Gramophone Pick-up Attachments, Six-Sixty Grid Leaks and Holders.

Made by the makers of the famous Six-Sixty Valves.

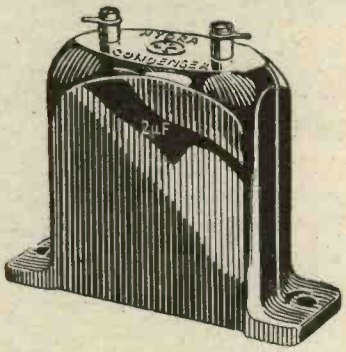
SAY

SIX-SIXTY

(B.V.A. RADIO VALVES AND EQUIPMENT)

Six-Sixty Radio Co., Ltd., Six-Sixty House, 17/18, Rathbone Place, Oxford Street, W.1. ***Telephone: Museum 6116/7.***

HYDRA



Follow our example and take no risks with your reputation. Hydra Condensers are never placed into stock without being tested at twice their rated voltage . . . . Hydra Condensers are never fitted to sets without giving absolute satisfaction.

LOUIS HOLZMAN LTD.
37, Newman St., W.1.
Telephone; Museum 2641.

TONEX UNIBOX

SCREENED GRID UNIT

Make your Det. L.F. Set up to date—to-day—with S.G. **Get a "TONEX UNIBOX"—the complete S.G. Unit.** Enclosed in the crystalline enamelled metal case are coils to cover long and short waves controlled by a switch. The Valve is placed in the most correct position for efficient shielding. Plainly-marked terminals are provided for easy hooking up. *The very thing you have been waiting for.*

Send for diagrams and details of this and other Tonex Products.

PRICE 30/-

FROM ALL RADIO DEALERS.

THE TONEX CO., WALKER ST., BLACKPOOL.

Sold with a 12 Months' Guarantee

LAMPLUGH LEADS AGAIN

with this ALL-BRITISH SPEAKER

Manufactured under FARRAND and LEKTOPHONE STANDARD HOPKINS PATENTS and PATENT APPLICATIONS.

DEFINITELY ABOLISHES ALL PAST AND PRESENT TYPES OF SPEAKERS.

The verdict of Olympia.

LAMPLUGH INDUCTOR *Dynamic* SPEAKER

This is the latest conception of the Inductor principle, invented by the American radio pioneer, Farrand, and is as great a step forward over present known types of speakers—whether balanced armature or moving coil—as the original cone was over the horn type. It possesses all the advantages of a moving-coil speaker, has a better response at the lower frequencies, and has none of the disadvantages associated with the M.C. type.

ADVANTAGES.

There is no moving coil to pick up field current. There is no field excitation coil, therefore no introduction of hum from that source.

There is no heat generated.

Requires no Rectifier, Transformer, Smoothing Condenser associated with Moving-coil Speakers on A.C. operated sets.

Only a quarter the weight of a M.C. Speaker.

AMATEURS

will realise at once the enormous saving in cost that the Lamplugh Inductor Dynamic offers without sacrifice in performance—which is indistinguishable from that of the finest M.C. Speaker. It must not be confused with the many Balanced Armature Movements on the market at the moment designed to give Moving-coil effect by artificial methods.

There is nothing to get out of order; it is beautifully finished and of robust construction.

STANDARD CABINET **£5 - 10**

DE LUXE CABINET **£6 - 10**

CHASSIS COMPLETE AS ILLUSTRATED ABOVE **£3 - 10**

The GREATEST ORCHESTRAL SPEAKER of all TIMES.

Ask your dealer for a demonstration.

LAMPLUGH INDUCTOR DYNAMIC SPEAKER

S. A. LAMPLUGH LTD.,
KINGS RD., TYSELEY, BIRMINGHAM.

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RECEIVERS FOR SALE.

SCOTT SESSIONS and Co., Great Britain : 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

BURNDEPT 3-valve Short Wave Set, coils cover 12-100 metres, perfect condition, less valves; bargain. £2.—Compton, 16, North St., Lewes, Sussex. [1635

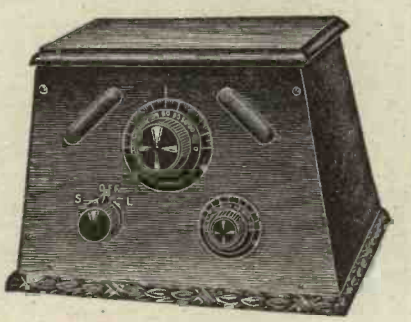
CLIMAX A.C. All Mains Set, as new, guaranteed; £7/10.—Barrington, 186, St. James' Rd., Croydon. [1634

Receivers for Sale.—Contd.

'PYRAMIDS 2'

Designed for either battery or mains operation.

A PRODUCT OF 'ELECTROCETS'



This wonderful little set will give you a choice of many foreign stations, and easily separate your local Regional Stations.

Complete and simple instructions are mounted in the lid for connecting either batteries or our mains unit illustrated below. Both cabinets are finished in polished oak, and form together one unit, which when used with A.C. valves makes the set completely all electric. No internal alterations are necessary, as 5 pin valve holders are standardised, which take either ordinary or 5 pin A.C. valves. The G.B. battery is mounted in the cabinet. Flex leads are included, for connecting to battery and accumulator, and are plainly marked with tags.

Like with all 'Electrocets' you get a written guarantee for 12 months. The cash price is

70/-

Or 15/- down, and 6 monthly payments of 10/8.

'ELECTROCETS' H.T. and L.T. Battery Eliminator.

Enables you to dispense with both H.T. battery and L.T. accumulator, and convert your present set into a highly efficient all electric receiver. Complete instructions are issued with each unit.

Model J.1. H.T. output 120 volts, 20 milliamps. 70 volt detector tapping. L.T. output 4 volts, 3 amps. Suitable for 2 and 3 valve sets.

Finished in a polished oak cabinet, complete with mains switch, 4 yds. of flex, and lamp plug, Cash price

80/-

(A.C. mains only.)

This model is most suitable for 'Pyramids 2,' making a complete all electric set for a cash price of

£7:10:0

Or deferred payments, 14/- down, and 12 monthly payments of 12/11.

May we send you our illustrated leaflet describing both these fine instruments, and our 7 days' free trial form, or Deferred Payment agreement form? Free on request.

THE ELECTROCET RADIO CO.,
Poplar Road, Solihull, Birmingham.
Agents wanted—see Agency column.

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., 67, Guildhall St., Preston. [0226

SUPER Power, 240v. D.C. mains, 3-stage, 6 valve, gramophone amplifier, including built-in record motor, Woodruffe pick-up and spring tensioned arm, P.A. microphone and 6ft. exponential speaker, powerful and true toned reproduction; accept £35.—Further details write Box 7700, c/o *The Wireless World*. [1665

PHILIPS 2511 All-electric 4-valve Receiver, 200-240v., cost £37/10, price £26; Celestion U12 loud-speaker, mahogany, cost £7/10, price £3; all as new.—Blyton, 3, Ashburton Av., Addiscombe. 'Phone: Addiscombe 1246. [1651

EVERYMAN Four, in perfect condition; cost £32, will take £12.—Bloomfield, 54, Sherwood St., Mansfield. [1649

FOR Sale at End of October, McMichael super range portable four, excellent condition, new batteries, spare accumulator; £14; owner leaving for India.—Leigh, Onslow Arms, West Clandon, Surrey. [1646

PYE All-electric Three, latest model, complete with Marconiphone walnut loud speaker; cost £31 2 months ago, bargain, £22.—Cannon, 36, Marlow Rd., Anerley, S.E.20. [1692

EVERYMAN Four with 6v. Marconi Valves, best component parts, 6v. Exide accumulator, 2v., 4v., 6v. Ferranti trickle charger, 30v. G.B. Pertrix battery, full working order; the lot cheap for quick sale.—Box 7707, c/o *The Wireless World*. [1689

WHAT Offers?—Igranic superhet.—Box 7706, c/o *The Wireless World*. [1688

4-VALVE Electric Radio Gramophone, oak cabinet, mains A.C., 100 or 200 to 250 volts, moving coil loud speaker; bargain, 27 guineas; evening demonstration.—6, Pinkwell Villas, Dawley Rd., Hayes, Middlesex. [1685

MARCONIPHONE Type D.C.B. Super Power Amplifier for D.C. Mains, hardly used; absolute bargain. 30/-.—6, Pinkwell Villas, Dawley Rd., Hayes, Middlesex. [1686

PHILIPS' 3-valve Set, 240-volt A.C., little used, perfect, and Marconiphone moving coil speaker; £20; can be heard by appointment.—Ellis, 28, Redhill Drive, Edgware, Middlesex. [1679

PHILIPS' 2511 All-electric A.C., maker's guarantee 9 months unexpired, new, unboxed valves; list £35, take £21; buying Radiogram; heard working.—Apply Newth, 31, George St., Hanover Sq., London, W.1. [1675

ORMOND 5-valve Transportable, turntable, waterproof cover, Hellensen H.T.; cost £16, sell £10; deposit system.—31, Cassland Cres., South Hackney, E.9. [1674

MARCONIPHONE Portable Model 55, with canvas case, as new; cost 18 guineas, no offers, 10 guineas; heard by appointment.—Box 7704, c/o *The Wireless World*. [1667

6-VALVE Mullard Orgola Senior, with valves; £8, little used.—Hawkins, Station Lane, Wombwell, Barnsley. [1665

ACCUMULATORS—BATTERIES.

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

ACCUMULATOR HIRE.

DON'T Buy Dry Batteries, join our service; we keep you continuously supplied with fully charged C.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 B2, post free.—Radio Service (London), Ltd., 105, Torriano Av., Camden Rd., N.W.5. 'Phone: North 0623 (3 lines). [1466

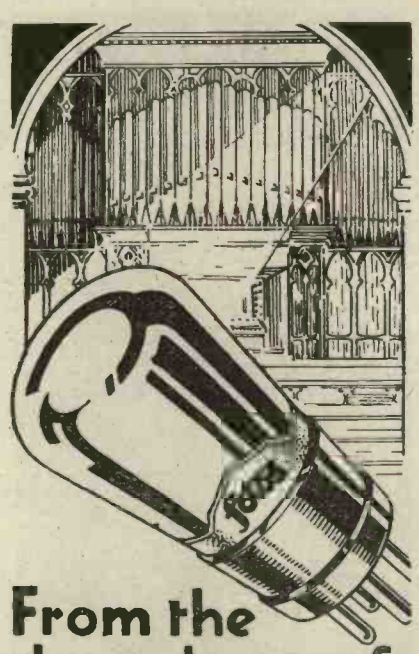
CHARGERS AND ELIMINATORS.

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



From the deep bass of the organ to the shrill of the flute

The deep pealing of the church organ swelling up through various stanzas, and the upper C of the violin, are reproduced faithfully, with perfect clarity. The finest materials and expert craftsmen have made Fotos famous. Minutely tested under tests more strenuous than ever met with in operation, Fotos valves are masterpieces of valve construction. When first sold at 5/6, quality and price seemed incredible, but after stringent tests radio fans prefer Fotos and save money.

Prices **from 5/6** each.

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THE HEART OF EVERY SET

STAND 67, TONMAN HALL, MANCHESTER.

CONCERTON RADIO & ELECTRICAL Co. Ltd., 256-7, Bank Chambers, 329, High Holborn, W.C.1. 'Phone: Holborn 8667.

Chargers and Eliminators.—Contd.

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 HT., 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

EKCO D.C. Eliminator, cost £3/18, 60 m.a. output; price 35/-; Seers, Jesmond, Laura Grove, Paignton. [1642

MAINS Transformers and Chokes for Radio and Sound Systems, totally enclosed in cast aluminium plates, guaranteed; write for lists, manufacturers and traders enquiries invited.—Eric Cookson and Co., 14, Cambridge Rd., Blackpool. [1645

RECTIFIER, 230 volts 50 P output, 220 volts 300 milliamps, full smoothing equipment, cost £8, perfect condition; £4.—Bramhall, 55, Branston St., Birmingham. [1656

SCHOOLS Demonstration Eliminator, components as specified by "Wireless World" designer; cost £19/18, price, complete with 3 rectifying valves and 1 L.S6A, £11, or without valves, £9.—H. C. Elsden, Fair View Barming Heath, Maidstone. [1660

ELIMINATOR Kits, transformer, choke, condensers, valve, valve holder, resistance, terminals; 36/-, post free.—Fel-Ectric Radio, Garden St., Sheffield. [9963

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 C32/0. 20/-.

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. [1283

BANK of 80/1 Westinghouse Rectifiers; 7/6 each. —Box 7705, c/o *The Wireless World*. [1687

BRYCE'S.—Mains Transformers easily made at home, suitable for new Westinghouse rectifiers and "Wireless World" sets.—Bryce's, 54, Dawson St., Bury, Lancs. [1683

TRICKLE Chargers. A.C. mains for 4- and 6-volt accumulators, 0.5 amp., no upkeep; 18/6, carriage paid.—Benoit, 4, Manor Gardens, Gunnersbury Av., London, W.3. [1682

ZAMPA, the cheapest, best and most silent eliminator kit on the market.

ZAMPA Power Kit. 120b. at 20 mA., with tapping, incorporating Westinghouse rectifiers; 49/6.

ZAMPA Heavy Duty Kit, 200 volts at 28 mA. with tapping; 69/6; sent on seven days approval against cash; full particulars of these and other kits willingly forwarded on request.—Mic Wireless Co., Market St., Wellingborough. [1677

CABINETS.

CABINETS to Your Own Requirements; quotations by return.—Hammonds, 1, Stratford St., Nuneaton. [1234

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 Customers' 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

Cabinets.—Contd.

BEAUTIFUL Portable Cabinets, fancy wood and plain, some inlaid, clearing under cost; also rexine portables (damaged), from 4/6.—Apply 12, Mornington Crescent, N.W.1. Phone: Museum 9247. [1441

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.—Grove Brothers, St. Mary's Place, Shrewsbury. [1334

BAND-PASS Four Coils, complete set; 25/-; c.o.d. or deposit.—Smith, 3, Park Parade, Harlesden, N.W.10. [1590

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

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. [1670

DYNAMOS, ETC.

600-VOLT 80 m.a. Mackie H.T. Generator, with 6-volt winding, £4/10; 100-200-volt ¼h.p. Century refrigeration motor, new, £5; both seen working.—G-2HP, 123, Upper Brockley Rd., London, S.E.4. [1697

GRAMOPHONES, PICK-UPS, ETC.

LATEST Marconiphone Pick-up, new condition; 37/6.—1, King's Rd., Brislington, Bristol. [1652

PICTURE RECEIVER APPARATUS.

BAIRD Televisor Kit, month old, used very little, perfect condition; cost £15, £9/10, carriage paid. Box 7667, c/o *The Wireless World*. [1636

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 in Yours for the Asking"; write now for new edition; see displayed advertisement on page 25. [0231

"REALISTIC SPEAKERS."—All-wood diaphragm chassis, will fit any unit, 27/6; send to-day for particulars "How to Build a Wonderful Speaker"; we also manufacture complete speakers, ranging from £3/10 to £25.—"Realistic Speakers," 72, Penton St., N.1. [1296

MARCONIPHONE Moving Coil, 6-volt type, in mahogany cabinet, complete with accumulator and switch; £5 (cost £11).—Church, "Weston," Victoria Rd., Tunstall, Stoke-on-Trent. [1662

CELESTION C10, oak, perfect, 35/-.—North, 97, Chase Rd., Brownhills. [1661

MAGNAVOX Speakers.—R5, mahogany cabinet, £6; M7L, oak cabinet, £2.—Ville, 12, Kent Gardens, Ealing. [1659

AMPLION, Lion, power, chassis, nearly new; £5.—Jackson, Glenoran Garage, Rhu, Dumbartonshire. [1655

USED Demonstration Tests Only.—Magnavox moving coil 180-250 D.C., with 25×30in. 8-ply baffle, exceptional tone, £3/5 complete; also 2 brand new Osram P.X.4 valves, 11/6 each.—Tetley, 9, Prince of Wales Ter., London, W.8. [1698

SOUND SALES.—Magnavox bargains; we have a limited number of recent models, all A.C. 200-240v., complete with rectifier, mains transformer and input transformer, at the amazing price of £4/15, nearly 50% off list price; further particulars will decide you to purchase; c.o.d. if required, subject to being unsold.—Below.

SOUND SALES Will Give You the Highest Price for Your Old Speaker in Part for a new Magnavox; all the latest Magnavox speakers at list price.—Below.

SOUND SALES.—Special 25-cycle 100v. transformers, made by Parmeko for Sound Sales, who can supply all Magnavox speakers for 25-cycle mains, 10/- extra on list prices.—Below.

SOUND SALES.—Special rebuilt Magnavox all A.C. 200-240 speakers, complete and fitted with British mains transformers, 50-cycle; £4.—Sound Sales, Tremlett Grove, Highgate. [1669

Loud-Speakers.—Contd.

SENSITIVE
MICROPHONES

For addressing a large Audience out-of-doors or indoors through Loudspeaker (via Valve Amplifier or L.F. Stages of Wireless Set), for announcing Gramophone Records through connections of Pick-up, for relaying Speech and Musical Entertainment to any distance, and for recording Gramophone Records.

Powerful SPEECH and MUSIC Reproduction with perfect Purity.

Hand Type.

Highly distance-sensitive, yet guaranteed entirely free from distortion or microphonic noises, absolutely silent background; far superior to ordinary Microphone Transmitters; for use with Valve Amplifier or Wireless Set at Open-air Meetings, Sports Grounds, Garden Fetes; in Cinema, Theatre, or Dance Hall Operates from 2-volt tapping of L.T. Accumulator through Microphone Transformer. Current consumption one-tenth Ampere. Provided with detachable sound collector and a 9ft. silk connecting cord; every metal part nickel-plated, black polished Ermold handle, as illustration **16/6**

Pedestal Type.

Highly Sensitive Microphone, as above described, provided with detachable sound collector and a 9ft. silk connecting cord, and fixed by silk-braided rubber suspension in nickel-plated frame on pedestal 11in. high; for mounting on Speaker's Platform, in Pulpit, on top of Camera Stand, or for suspension from ceiling, as illustration **25/-**

Microphone without Stand: 18/-

The above Microphones are rendered **Directional** *by attaching the Sound Collector.*

Microphone Transformer,

special design to obtain best possible results from sensitive Microphones when connected to high-resistance phones, Loudspeaker, Wireless Set, or Valve Amplifier; best Transformer made for clear speech with volume, modulation, speech and music transmission, Public Address Microphones, etc. Prim. and Sec. terminals fitted. **6/-**

Full directions for use of Microphones and diagrams of connections free. Goods by return post.

"COMPACTUM" MICROPHONE COUPLER.

Size of polished Mahogany box 5½ × 4 × 3½ inches.

For broadcasting Speech and Music, and for making Announcements by Microphone through Loudspeaker working from Valve Amplifier or Wireless Set, WITHOUT ANY FURTHER ACCESSORIES, EXCEPTING MICROPHONE.

If a Valve Amplifier or a Wireless Set is provided with connections for a Gramophone Pick-up, it is only necessary to connect one pair of plugs of the "COMPACTUM" Coupler to a good Microphone, and the other pair to the Pick-up terminals of the Amplifier (or Wireless Set) in order to broadcast Announcements right away.

By fixing a Stand Microphone on top of the "Compactum" Coupler, an excellent self-contained **SPEECH AND MUSIC RELAY** is obtained.

The "COMPACTUM" Coupler comprises a Microphone Transformer, a Volume Control, a small toggle switch, and a standard "Ever-Ready" battery of about 600 working hours. If desired, a 2-Volt Accumulator can be placed in the box instead of the dry battery.

Price, complete for immediate use with any good Carbon Microphone, inclusive plugs for the Microphone cord and for connections to Amplifier (or Wireless Set) - - - - - - **25/-**

FREDK. ADOLPH, Actual Maker, 27, Fitzroy Street, London, W.1. Phone: Museum 8329.

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

SET of 1930 Everyman Four Coils, 20/-.—Bramhall, 53, Branston St., Birmingham. [1657

A.C. Red Spot, 5/-; A.C. Green Spot, 5/-; M.H.L.4, 7/6; Pye 20 henry, 8/-; Weston relay, 10/-; galvanometer, 3/6; Western Electric horn speaker, £1.—Hulley, 255, Onslow Drive, Glasgow, E.1. [1629

EKCO All Mains Units, C2A, cost £10/17/6, £7, or near offer; Ferranti A.F.4, 10/6; hypermu, 13/-; Mullard R.C. Unit, 10/-; all as new.—82, Molesey Rd., Hersham, Surrey. [1630

PHILIPS Rectifier, type 366, 3 outputs, 6 volts, 5 and 6 amps, 12 volts 3 amps, sell, 70/-; 6-volt moving coil speaker, 40/-.—29, Bushey Av., South Woodford, E.18. [1633

EXPERIMENTER'S Surplus.—Kit magnum coils, 2 s.p. aerials, 2 s.p. H.F. transformers (250-2,000 metres), 20/-; Blue Spot 66K, 12/6; Amplion A.R.65, cost 70/-, take 25/-; P.M.254, 6/6; Magnum L.F. choke, 3/6; all as new, perfect.—G. P., 90, Ashbury Rd., London, S.W.11. [1650

LEWCOS Dual Coil, D.R.A/1, 10/6; Westinghouse H.T.4, 32/6; transformer, with 4v. 4a. winding, 17/6; B.I. choke, 16/9; Nicore I, 16/6; Blue Spot 66R, 29/6; R.I. hypercore, 15/-; all absolutely as new.—S. G. L., 49, Clifton Rd., Tuebrook, Liverpool. [1639

DISMANTLED S.G. 5-valver components, half price; also speakers, accumulators; send list.—6, Elphinstone St., N.5. [1641

GAMBRELL Novotone, 70/-; B.T.H. pick-up, complete, 25/-.—Harwood, Crocker End, Nettlebed, Henley-on-Thames. [1644

FERRANTI Moving Coil Speaker Chassis, D.C. mains, with output transformer, £5; Hegra, ditto, £2; 2 Cossor S.G.220, 2 Osram S.G.215, 10/- each.—H. Spriggs, 4, Swan St., Isleworth, Middlesex. [1653

EXIDE W.H.10, 140 volts, 50/-; Exide charger, combined H.T. and L.T., 200-250 volts A.C., 60/-; Westinghouse Rectifier, H.T.3 12/-; Marconi DEH610, 5/-; all perfect.—Fagan 46, Liberia Rd., Highbury Corner, N.5. [1658

A.F.5, 19/-; Hypermu, 12/6; Mazda, A.C./P.E.N., 18/-; A.C./P., 8/-; A.C./H.L., 5/-; P.M.24, 9/-; P.M.254, 6/-; P.M.4D.X., 5/-; Marconi pick-up, new type, 45/-; all as new.—27, Miles Hill Av., Leeds. [1672

A.F.5, £1; B.T.H. pick-up, 25/-; Kone L.S., £2.—Smith, 10, Parade, Felixstowe. [1671

INDUCTOR Dynamic Loud-speaker, Farrand, 45/-; Loewe pick-up, 7/6 Edison tonearm, 2/6; all new.—72, High St., Cheadle, Staffs. [1664

HEGRA Unit, 12/6; 66P., 22/-; Hegra speaker, 22/6; surplus components; stamp.—335, Barton St., Gloucester [1668

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G. A. RYALL, 182, Kennington Rd., London, S.E.11. [1666

B.T.H. Pick-up and Tone Arm, unused, 30/-; Mullard E speaker, £1; Weston m.c. m.a. meter, £1; approval.—Ordish, 50, Bonnington Cres., Sherwood, Nottingham. [1676

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

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Wednesday, October 15th, 1930.

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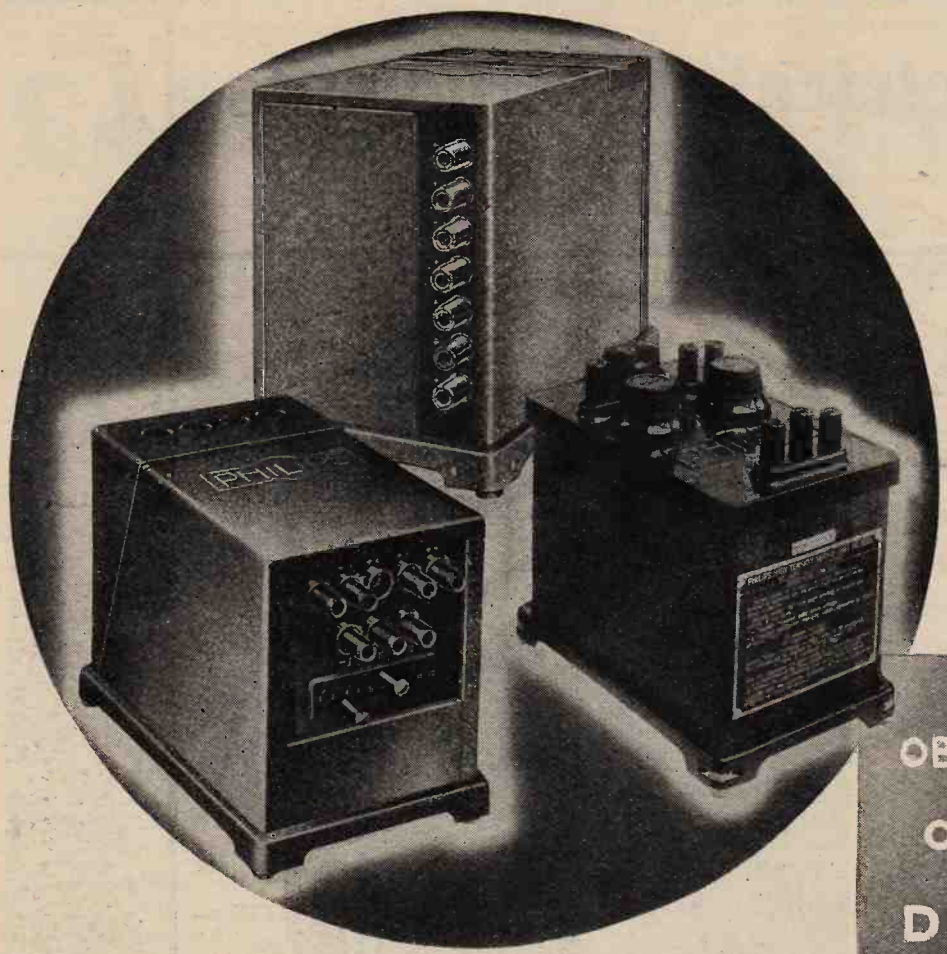

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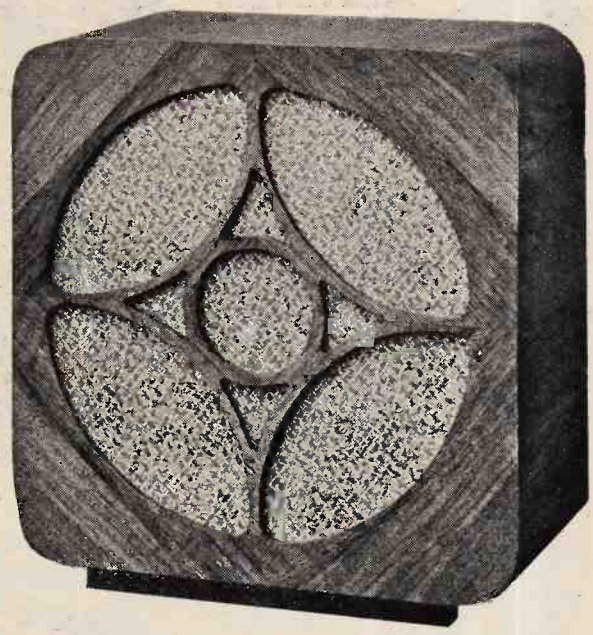

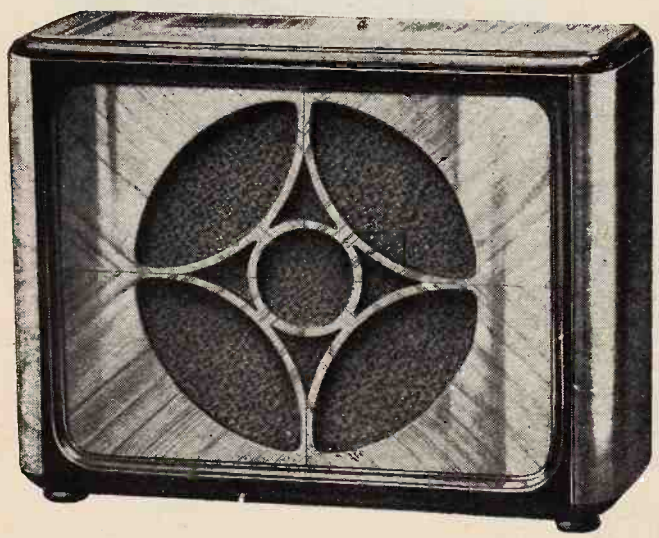

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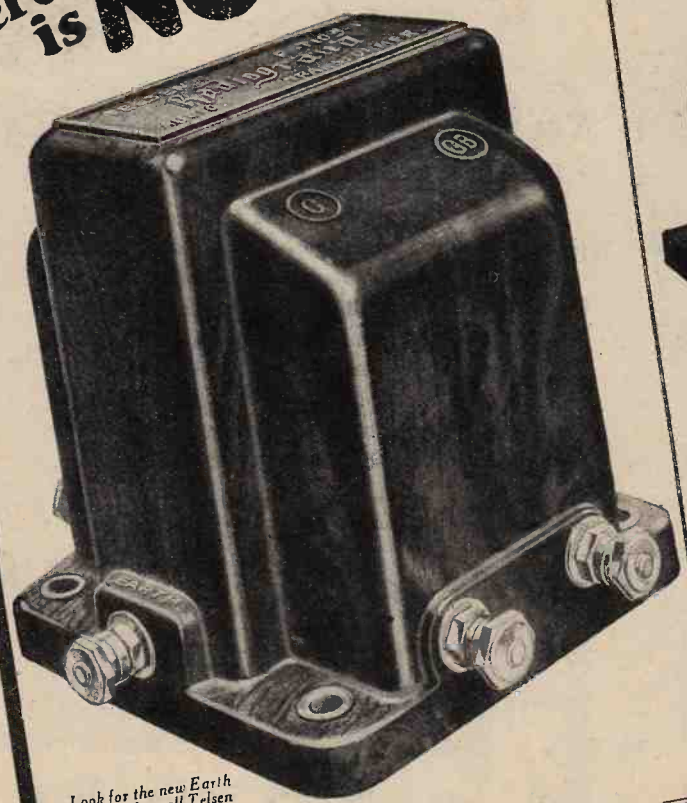

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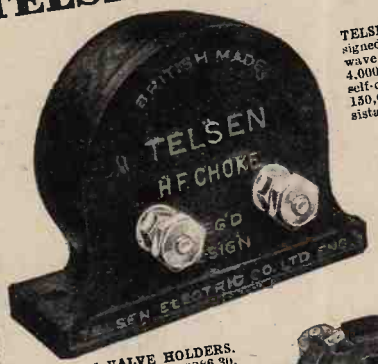

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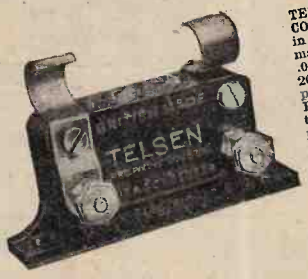

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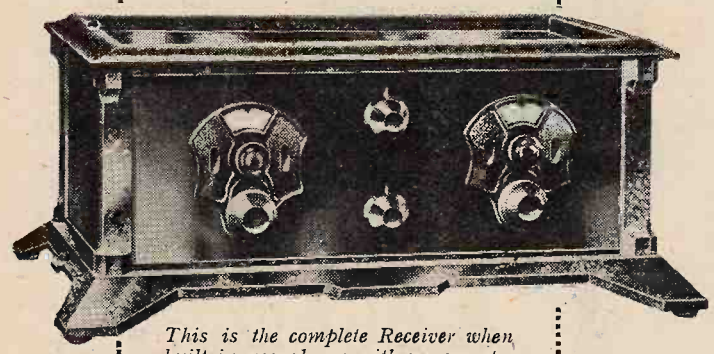

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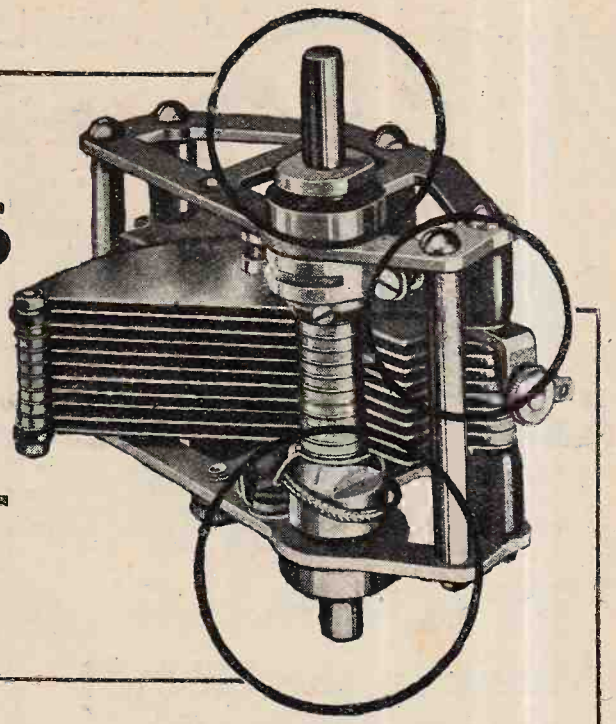

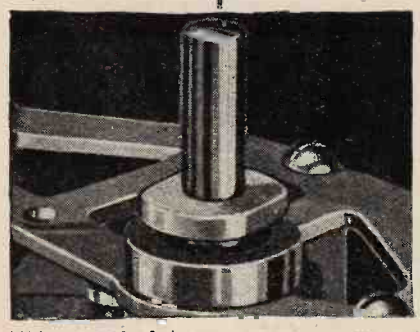

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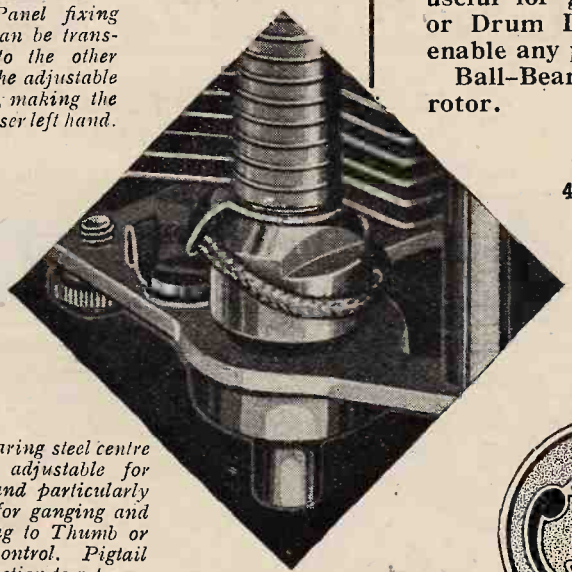
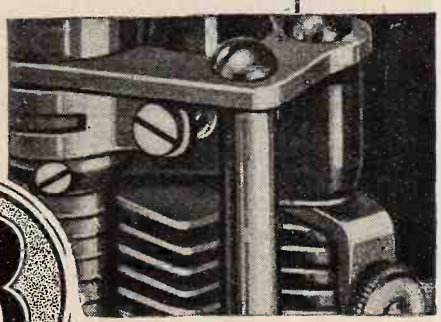
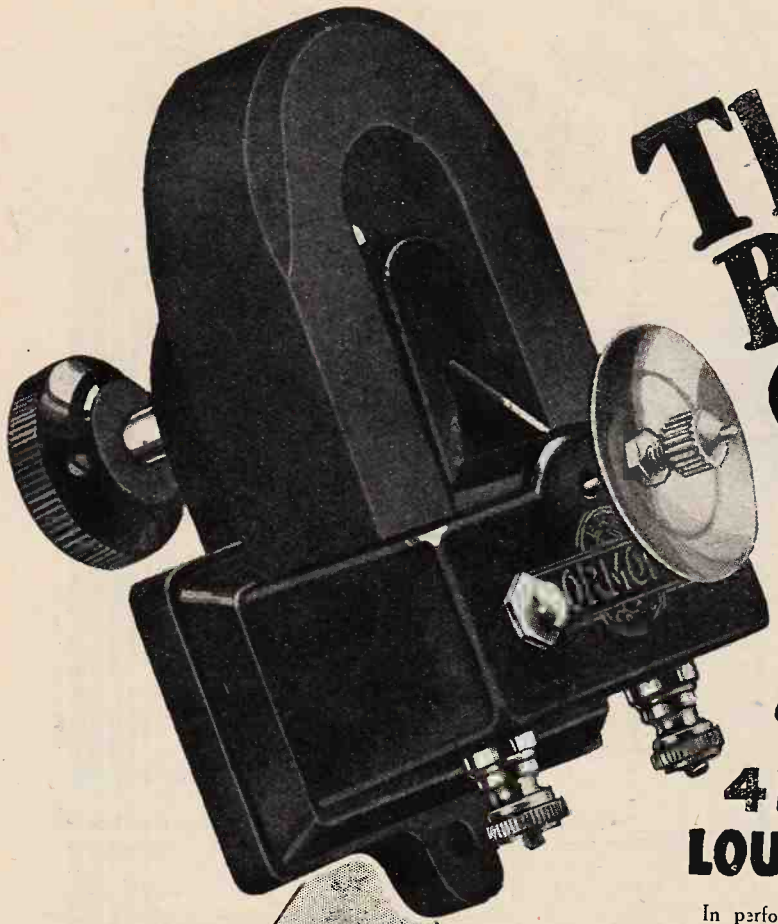


Ball-bearing steel centre spindle adjustable for length and particularly useful for ganging and attaching to Thumb or Drum control. Pigtail connection to rotor.



Showing the well-known J.B. adjustable tension to centre spindle

PRECISION INSTRUMENTS



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The Wireless World AND RADIO REVIEW

(18th Year of Publication)

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Editorial Comment

A German Experiment.

ONE of the German broadcasting stations has recently conducted an interesting experiment which provides material for reflection by our own B.B.C. Stuttgart arranged a mixed programme of gramophone music and items broadcast by studio artistes, and listeners were asked to distinguish between the two types of transmission. Of 16,274 listeners who participated in the test and sent in their results, only 52 were able to distinguish correctly between the transmissions, all the remainder having failed to sort out consistently the items reproduced from records from those by living artistes.

We would suggest that, without necessarily making any announcement to the effect, the B.B.C. might from time to time introduce records in their programmes in order to see whether the public is able to distinguish the difference, and we are inclined to think that the majority of listeners would often prefer a gramophone record performance by first-class musicians to a first-hand rendering by such poorly qualified amateurs as sometimes appear in the present programmes. Perhaps we should add that the B.B.C. would have to be a little more careful in their methods of transmitting records than at present if they were to hope to avoid detection of the experiment by the listener. It would be necessary, for instance, to see that the pick-up was not dropped on the record; needle scratch would have to be eliminated more effectively, and we would particularly recommend that the gramophone motor should not be allowed to run down whilst a record was being played.

The "Wireless World Four."

IN this issue a description is included of *The Wireless World* Four, a receiver to which we would like to draw special attention. Readers of *The Wireless World* are familiar with a number of new features in receiver design which have been introduced or popularised through the columns of *The Wireless World* during past months, and it will be found that in this new set an endeavour has been made to incorporate all the more important of these features, the result being a receiver of unusually attractive design and having a performance which should satisfy the most fastidious as regards selectivity, range, and quality. Single-dial tuning with band-pass circuits is incorporated, and we believe that, in particular, the set will prove a revelation to those who take an interest in quality reception of distant transmissions.

The complete design has been produced in the form of a radio gramophone, including the turntable and loud speaker, and the equipment is entirely mains operated. Those who may want to build the chassis of the receiver apart from the gramophone can do so, as the design is self-contained and lends itself admirably to separate construction.

In This Issue

THE Wireless World FOUR

Modern Principles in Practice.

By F. H. HAYNES.

ALL that is modern in radio practice has been brought together and embodied into this receiver. Since last winter some half-dozen new features have been theoretically, and, in some cases, practically, exploited by the contributors to the pages of this journal. This set represents a practical interpretation of all these new principles working as they should, and is put forward at a time of the year when longer evenings and better conditions give added interest in foreign-station reception.

While the set was developed during the summer months publication was delayed until after the Show in order that new components might not be overlooked and to be quite sure that the design was entirely up to date, and that no feature would be rendered obsolete by new developments revealed at the exhibition. A preliminary notice of the set appeared in the exhibition issue (page 316, September 24th), and no change has been made in its specification.

A brief summary of the advantages resulting from the inclusion of the many new features is given in support of the various details shown in the circuit diagram.

SPECIFICATION.

Selective band-pass tuning.
Single dial control without trimming condensers.
Pre-H.F. volume control.
Critical regulation of regeneration at point of maximum amplification.
Complete coil and valve screening.
All H.F. above baseboard with distribution circuits immediately beneath.
Tuned grid intervalve couplings.
Ganged wave change switching.
Distortionless power grid detection.
High voltage compensated pentode output.
Complete smoothing and decoupling with a minimum of apparatus.
All mains operation.
Provision for gramophone and designed for housing in a standard radio-gramophone cabinet.
Easy access to all components and straightforward wiring so that but few leads appear above the baseboard.
No components to be home constructed.
Lowest possible cost.

Band Pass.

Proof that band-pass tuning is an essential to modern receiver design is very convincing when one first operates a set in which it is included. At no point over the condenser scale do we find excessively sharp tuning, neither does any station occupy more than about two and a half divisions of the dial. The condition of a steadily declining signal as we detune is not met with, and in its place a sudden disappearance of the signal occurs as soon as a limited band is passed. As regards station getting and interference, the set is one of great selectivity without noticeable sacrifice of range, and, what is more important, without producing a sharp, peaky tuning where the quality of reproduction with a loss or accentuation of bass depends so much upon the precise setting of the tuning condenser when listening to a distant station.

Band-pass tuning consists of a loose coupled aerial circuit in which the extent of coupling is governed by the value of a capacity or inductance common to both circuits. Capacity coupling is chosen in this instance primarily because it facilitates ganged control of the tuning condensers, and does not entail the possibilities of the differences in inductance value which would be fatal to the successful ganged tuning. Reference to the circuit diagram will reveal that condensers are, moreover, essential in connection with grid biasing of the H.F. valves. In order that the wave-range covered will extend from 190 to just over 570 metres, the inductance value of the tuning coils was adjusted to 200 microhenrys.

While several values of coupling condensers were used between the two circuits for the purpose of test it was found that the best results were obtained with a capacity of 0.01 mfd. This value, combined with tuning coils of 200 microhenrys, places the 10 k.c. peak separation in a central position of the tuning scale. Using log-law tuning condensers as the most convenient, and in which the relationship between frequency change and dial divisions is slightly greater towards the zero end of the scale than the maximum, an apparent sharpening up of the tuning occurs as the zero end of the tuning scale is approached. This observation is made bearing in mind that the peak separation becomes less as the wave-

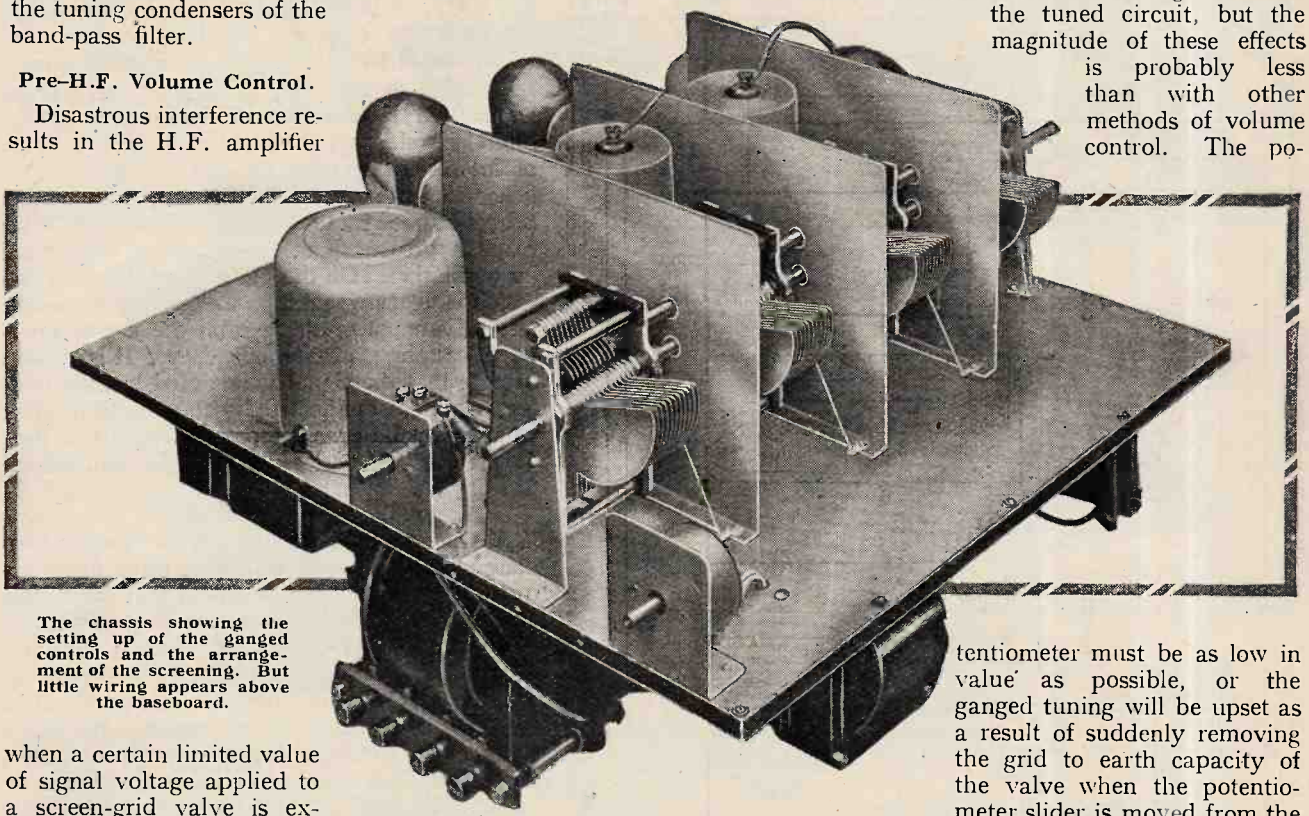
The Wireless World Four.—

length decreases, whilst the steepness of the slope of the resonance curve up to the peaks is not so great with small values of tuning capacity. As a result, weak stations appear much more sharply tuned and strong stations more flatly tuned as the low wavelength end of the tuning scale is approached.

Reference to the circuit diagram shows that the coupling capacity of 0.01 mfd. is produced by two parallel-connected condensers, one associated with each tuned stage, and are equivalent, with regard to tuning, to the inclusion of 0.01 mfd. in each of them. Test revealed that when precisely similar tuning coils are used, and when one coil is very loosely coupled to the aerial, that a balancing condenser was unnecessary across either of the tuning condensers of the band-pass filter.

Pre-H.F. Volume Control.

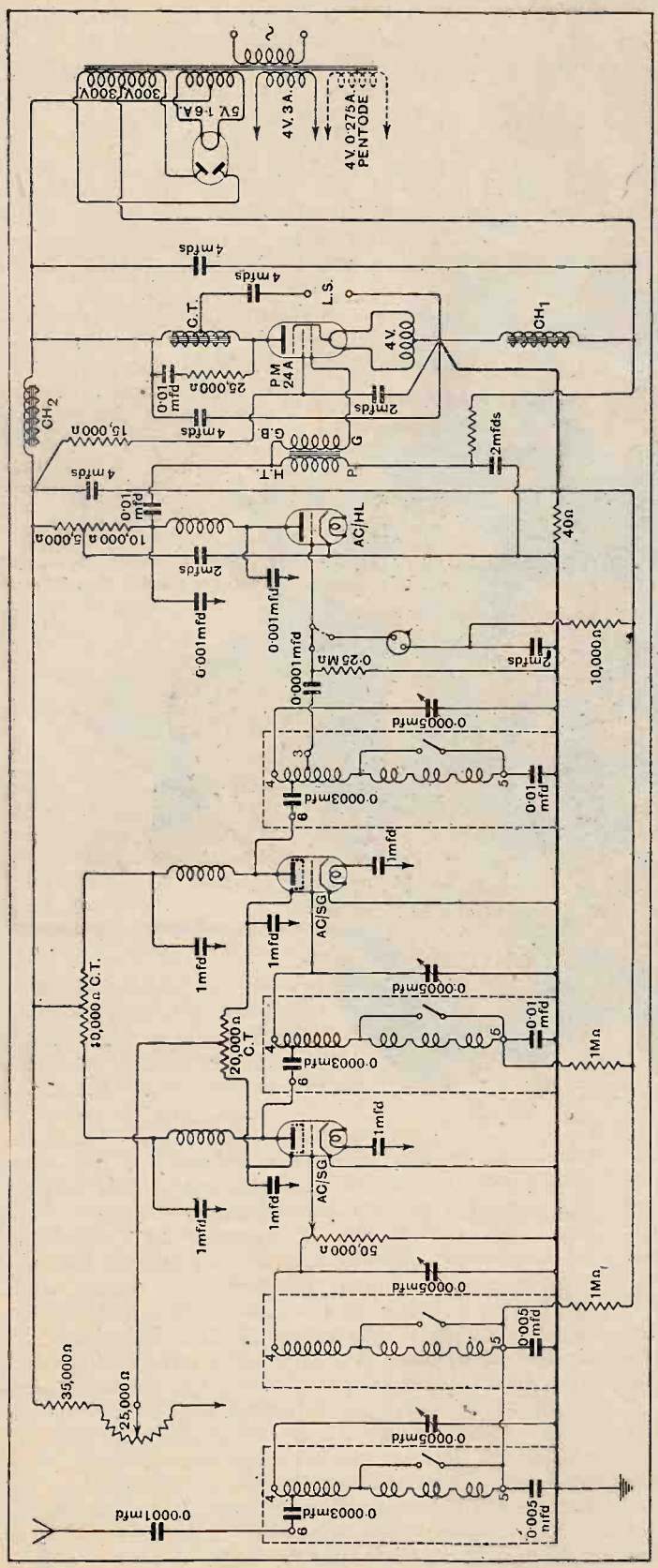
Disastrous interference results in the H.F. amplifier when a certain limited value of signal voltage applied to a screen-grid valve is exceeded. This is due to the fact that, unlike the triode, the plate current of the screen-grid valve is only proportional to the grid voltage within a very limited value of grid swing. When the anode current is no longer proportional to the grid voltage rectification occurs, resulting in the modulation of other carriers, and interference between the frequencies is created. It is essential, therefore, to give no more input to the H.F. valves than they can handle without appreciable rectification, bearing in mind, also, that greater signal input will overload the detector.



The chassis showing the setting up of the ganged controls and the arrangement of the screening. But little wiring appears above the baseboard.

Pre-H.F. volume control is essential, and, while the first valve may be capable of handling the input signal, no provision is made in a second H.F. stage for a magnified signal input to be dealt with. While it might seem an exceedingly simple matter to regulate the amount of signal passed from the aerial to the set, the problem is one most difficult of solution. True, a small variable series condenser in the aerial regulates the input, but this upsets the ganging of the filter, while zero on this volume control condenser by no means gives an extinction of signal. A differential condenser in the aerial which links the first tuned circuit to a varying extent between the aerial capacity and a condenser equal in capacity to that of the aerial gives a good control of input, but here, again, calculation reveals a small change in the capacity value thrown on to the tuned circuit sufficient to influence ganging near the minimum position of the tuning condenser.

A potential divider, as shown in the circuit diagram, is the only alternative method. Such a potentiometer suffers from two drawbacks. It affects tuning, and loads the tuned circuit, but the magnitude of these effects is probably less than with other methods of volume control. The potentiometer must be as low in value as possible, or the ganged tuning will be upset as a result of suddenly removing the grid to earth capacity of the valve when the potentiometer slider is moved from the maximum position. The low value of 50,000 ohms chosen may be queried, but it is pointed out that the throwing of a 50,000-ohm load across the input tuned circuit made no audible difference to the reception of a weak station. This reveals the fact that the dynamic resistance of the tuned circuits is low, which, while being true, is not without its advantages, and, in particular, should it be mentioned that the valves are capable of handling a greater input without the selectivity being entirely crippled by valve overloading when the dynamic of the tuned circuits is kept within bounds. Before going farther, it may be pointed out that this method of volume control functions admirably when receiving distant stations like Vienna, Budapest, and Katowice, so that its effect on gain, as well as on the tuning, must be insignificant. The potentiometer is noiseless in action, and to the ear the change of volume is linear



Complete circuit of mains-operated radio-gramophone giving all essential values. The decoupling and smoothing resistance feeding the 2 mfd. condenser connected to the L.F. intervalve coupling has a value of 2 megohms.

over the range of control, while there is no variation of pitch.

A variable high resistance is sometimes connected in the grid lead as a means of regulating volume, so that a potentiometer is formed through the grid to earth capacity of the valve. This method does not give a position of zero signal, and demands the use of a very high resistance, which affects tuning.

Regeneration Control.

In addition to the volume control, another knob is brought on to the front of the set, which, although by no means essential, helps one to get that last ounce out of distant reception. Over a limited range it controls the screen voltage, and therefore regulates regeneration within the H.F. stages. The merit of the screen-grid stage is that the signal is always being augmented by reaction brought about by the interelectrode capacity. The lower the value of interelectrode capacity and the less the regeneration the better, in that the amplification brought about by the valves' characteristics can reach a greater figure before being obliterated by oscillation. On the other hand, the reaction which is ever present goes a long way to nullify any advantage resulting from the use of intervalve couplings of high efficiency. It is curious to note that the signal voltage fed to the detector is almost unaffected by the substitution of what might be considered "bad" coils so long as precise inductance matching is maintained.

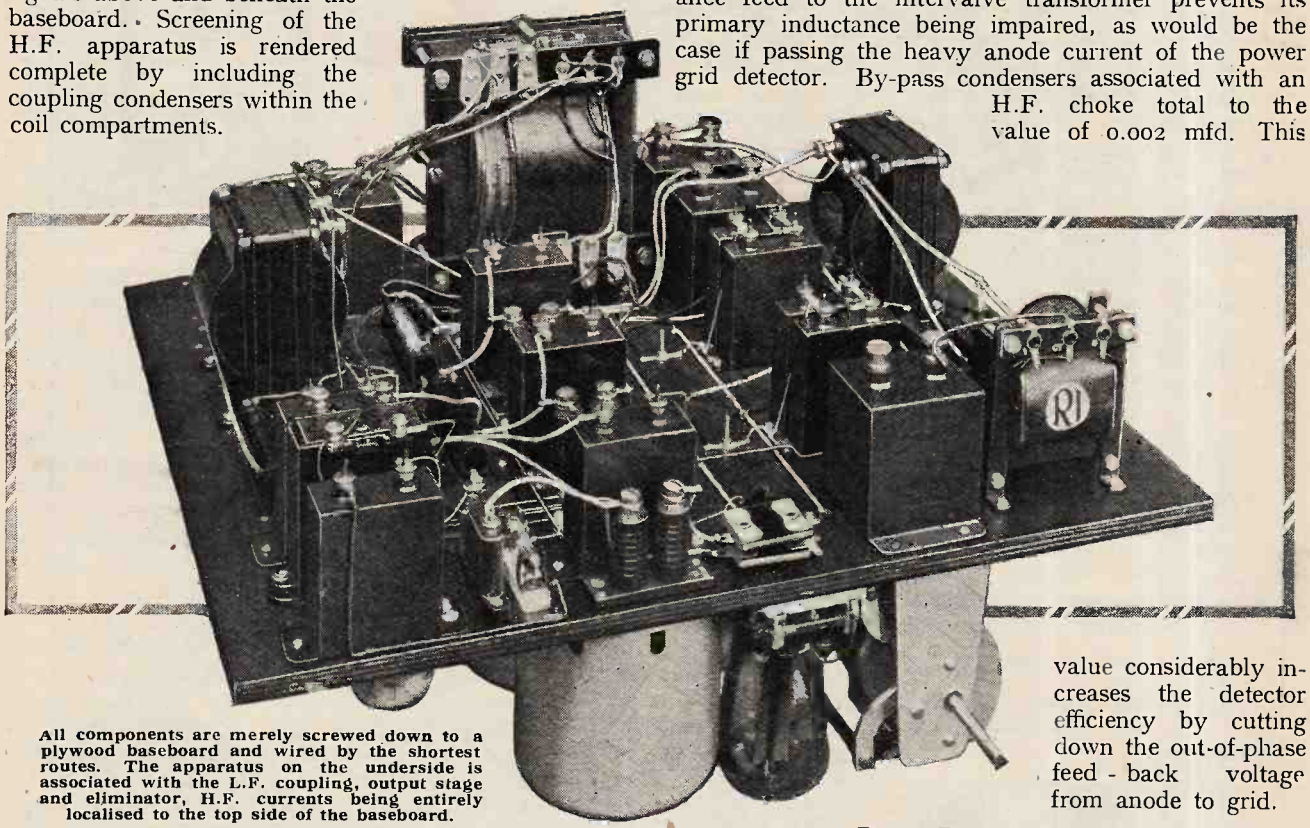
Single Dial Control.

Absence of trimmers across the tuning condensers may call for comment from those acquainted with the improvement that sometimes results when a little added capacity is thrown on to one or other of the tuned circuits. Assuming that the coils are all exactly matched, as may be checked with oscillator and anode-bend meter, if home-made, it only becomes necessary to introduce trimming capacities when the intervalve couplings are sharply tuned and the stray capacities across the tuned circuits differ. The intervalve couplings used are arranged for maximum amplification and the coils are not tapped down with the object of improving selectivity, this being taken charge of by the band-pass filter. In consequence, the H.F. stages will accept signals over an adequately wide tuning range to render the need for capacity trimming unnecessary. Incidentally, it is a fact that the stray capacities thrown across the tuned circuits by the aerial, the volume control, the screen-grid valves and their choke feeds, and the detector, with its tapped connection, are approximately equal, as was revealed by tuning up every stage to the best position and watching an anode current meter in the detector circuit. All condensers were found to have been set in identical positions.

The Wireless World Four.—

One-knob switch control introduced into the original Foreign Listener's Four is retained and has been simplified. By this means the coils are wired as easily as for single range tuning, the switch and its connections being part of each coil.

Screening is generous, but in every particular essential. Only so long as all the coil covers and valve covers are pressed right home is a strong loud speaker signal produced from well over a score of Continental stations. With a loose cover stations will still be heard, but reduced in strength, and it will be noted that maximum screen grid volts cannot be applied. A feature of the design is the complete barrier between H.F. and L.F. signals above and beneath the baseboard. Screening of the H.F. apparatus is rendered complete by including the coupling condensers within the coil compartments.



All components are merely screwed down to a plywood baseboard and wired by the shortest routes. The apparatus on the underside is associated with the L.F. coupling, output stage and eliminator, H.F. currents being entirely localised to the top side of the baseboard.

Power Grid Detection.

While grid detection is usually favoured for distant station reception owing to the fact that it is much more sensitive with small voltage inputs than the anode bend detector, it can be shown that power grid detection may be superior to the anode bend method on the score of both sensitivity and quality. Ordinary leaky grid detection results in a loss of the higher audio frequencies owing to the values of leak and condenser chosen, these being essential to good sensitivity. When the signal reaches more than certain critical value, however, anode rectification in opposite phase takes place, so that whatever the voltage input linear rectification never results.

Grid condenser and leak values of 0.0001 mfd. and 250,000 ohms are adopted in order that the resultant time constant may permit of the signal variations being correctly followed. In addition a voltage of 150 is applied to the anode of the detector in order to give a straight anode characteristic and permit of the valve delivering generous output. A departure is made from the customary practice of connecting the low-resistance leak across the grid condenser, owing to the condenser connected on the lower side of the coils, but the value of the leak, incidentally, is far too high in value to influence the tuned circuit.

Filter-fed Intervalve Coupling.

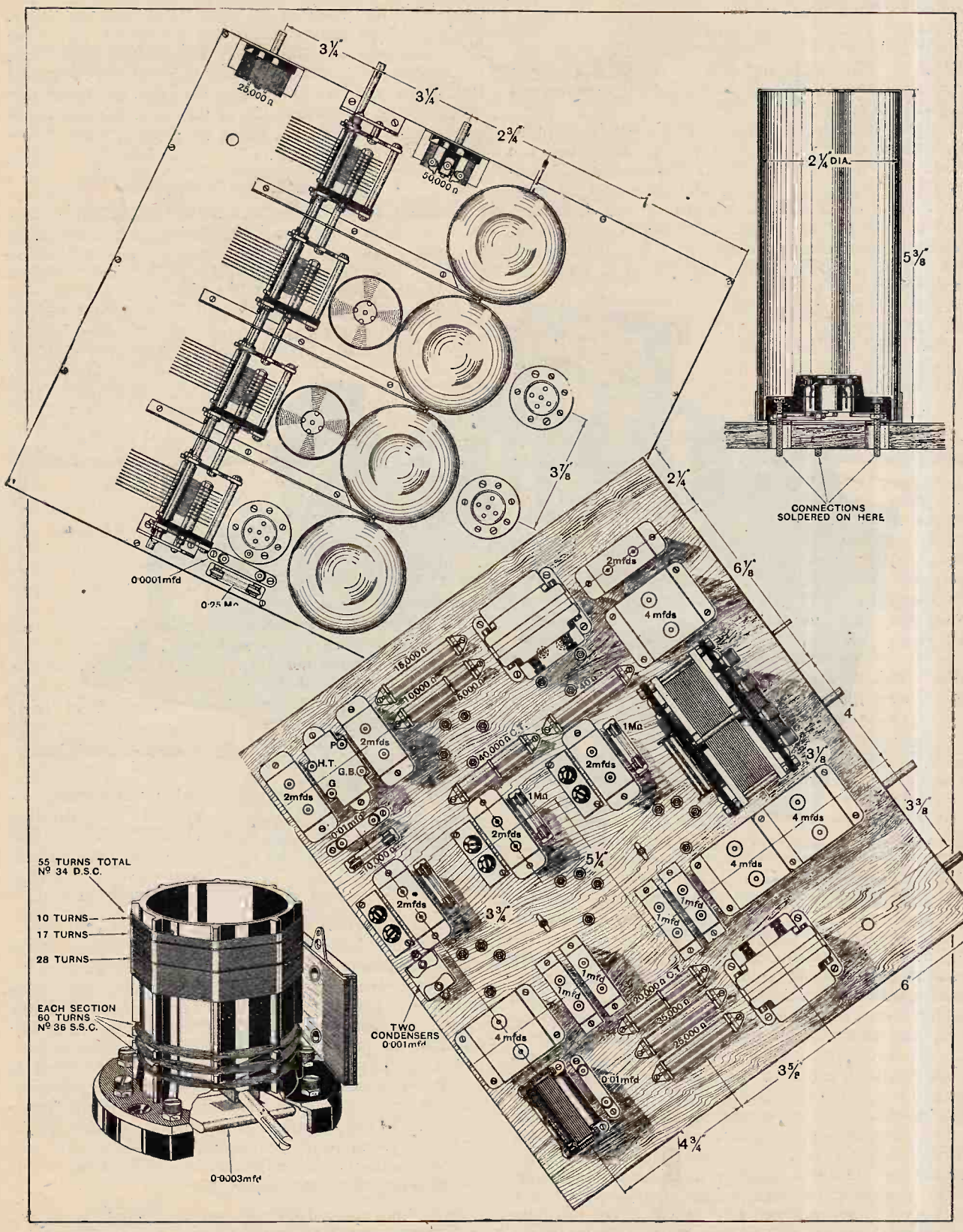
With an initial voltage of nearly 300 adequate resistance decoupling and resistance feed may be introduced into the anode circuit of the detector while still maintaining a high voltage on the plate of the valve. Resistance feed to the intervalve transformer prevents its primary inductance being impaired, as would be the case if passing the heavy anode current of the power grid detector. By-pass condensers associated with an H.F. choke total to the value of 0.002 mfd. This value considerably increases the detector efficiency by cutting down the out-of-phase feed - back voltage from anode to grid.

Power Pentode Output.

Maximum low-frequency stage gain results from the connection of the intervalve transformer as an auto-coupling. By this means a higher transformer ratio results than that as expressed from primary to secondary alone. At the same time, in addition to giving a higher input to the pentode a frequency characteristic is produced, slightly falling in the upper register. This is easily compensated for by the pentode valve which, with its brilliant output, normally augments the upper register. In the output stage a valve is chosen capable of an output of nearly 2,000 milliwatts (compare with a good triode, which handles the same signal input and gives an output of 900 milliwatts).

Compensated Output and Tone Control.

Owing to the fairly high working impedance of the pentode it is normally found that the transmission



Dimensional layout of the components on the top and underside of the baseboard. Details are also given of the coil construction and the tubular valve screens.

LIST OF PARTS.

Chassis.

4 condensers, 1 mfd. } 400 working voltage.
6 condensers, 2 mfds. } (T.C.C. type 80.)
4 condensers, 4 mfds. }
2 condensers, 0.01 mfd. } (Polymet postage
2 condensers, 0.005 mfd. } stamp type.)
2 condensers, 0.001 mfd. }
2 condensers, 0.01 mfd. } (Mica dielectric. T.C.C.
1 condenser, 0.0001 mfd. } upright type.)
1 Intervalve transformer (R.I. Hypermu).
1 Low frequency choke (R.I. Pentomite).
2 Low frequency chokes (Ferranti type B1).
1 Mains transformer (Rich & Bundy, Model 35).
3 High frequency Chokes (McMichael Binocular Junior).
1 Grid leak, 2 megohms. } (Loewe.)
2 Grid leaks, 1 megohms. }
1 Grid leak, 0.25 megohm. }
1 Grid leaks, 0.1 megohm. }
5 Porcelain grid-leak holders (Bulgin).
5 Five-pin valve holders (W.B.).
4 Variable condensers 0.0005 mfd. with screens and arranged for ganging (Cyldon).
1 Reduction gear dial (Burndept Ethovernier).
2 Potentiometers, 25,000 ohms and 50,000 ohms (Colvern).
Resistances as follows: 40 ohms, 10,000 ohms, 25,000 ohms, 35,000 ohms, 20,000 ohms centre tapped, 40,000 ohms centre tapped, 15,000 ohms tapped at 5,000 ohms (Colvern).
4 Coils with switches and screens (Colvern TGSC).
2 Valve screens (The Loud Speaker Co., Ltd., 2, Palmer Street, London, S.W.1).
Baseboard, tin plate, systoflex, screws, wire, etc.

Radio Gramophone Equipment.

Electric gramophone motor (Garrard).
Pick-up and tone arm
Loud speaker movement and chassis. } (British Blue Spot Co., Ltd.).
Single-pole two-position switch (Benjamin)
Radio gramophone cabinet (Kabilok).

becomes high-pitched. This is due to the fact that the impedance of the loud speaker only becomes comparable with that of the valve at the higher frequencies. For maximum transference of power to the loud speaker the latter should have an impedance value about twice that of the valve at frequencies in the middle register. On the other hand, overloading of the valve, with consequent distortion and a limiting of its signal handling capacity, would result were an output transformer ratio adopted, which would excessively raise the loud speaker load.

It has been shown that the pentode behaves like a fairly high impedance triode, and that a two-to-one step-down ratio matches the valve to the average loud speaker, taking the impedance of the latter at its value in the middle register. Having thus obtained good reproduction of the lower notes, excessive momentarily anode voltages, dangerous to the pentode, may result at the upper frequencies, where the impedance to the loud speaker is excessive. This is remedied by shunting a condenser across the output auto-transformer, the impedance of which falls as the frequency rises. By this means excessive voltages are shunted away while the effectiveness of this condenser is regulated by a series resistance.

Complete Decoupling.

Assuming that audio-frequencies are unavoidable in the high-frequency amplifier, values of decoupling must be taken that will provide complete separation between all the valve stages. High value resistances and condensers effectively decouple grids, screens and anodes of the H.F. valves to an extent that the lowest audio frequencies find a much easier path through the by-pass condensers than that offered through the resistances and back to the common H.T. source. These resistances are inexpensive and can be used generously.

Special problems of decoupling present themselves between power detector and pentode. In addition to resistance decoupling, choke decoupling must be provided between any power detector and its following pentode. While this could be put in without further thought, attention has been turned to cost. The choke used, therefore, serves a dual purpose. It is the smoothing choke essential between rectifier and early valves, and at the same time is the decoupling barrier between detector and pentode.

Additional difficulties present themselves when the choke in the anode of the pentode is turned over from filter feed to auto-transformer. In the first place the choke is a stopper to potentials going back to the H.T. source; in the second it develops a high signal potential across the H.T. leads which may be readily conveyed to other valves. The decoupling is adequate to prevent this difficulty, but it should be noted that the feed condenser to the intervalve transformer is lower than the customary value. It can be made bigger without trouble, but tests with frequency records and valve voltmeter through the L.F. amplifier revealed that quality is unchanged. What is important is that its small value increases the effectiveness of the decoupling.

To save the purchase of unnecessary expensive components the other smoothing choke serves the dual purpose of smoothing as well as biasing the output stage. It will be noticed, moreover, that the grid bias developed is fed into a decoupling circuit consisting of a 2-mfd. condenser and a 2-megohm leak directly from the H.T. eliminator, these values producing a most generous smoothing.

The circuit arrangement, in general, has been developed from that of the Foreign Listener's Four as regards the arrangement of the single dial control, the H.F. stages, much of the decoupling and grid biasing, though the modifications just mentioned have been introduced into the detector and output stage to economise in the amount of apparatus required by the inclusion of power-grid detection and pentode.

(To be concluded with constructional details.)

This receiver can be seen on "The Wireless World" stand at the Manchester Exhibition.

For a more detailed treatment of the various features which have been embodied the reader is referred to the following *Wireless World* articles:—

Band Pass.
"*Selectivity and Quality*," by W. T. Cocking, Oct. 30th, 1929.
"*Capacity Coupled Filters*," by A. L. M. Sowerby, M.Sc., April 2nd and 9th, 1930.
"*The Band Pass Four*," by W. T. Cocking, June 25th and July 2nd, 1930.
"*Band Pass Unit*," by W. I. G. Page, B.Sc., August 27th, 1930.
"*Notes on The Band Pass Three*," by H. F. Smith, Sept. 24th, 1930.

Power Grid Detection.
"*Power Pentode Two*," by W. I. G. Page, B.Sc., May 7th, 1930.
"*Power Grid Detector*," by W. T. Cocking, May 7th, 1930.

Resistance Fed Intervalve Coupling.
"*The Parallel-Fed L.F. Amplifier*," by F. Aughtie, Ph.D., and W. F. Cope, B.A., December 11th, 1929.

Output Stage.
"*Matching Valve and Loud Speaker*," by A. L. M. Sowerby, M.Sc., May 28th, 1930.
"*Quality Reception*," by John Harmon, October 8th, 1930.

Mains Operation and Single Dial Control.
"*The Design of A.C. Mains Sets*," by W. T. Cocking, September 11th and 18th, 1929.
"*Mains Sets and Grid Bias*," by F. H. Haynes, December 4th, 1929.
"*New Foreign Listener's Four*," by F. H. Haynes, February 12th and 26th, 1930.
"*Notes on the New Foreign Listener's Four*," by F. H. Haynes, May 28th, 1930.
"*The Logarithmic Condenser*," by F. H. Haynes, May 18th, 1927.

Current Topics

TOULOUSE NOT "ALL OUT."

Radio Toulouse is already noticeably stronger to listeners in Britain, but we learn that the new transmitter's maximum power of 60 kW. will not be used until March or April next.

oooo

PARIS POWER INCREASE.

Radio Vitus, the well-known Paris station, is to increase its power from 2 to 20 kW., though the change will not be effected until the spring. The station is now controlled by Etablissements Pathé.

oooo

AMATEURS REMEMBERED ON NAVY DAY.

The ceremonies attending America's Navy Day on Monday, October 27th, will include a special message to U.S. radio amateurs broadcast from naval stations at Washington (74.7 and 33.8 metres) and San Francisco (68.4 and 34.2 metres) at 7.30 p.m. E.S.T.

oooo

WATCHING THE "HAMS."

Licensing of all the 17,000-odd amateur stations in the United States has been taken over by the Federal Radio Commission from the Radio Division of the U.S. Department of Commerce, which has been responsible since the early days of "ham" radio before the War.

oooo

PHYSICAL AND OPTICAL SOCIETIES' EXHIBITION.

Wireless will find a place at the Twenty-first Annual Exhibition of the Physical and Optical Societies, to be held on January 6th, 7th, and 8th, 1931, at the Imperial College of Science, South Kensington.

oooo

120 KILOWATTS FROM IRELAND?

The possibility of broadcast transmissions from the Irish Free State with an aerial power of 120 kilowatts will be provided for in the apparatus about to be constructed by the Marconi Company at Chelmsford. The Irish Free State authorities require a transmitter capable of serving the whole of the State, and while the new transmitter will have a normal aerial energy of 60 kilowatts, arrangements will be made to enable the aerial energy to be doubled if necessary.

It is interesting to note that power to operate the station will be supplied from the Irish high-tension network, the A.C. current being rectified at the wireless station by a Brown-Boveri Mercury Arc Rectifier.

The transmission frequency characteristic should be of unimpeachable quality, as linearity between 30 and 10,000 cycles will be arranged for in the modulation system. It is understood that the wavelength used will be 413 metres.

It is expected that the station will be ready to begin operation in the autumn of next year.

EVENTS of the WEEK in BRIEF REVIEW

EASY TERMS.

Heard outside the Paris Salon :—

A. : "I have scored a great bargain—one of the latest sets at 10 francs a month!"

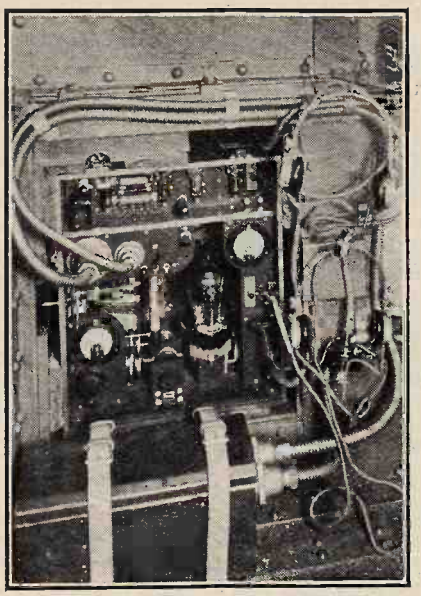
B. : "For how many months?"

A. : "Great Scot! I forgot to ask!"

oooo

8-METRE TRANSMISSION ON TANKS.

An ultra short-wave portable installation—operating on between 7 and 8 metres—has been produced by Marconi's Wireless Telegraph Company, Ltd., for use on armoured vehicles such as tanks. Known as the Type S.B.1a, the combined transmitter and receiver are specially mounted in a shock-proof teak case. Power for the transmitting valves is supplied by a rotary transformer, driven by a 12-volt accumulator and delivery 600 volts to the anodes.



A SHORT-DISTANCE TRANSMITTER. The S.B. 1a wireless set developed by the Marconi Company for use on tanks and armoured cars. The installation works on between 7 and 8 metres and is specially intended for communication over very short distances.

The aerial is almost invisible and consists of a copper-plated steel rod 12ft. in height and made in four sections. A feeder cable connects the transmitter to the aerial system, which is connected to the body of the tank or to "earth" by a balancing coil so as to permit the maximum amount of energy to be transferred to the aerial for the wavelength in use.

R101.

The Daily Telegraph correspondent, writing from Beauvais last week, referred to discoveries made by salvage workers amid the wreckage of the ill-fated airship. He said: "Near the wireless cabin was found a copy of *The Wireless World*, which had apparently not been touched by the flames."

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BEAM TESTS BY PCJ.

PCJ, the Philips short-wave station at Eindhoven, Holland, is now testing with a beam aerial, in addition to that of the normal type.

Listeners, who will be notified which aerial is in use, are invited to send critical reports of the transmissions, which are given on 30.2 metres according to the following schedule :—

Wednesday, 16-20 (for India); Thursday, 18-20 and 23-0; Friday, 0-3 and 18-20; Saturday, 0-6. (Times are G.M.T.).

Reports should be addressed to Philips Lamps Limited, 145, Charing Cross Road, London, W.C.2, marked "PCJ Report."

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RADIO-GRAMOPHONE TALKIES IN AMERICA.

Talkie projectors incorporated in radio-gramophone sets are scheduled for appearance on the American market this winter, according to our Washington correspondent. Prices, it is stated, will be less than £40 for the complete instruments. The gramophone section will be provided with a switch connecting the amplifying system to the film projector. Under a rental system, records will be available to purchasers, together with synchronised films, which will be similar to the silent variety, being 16 mm. in width and 400ft. in length per reel.

Home talkie recorders will also be produced, the trade slogan being "Take your own voice and screen tests."

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AMPLION "TWO SCREEN-GRID CABINET."

It is regretted that an error occurred in the reference to this receiver in our Olympia Show Report of September 24th. The "Two Screen-Grid Cabinet" receiver is obtainable in A.C. and battery models, but not D.C., also, as stated.

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PICTURE GALLERY AT OLYMPIA.

Readers who visit the Olympia Car Show (October 16th-25th) will be interested in a display of original paintings and drawings by F. Gordon-Crosby, the artist of our sister journal, *The Autocar*. Besides many drawings illustrating "Meteors of Road and Track," the collection includes clever pen-and-ink sketches depicting lightly and humorously the processes of manufacture of famous cars and accessories. These have been used to illustrate a series of articles by Maurice Sampson which have been a feature of *The Autocar* for the last two years.

MANCHESTER RADIO SHOW

New Sets and Components Seen at the Stands.

SIR JOHN REITH, Director-General of the B.B.C., on Wednesday last opened the Seventh Annual Manchester Radio Show in the City Hall, Deansgate. Organised by the *Evening Chronicle*, this year's exhibition is larger than any of its predecessors, and a record total attendance may be expected before the doors are closed on Saturday, October 18th.

Mr. R. M. Ellis, of the Radio Manufacturers' Association, presided at the opening ceremony. In his inaugural speech Sir John Reith reminded Mancunians that listeners in the whole of the northern region would soon be enjoying reception such as they had never had before, due to the radiation power of the new regional station.

Mr. E. G. D. Liveing, north regional director of the B.B.C., said that the Manchester exhibition was rapidly assuming the position of being the most important of its kind outside London. The present trend was for people to buy wireless sets in the same manner as they bought motor cars, substituting new for old every two or three years in order to keep abreast of the times.

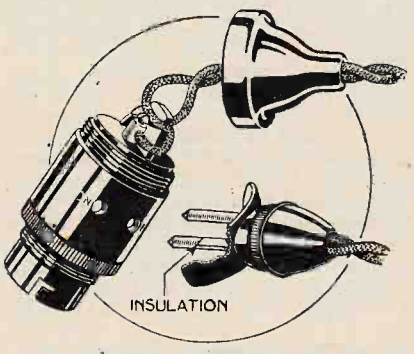
The following Show Report deals principally with new apparatus not shown at Olympia.

AMPLION. (24)

The receivers on this stand are headed by the "Two Screen Grid Cabinet Radio," a pedestal cabinet model incorporating a chassis similar to that of the "Two Screen Grid Portable." Designed for A.C. mains only, the cabinet model has a self-contained frame aerial which can be rotated by a control on the tuning panel. Another receiver which is certain to attract attention is the "Two-valve A.C. Mains" model, which consists of an efficient detector-pentode circuit in a shallow walnut cabinet and is priced at 15 gns. Full descriptions of these and other models appeared in our Olympia Show report.

The well-known "Lion" loud speakers are continued, and several new models have been introduced for the coming season. The "Two Guinea" cabinet cone is a useful addition to the range and is suitable for use with low-priced two-valve sets, though the power-handling capacity is considerable. The standard Amplion cone unit forms the nucleus of the new A.B.6. model at £4 10s., but an entirely new unit of exceptional power-handling capacity has been developed for the special balanced armature speakers, types A.B.41 and A.B.45, at £5 15s. and £6 15s. respectively. Series-parallel connections are provided for the windings, so that the speakers are readily adaptable to either super-power or pentode output valves.

Graham Amplion, Ltd., Slough, Bucks, and 10, Dolefield, Manchester.



"Xtra-Point" lampholder adaptor. (Beardsall.)

BAKER'S "SELHURST" (110).

This firm specialises in the manufacture of moving-coil loud speakers, and the 1931 programme is headed by the "Super Power" model, which is available for 6-volt batteries, D.C. or A.C. mains. The A.C. model incorporates a Westinghouse rectifier and has a high-voltage field winding taking 100 mA. at 200 volts. The moving coil is available in a variety of impedances, and the pentode model has a linen diaphragm to correct over-emphasis of the high frequencies. The price of the D.C. models is £6, and the A.C. model costs £9 10s.

A permanent-magnet model with cobalt-steel magnet is available at £6.

Baker's Selhurst Radio, 89, Selhurst Road, South Norwood, London, S.E.25.

BEARDSALL. (2)

This firm are agents for Regentone mains apparatus and receivers, which were described in our Olympia Show report. They are also manufacturers of the "Xtra-Point" lampholder and plug.

W. E. Beardsall and Co., Ltd., Victoria Bridge, Manchester.

Manchester Radio Show.—

BELLING LEE. (7)

As they were shown at Olympia, the new Belling Lee products have already been described. Reference might, however, be made to the wander plug with enclosed interchangeable fuse. Its use is almost essential for providing complete protection of the valves from the H.T. supply.

Now in its second edition, a useful booklet entitled "Radio Connections" is available at the stand. It completely covers the choice and application of the many forms of connections.

Belling and Lee, Ltd., Queensway Works, Ponders End, Middlesex.

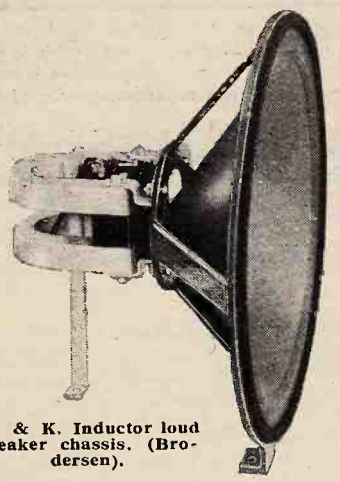
BLUE SPOT. (26)

Blue Spot loud speakers and units, now being manufactured in this country, are shown by H. C. Rawson, Ltd., who are northern agents for these products, which were described in our Olympia stand-to-stand report.

H. C. Rawson (Sheffield and London), Ltd., 100, *London Road, Sheffield.*

BRODERSEN. (105)

N. and K. inductor loud speakers, made under licence from the Farrand Corporation, are exhibited on the stand by the distributors. One of these instruments was recently reviewed in *The Wireless World.*



N. & K. Inductor loud speaker chassis. (Brodersen).

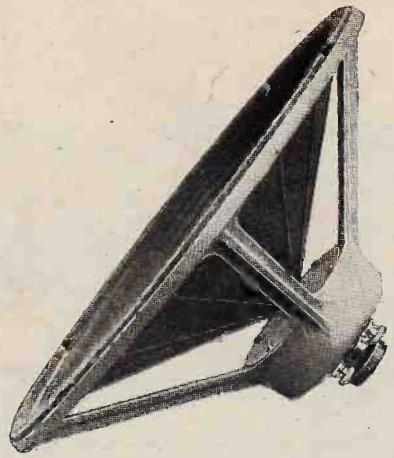
The loud speaker in chassis form, complete with cone, costs £3 10s.; mounted in cabinets of various designs, prices vary between 6 guineas and £7.

A. Brodersen, 11, *Northampton Square, Goswell Road, London, E.C.*1.

BROWN, S. G. (39)

Lack of space in our Olympia Show Report number precluded the publication of a detailed description of the new Brown "Dorchester" console receiver. This set is arranged for either A.C. or D.C. mains feed; its three valves act as H.F. amplifier, grid detector, and L.F. amplifier. The tuning condenser dials, though mounted side-by-side, are separately operated, and an H.F. input potentiometer and reaction control are fitted. A permanent-magnet moving-coil loud speaker is built into the lower part of the cabinet.

*S. G. Brown, Ltd., Western Avenue, North Acton, London, W.*3.



Celestion Chassis designed for incorporation in radio gramophones.

BURNDEPT. (17)

A new three-valve chassis incorporating indirectly heated screen-grid H.F. and power pentode output valves forms the basis of the new receivers and radio gramophones shown on this stand. A full technical description appeared in our Olympia Show issues, but it should be noted that the volume control takes the form of a differential condenser in the aerial circuit and not the combined variation of grid-bias and screen-grid potentials as previously stated.

The principal receiver employing the new circuit is the "A.C. Receiver De Luxe," type 1850, in console cabinet with self-contained receiver. A radio-gramophone on similar lines is also exhibited.

The "Universal Screened Five" is continued with numerous detail refinements, and other important exhibits on this stand include the "Needle Armature" pick-up.

Burndept Wireless (1928), *Ltd., Blackheath, London, S.E.*3.

C.A.V. (43)

This firm specialises in accumulators, and types for all wireless requirements are shown, including "mass" type cells, L.T. accumulators in glass and celluloid containers and H.T. batteries, both in moulded containers and air-spaced glass tubes.

*C. A. Vandervell and Co., Ltd., Acton, London, W.*3.

CELESTION. (41)

The loud speakers for which this firm is noted have been supplemented for the coming season by a new permanent magnet moving coil (type D.100) and inductor loud speaker (type D.50). There are also two new models representing very good value for money in the D.10 and D.12, which replace the old C.10 and C.12 types.

A new gramophone pick-up has been introduced, and, judging from the measured frequency characteristic, is destined to take its place in the front rank of components of this type.

Celestion, Ltd., London Road, Kingston-on-Thames.

CLARKE ATLAS. (40)

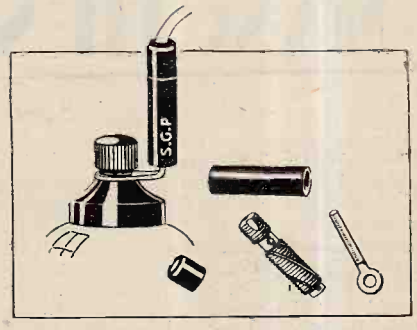
The model 188 A.C. conversion unit, a very practical combination of H.T. eliminator and L.T. trickle charger, as described in our Olympia Show Report, is exhibited in chassis form, so that its internal construction may be examined. This instrument seems to offer good value at £6. A number of other eliminators, both for A.C. and D.C., are exhibited, together with components and accessories.

H. Clarke and Company (Manchester), Ltd., Atlas Works, Old Trafford, Manchester.

CLIX. (111)

Among the very many types of plug and socket connectors exhibited one noted as new a simple and inexpensive tag and holder used for screen grid valves. The new Clix valve holder with self-aligning sockets with the minimum of dielectric material is also shown.

Lectro Linx, Ltd., 254, *Vauxhall Bridge Road, London, S.W.*1.



Useful connectors for screen grid valves. (Lectro Linx-Clix.)

COLLIE. (121)

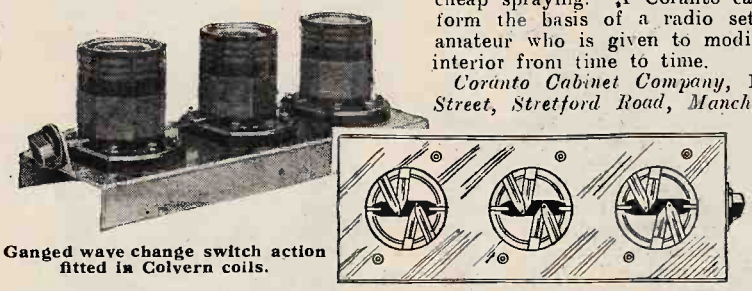
Hydrometers, manufactured under the trade name of "Chaslyn," are exhibited by this firm. Simple instruments of the coloured ball type cost from 1s. 6d. upwards: some of these are designed to be left permanently in the vent-holes of small accumulators. Float type hydrometers, with a guide for the float to prevent its sticking, are made in both glass and celluloid.

J. H. Collie and Co., 10, *Canning Place, Liverpool.*

COLVERN. (14a)

While the products of this firm were described in connection with their Olympia exhibit, one notes the inclusion on the stand of popular receiving sets. These demonstrate the applications of Colvern products. In addition to the Foreign Listener's Four we find a new set developed by the *Manchester Evening Chronicle*, incorporating screened and ganged control coils, Colverstat resistances, and the new wire-wound Colverstat potentiometer. The use of Colvern gang-controlled coils is demonstrated in a band pass unit for the home constructor, a

Manchester Radio Show.—highly selective arrangement designed to meet the conditions produced by the powerful Regional transmitters and to provide high selectivity without loss of sidebands. A free 40-page booklet,



Ganged wave change switch action fitted in Colvern coils.

which includes a resistance calculator, is of special interest.

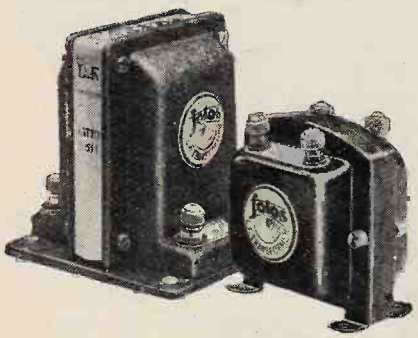
Colvern, Ltd., Mawneys Road, Romford, Essex.

CONCERTON. (67)

This stand is devoted to "Fotos" valves and L.F. transformers. The range of valves is unusually complete, and comprises twenty-five distinct types. Prices are very reasonable, and range from 5s. 6d. up to 22s.

"Fotos" L.F. transformers are made in two types, the "Nipper" at 5s. 6d., and the "Super" at 12s. 6d. Both types are available with either a 3 : 1 or 5 : 1 ratio.

Concerton Radio and Electrical Co., Ltd., 256-7, Bank Chambers, and 329, High Holborn, London, W.C.1.



Fotos "Nipper" and "Super" L.F. transformers. (Concerton.)

CONTINUOUS GRAMOPHONES. (106a)

This exhibit consists of electrically operated gramophones and radio gramophones with a special mechanism for changing records : up to thirty can be accommodated on the carrier at one time.

The turntable is operated by a Kolster-Brandes motor, while another $\frac{1}{8}$ h.p. electric motor of B.T.H. manufacture supplies energy for the record-changing mechanism.

The Vista Continuous Gramophone Co., Ltd., 119-125, Finsbury Pavement, London, E.C.

CORANTO. (70)

Visitors should obtain the sixteen-page list of Coranto wireless cabinets. Its contents cover all requirements, the designs being distinctive and the cabinets of real furniture value. Prices are modest, while it is at once obvious that a high-grade hand-polished finish has been obtained with avoidance of that high gloss surface sometimes met with and attributable to cheap spraying. A Coranto cabinet can form the basis of a radio set for the amateur who is given to modifying the interior from time to time.

Coranto Cabinet Company, 122, Leaf Street, Stretford Road, Manchester.

COSSOR. (30)

Full details have recently appeared of all the new Cossor valves. At this stand one realises that Cossor must not only be looked upon as producers of valves, but also as manufacturers of a complete range of modern receiving sets. The Cossor two-valve A.C. All-Electric receiver has the external appearance of a well-finished loud speaker. Under its hinged lid are the simple controls of reaction, wave change and tuning. The interior does not display an assembly of components, but rather a well-finished receiving unit in a moulded case. Pentode output and valve rectification are included.

The Cossor Commander receiver is a good specimen of the class of receiver which has made its appearance this season. It has screened coils and valves, two H.F. stages, and single-dial control. It is chassis built and is obtainable for £12 15s. Battery eliminators with valve rectification and with correct decoupling between the various outputs are available at moderate prices in the form of units.

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

DIGGLE. (108)

"Reliance" motor-generator charging plants for wireless retailers, garages, etc., are shown under working conditions on this stand.

A. Diggle and Co., Jane Street, Rochdale.

DUBILIER. (15)

The name of Dubilier is primarily associated with condensers, and, as some indication of the wide experience of this firm, a large condenser bank for mains power factor correction is shown in contrast to the range of small paper-dielectric condensers for wireless receivers. Space does not permit a detailed description of the numerous types available, but visitors to the stand should not fail to inspect the new electrolytic condensers (Type A.D.) for L.T. smoothing, the non-inductive paper condensers (Type L.D.), and the condenser blocks for mains receivers and eliminators. Since the last Manchester Show there has been a general reduction in prices.

The range of variable condensers has been supplemented by solid dielectric condensers of both the single and differential types, and there are several additions to the already comprehensive list of toroid coils and H.F. transformers.

Finally, there are the three-valve All-Electric receivers for both A.C. and D.C. mains at £25, and a range of radio-gramophones with two-, three-, and four-valve circuits from £42 to £80.

Dubilier Condenser Co. (1925), Ltd., Victoria Road, North Acton, London, W.3.

DULCETTO-POLYPHON. (79)

Electrically reproducing gramophones of generous design for home or dance hall are shown. High-grade cabinet work with quality amplifiers of the heavy-duty type are features of the apparatus shown at prices from 75 to 176 guineas.

Dulcetto-Polyphon, Ltd., 2 and 3, Newman Street, London, W.1. Manchester Branch: 31, Quay Street.

The new Cossor three-valve All-A.C. receiver.

EDISWAN. (28, 29)

The combined resources of the Met-Vick, B.T.H., and Edison Swan companies are concentrated on the radio products displayed on this stand. These are already well known and were described in our Olympia Show issues. Visitors to the stand should not fail to examine the new B.T.H. electric gramophone motor at 3 guineas, the new permanent magnet R.K. moving-coil loud speaker, the Ediswan three-valve battery-operated set, and the range of Mazda valves, including the remarkable AC/PEN power pentode.

The Ediswan Electric Co., Ltd., 1a, Newman Street, Oxford Street, London, W.1.

EKCO. (44)

Exhibits the same as at Olympia. Ekco receivers are designed for simple single-knob operation and are housed in durable bakelite cases. Designed for all-electric working, these sets are chassis-built, and all the essential details of construction are to be gleaned from the glass-panelled models which are being shown.

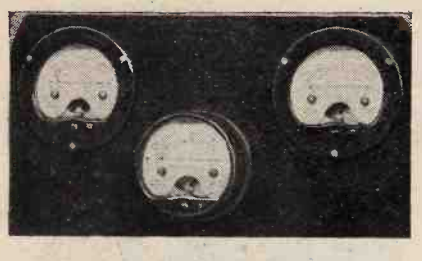
E. K. Cole, Ltd., "Ekco" Works, Southend-on-Sea.

Manchester Radio Show.—

EMU. (123)

While gramophones are principally shown at this stand, mention might be made of a popular three-valve set of reliable design which, complete with loud speaker, batteries and valves, is priced at £5 5s. Loud speakers, complete in cabinets with reed and four-pole movements, are shown at prices from 15s. to 35s.

The Emu Gramophone and Furnishing Company, 31 and 31*a*, *Bridge Street, Manchester.*



Ferranti electrostatic voltmeters.

EPOCH. (103)

No change has been made in this firm's products since Olympia, moving-coil loud speakers for all requirements being shown, with particular attention to permanent magnet and public address models.

*Epoch Radio Manufacturing Co., Ltd., Farringdon Avenue (near Ludgate Circus), London, E.C.*4.

EXIDE. (27)

No additions have been made to the Exide range since Olympia, but the visitor to this Exhibition is reminded to visit the Picture Theatre in the Gallery operated by British Talking Pictures. Here a talkie is being shown demonstrating in a most interesting manner radio reception with an Exide-operated set. Incidentally, this film is an excellent example of recording, and quickly convinces one that foreign talking-picture equipment is by no means essential to realism in reproduction. The Gel-Cel accumulator is this season's Exide development. Entry coupons are available at the stand for the Exide Competition with its £650 in prizes.

The Chloride Electrical Storage Co., Ltd., Clifton Junction, near Manchester.

FERRANTI. (51 & 52)

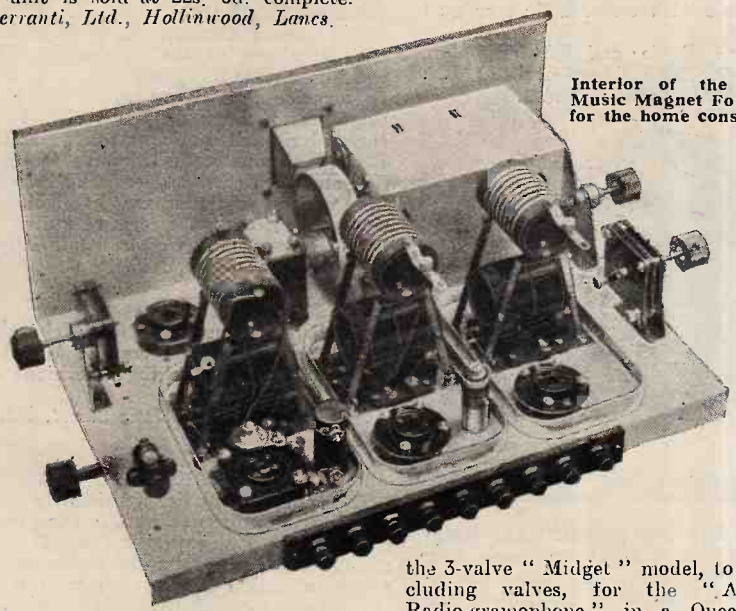
An important addition to the range of Ferranti measuring instruments has just been made; this is an electrostatic voltmeter, similar in size to the standard productions, and selling at £3 10s. It is unnecessary to lay stress on the many possible applications of an instrument of this sort, which gives a voltage reading without drawing current. Its use solves the problem of eliminator voltage measurements, and, further, the actual voltage impressed on the anode of a valve can be read directly without the need for making calculations and applying corrections.

As the meter gives readings of D.C., A.C., and audio-frequency differences of potential, it could be used to measure L.F. voltages developed across a loud speaker; although the minimum reading is on the high side (the lowest range is from about 100 to 450 volts), it can be extended in a downward direction by connecting a bias battery in series. Magnetic damping is provided, and the instruments are stated to be accurate within 2 per cent. at full-scale deflection.

Several new "kit" sets have been introduced since the opening of the Olympia Exhibition. The "Screen Grid Four" is a 1-v-2 combination with "aperiodic" aerial coupling and a dual range H.F. transformer fitted with magnetic reaction operated by a Bowden wire mechanism. Grid detection is followed by an L.F. amplifier coupled by one of the new low-ratio transformers. The output stage is push-pull. There is an input-volume control, in the form of a series aerial condenser, and post-detection regulation is afforded by a variable resistance across the first transformer primary.

There are also two-valve detector-L.F. sets, both for battery and A.C. mains supplies. These sets employ the new R.F.5 input-circuit tuning-coil assembly, which is fitted with a magnetic reaction coil with switchgear mounted on its control shaft; this is arranged so that the appropriate wave-range changes are effected by rotation of the reaction coil on each side of its "off" position. This coil unit is sold at 22s. 6d. complete.

Ferranti, Ltd., Hollinwood, Lancs.



Interior of the Osram Music Magnet Four, a set for the home constructor.

FONTEYN. (9)

"Cifel" mains transformers and chokes, battery chargers, and intervalve transformers are important features of this stand. The majority of components shown are of Continental origin, and are offered at extremely competitive prices.

A wide range of pocket voltmeters and testing instruments is also shown, and one of these—the "Multi-meter"—should be of special interest to the experimenter. Of the moving coil type, this instrument has a knife-edge pointer and parallax mirror which facilitates accurate reading of the scale. Terminals arranged round the outside of the case give the following ranges: (1) 0-6 volts, (2) 0-120 volts (or 0-240 volts if specially ordered), (3) 0-3 mA., (4) 0-12 mA., (5) 0-120 mA., (6) 0-6 amps. The sensitivity of the instrument (3 mA. for full-scale deflection) ensures a high internal resistance when used as a

Cifel "Multi-meter," with moving coil movement and parallax mirror. (Fonteyn.)

voltmeter, an important factor when testing H.T. batteries of low capacity, or the output from H.T. eliminators. The price of 55s. is very reasonable for a precision instrument of this type.

This year a range of "Cifel" receivers are also exhibited, the prices varying from £3 16s., excluding valves and batteries for the 3-valve "Midget" model, to £37, including valves, for the "All-Mains Radio-gramophone" in a Queen Anne design cabinet.

Fonteyn and Co., Ltd., 2-3, *Blandford Mews, Baker Street, London, W.*1.

FORMO. (32)

Exhibits as at Olympia, including the quadruple, triple and dual gang condensers; the two former models are carried in die cast housings braced together with a rod and a cord drive between knob and indicating drum is advisedly adopted.

*The Formo Company (Arthur Preen and Co., Ltd.), Golden Square, Piccadilly Circus, London, W.*1.

Manchester Radio Show.—

G.E.C. (47)

Complete details of the new season's products were revealed and reported on at the Olympia Show. The Osram Music Magnet Four is being featured, and since its introduction a few weeks back has firmly established itself as a well-designed easy-to-build receiver of the long-range class. Its construction in a few hours by an apparent tyro in radio is demonstrated in a most amusing talkie which is being shown in the Picture Theatre of British Talking Pictures in the Gallery.

General Electric Co., Ltd., Magnet House, Victoria Bridge, Manchester.

GOLTONE. (16)

The new "No-Mast" aerial consists of a capacity plate of perforated zinc mounted in a frame, and fitted with a long insulated lead-in wire. It is intended for fitting in any convenient elevated position, either indoors or outdoors.

Ward and Goldstone's new set.

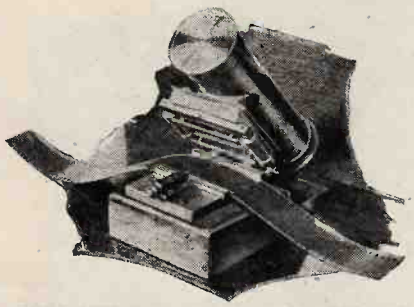
A new A.C. mains-driven receiver has just been produced; it employs an H.F.-det.-L.F. circuit with pentode output and a valve rectifier for H.T. supply. The tuning controls are ganged; capacity-controlled reaction is fitted, and there is provision for the use of a gramophone pick-up. Three jacks are mounted on the back of the cabinet, so that aerial-earth leads, loud speaker, and pick-up may be easily and quickly connected.

There is also a display of accumulators and H.T. batteries, together with wires and flexibles of every sort. Tuning coils to special designs are a speciality of this firm.

Ward and Goldstone, Ltd., Pendleton, Manchester.

GRAMO RADIO. (118)

An electric gramophone design to play sound films is certain to attract a good deal of attention on this stand. The sound head, comprising a film gate, source of light and photo-electric cell, is a modification of a standard design at present in use on cinema projectors. It is proposed to produce special films for use with this instrument in the form of a continuous band with the sound track in the form of a spiral. Making use of the standard width of film, as many as twenty sound tracks can be accommodated. It is also possible to make use of sound records



Film gate and photo-electric cell in the "Gramo Radio" light reproducing gramophone.

printed on bromide paper strips, the light in this case being reflected. A further development is promised in a recorder for attachment to any standard broadcast receiver, so that a permanent record may be kept of transmissions of outstanding interest.

Gramo Radio, Ltd., Commercial Works, Church, nr. Accrington.

GRESLEY RADIO. (76)

This firm are showing a range of inexpensive receivers, including a 3-valve console model with a detector-L.F. circuit, priced at £8 17s. 6d., complete with valves, batteries, and a built-in loud speaker of the balanced armature type. The detector of this set, which is also available as a mains-driven outfit at £13 17s. 6d., operates on the anode bend principle.

Gresley Radio cabinet receiver.

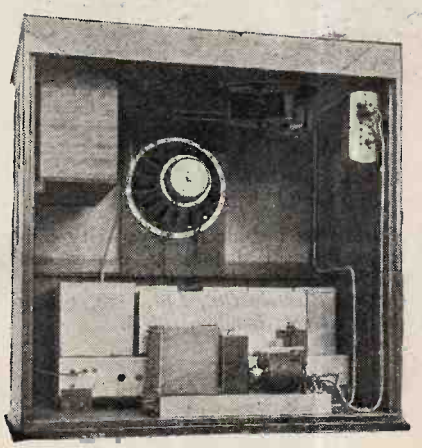
The Gresley "Gramo-Radio Minor" is of similar external appearance, but has an H.F.-det-L.F. circuit, separate tuning controls, and reaction, with a pentode output valve. It is fitted with a Garrard double-spring motor and a B.T.H. pick-up, and costs 16 gns. The same set, with an H.T. eliminator, trickle charger, and B.T.H. electric motor, is sold at 19 gns. There are also two- and three-valve upright cabinet sets with built-in loud speaker; these are completely self-contained except for aerial and earth, and are sold at very low prices.

Cabinet making is one of the main activities of this firm; their exhibits range from an ornate burr walnut bureau down to small receiver and loud speaker cabinets.

Gresley Radio (Garnett's), Islington Grove Works, Salford, Manchester.

HALLIWELL. (88)

In the de luxe class is the receiver shown by J. R. Halliwell, which was one of the few commercially built sets found in the Exhibition incorporating band-pass tuning. The set is specially designed for ready change over from D.C. to A.C. supply, and makes use of the new S4V.A. valves in its two H.F.



Interior view of the Dynatron equipment. It includes band pass tuning. (Halliwell.)

stages, which are followed by an anode bend detector and P.650 output valves arranged in push-pull. Built as a chassis, the receiver is contained in a walnut pedestal cabinet which is not disfigured by controls. The loud speaker is of the moving coil type.

J. R. Halliwell, 357, Deansgate, Manchester.

HARLIE. (113)

The redesigned Harlie pick-up is on view on this stand, together with a new constant speed induction motor for 50 cycle A.C. mains.

Harlie Bros. (Edmonton), Ltd., Balham Road, Lower Edmonton, London, N.9.

HYDE. (122)

An ingenious wire-stripping tool which should prove invaluable to the home constructor as well as to manufacturers and service agents, is shown on this stand. It resembles an ordinary pair of parallel cutters, but the simple operation of closing the jaws performs three operations in the correct sequence. The blades are interchangeable and will deal with cables ¼in. in diameter down to Glazite. A test on a specimen piece of Glazite showed that the wire is not nicked as often happens when the wire is bared by a knife.

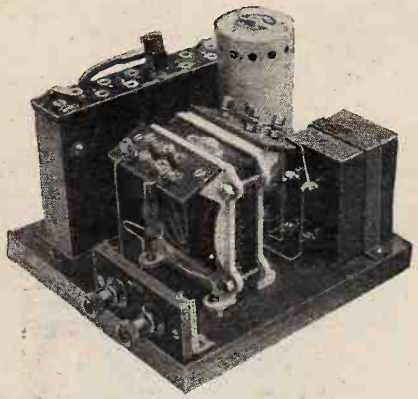
J. B. Hyde and Co., Broadheath, Manchester.

Manchester Radio Show.—

IGRANIC. (49)

Like most of the large exhibitors, this firm are showing products already seen at Olympia.

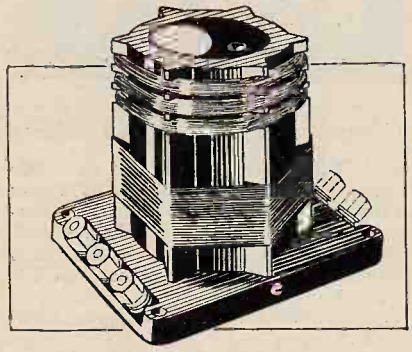
It may be mentioned, however, that among Igranic components are all the requisites for the inexpensive home construction of H.T. eliminators. Igranic



Igranic components for the home construction of battery eliminators.

products now include large capacity condensers, mains transformers, chokes and the Igranic "Elkon" metal rectifiers.

Igranic Electric Co., Ltd., 149, *Queen Victoria Street, London, E.C.*4.

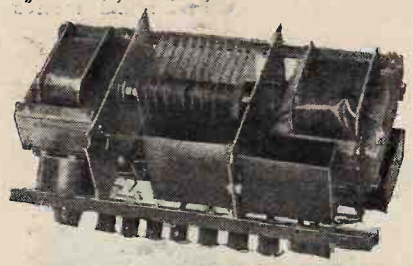


The new Igranic dual range coil.

IMPEX. (120)

In addition to the well-known battery-heated Dario valves, types for A.C. mains operation have been introduced comparatively recently. All these have heater elements consuming one ampere at 3.5 to 4 volts, and are fitted with standard 5-pin bases. The screen grid valve has a voltage factor of 1,000 and an A.C. resistance of 1 megohm, giving a mutual conductance of 1 mA. per volt, while its "general purpose" counterpart is rated at 40 and 20,000 ohms—a slope of 2 mA. per volt. There is also a third valve of lower impedance (7,500 ohms) with a voltage factor of 15, which is recommended for use as a detector or first-stage L.F. amplifier. A corresponding output valve, with a directly heated filament consuming 0.3 amp. at 4 volts, has a voltage factor of 8.5 and an A.C. resistance of 2,200 ohms. All these valves cost 10s. 6d. each, with the exception of the screen grid H.F. amplifier, which is sold at 18s. 6d.

Impex Electrical, Ltd., 538, *High Road, Leytonstone, London, E.*11.

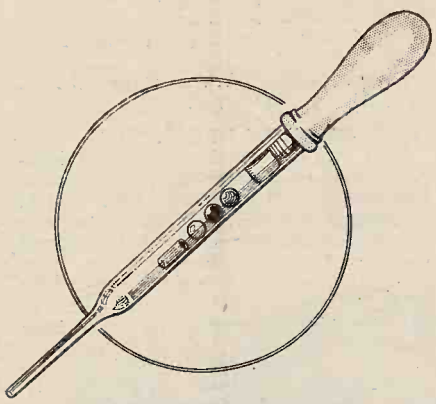


The chassis of the new Junit eliminator.

JUNIT. (69)

Terminal strips and valve holders of this well-known type are shown, together with the chassis-built interiors of the new Junit battery eliminators.

The Junit Manufacturing Co., Ltd., 2, *Ravenscourt Square, London, W.*6.



The Sopranist battery tester (Kalisky).

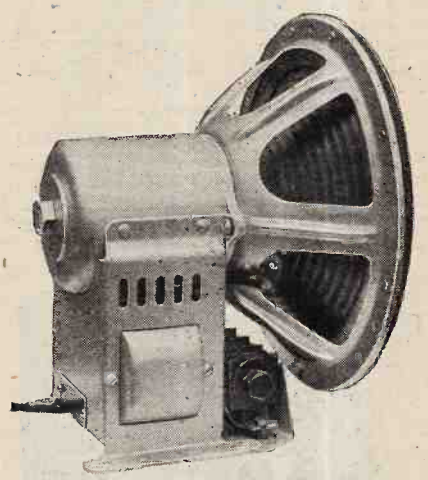
KALISKY. (10)

As well as being factors and trade distributors, this firm handles a number of specialised products under the names of "Sopranist" and "Eskay." A simple and inexpensive accumulator tester of the floating bead type would seem to be attracting interest. An extensive variety

A popular two-range meter shown by Kalisky.

of both British and Continental components are to be seen offered at competitive prices, and in particular the well-known French products of Sutra, which include chokes, intervalve, and mains transformers suitable for many requirements. Low-priced battery testing meters are also shown, as well as various types of loud speaker design.

S. Kalisky (Aldgate), Ltd., 16. *Withy Grove, Manchester.*

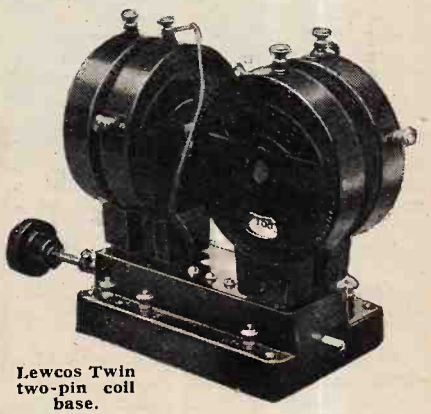


New Igranic moving-coil speaker with rectifier.

LAMPLUGH. (71)

The "Silver Ghost" Inductor Dynamic loud speaker is the centre of interest on this stand. The principle of operation, which was fully described in this journal in connection with the Olympia Exhibition, is illustrated by a large-scale working model, and demonstrations are being given in an adjoining room. Since Olympia, it has been decided to produce a special model for use with pentode output valves; the standard unit must be used with valves of A.C. impedance from 1,500 to 3,000 ohms.

S. A. Lamplugh, Ltd., King's Road, Tyseley, Birmingham.



Lewcos Twin two-pin coil base.

LEWCOS. (68)

The new "Twin Two-pin Base" is arranged to take two pairs of plug-in coils (tuning and reaction), and embodies a built-in switch arranged so that either

Manchester Radio Show.—

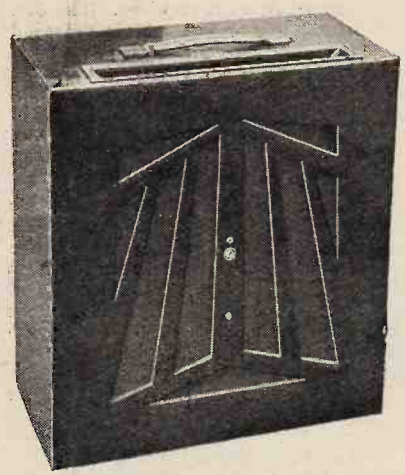
pair may be thrown out of circuit at will. The switch follows standard telephone practice, and is operated by a cam.

Coil Type D.W.A. is a dual-wave tapped aerial inductance assembly, also with a built-in switch. A reaction winding is included, but may be ignored when this coil is used, in an H.F. receiver, in conjunction with the corresponding H.F. transformer (Type D.W.G.), which also carries a reaction coil.

London Electric Wire Co. and Smith's, Ltd., 7, Playhouse Yard, Golden Lane, London, E.C.1.

LISSEN. (12 & 13)

A new Lissen four-valve A.C. radio-gramophone has been introduced since the opening of the Olympia Exhibition. The circuit arrangement comprises one H.F. stage, a grid detector, and two L.F. magnifying valves, and the set is normally intended for operation with a built-in frame, although an external aerial may be connected. Tuning controls are separate, and there is capacity-controlled reaction. This instrument costs 42



New Lissen mains transportable.

guineas in oak cabinet, or 47 guineas in walnut; its turntable is driven by an induction motor. Pre- and post-detection volume controls are fitted, the latter being operative for gramophone reproduction. The built-in loud speaker is of the moving-coil type

A new mains transportable set, with a balanced armature loud speaker, embodies the same circuit, and is sold at 19 guineas.

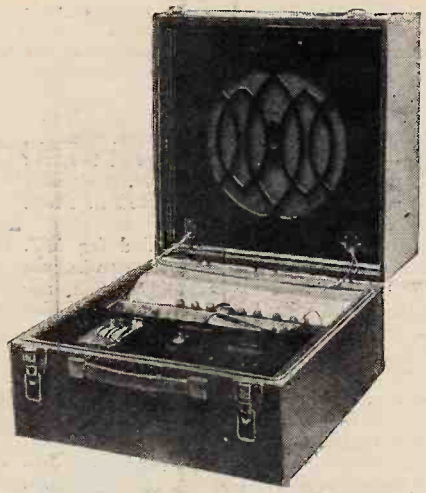
Lissen, Ltd., Worple Road, Isleworth, Middlesex.

LOUD SPEAKER Co. (73)

A new set, which has made its appearance since Olympia, is a portable of the suitcase type, arranged for all mains operation and fitted with a self-contained moving-coil loud speaker. The complete outfit, incorporating Mazda valves, is priced at 30 guineas.

Spun aluminium valve screens built to the details given in the preliminary notice of *The Wireless World* Four, are shown.

The "Loud Speaker" Co., Ltd., 2, Palmer Street, Westminster, London, S.W.1.



The new Enemains mains-operated portable fitted with moving-coil loud speaker. (The "Loud Speaker" Co. Ltd.).

McMICHAEL. (53)

At this stand one finds the same receivers as those recently described at Olympia. The Mains Three receiver is the principal exhibit, with its screen-grid H.F. stage, pre-H.F. volume control and super-power pentode output valve, and incorporating all those many features which illustrate strict conformity to modern theoretical considerations. The Super Range Portable Four, which has been slightly modified from last year, is still a leading portable. Loud speakers have been added to the range of McMichael products and include permanent magnet moving coil and balanced armature types.

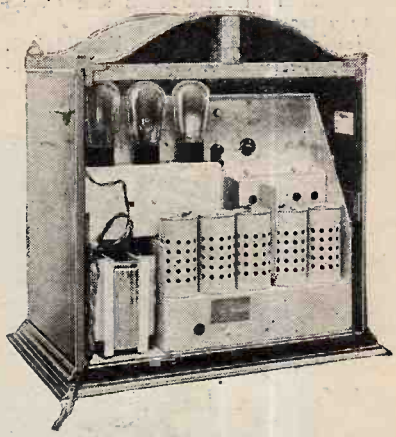
L. McMichael, Ltd., Wexham Road, Slough.

Majestic "Super Screen Grid" receiver.

MAJESTIC. (28)

The Majestic receivers and radio-gramophones, distributed in the North of England by this firm, are of interest not merely because they are of American manufacture, but because they are of an ambitious nature and embody many unusual points in design.

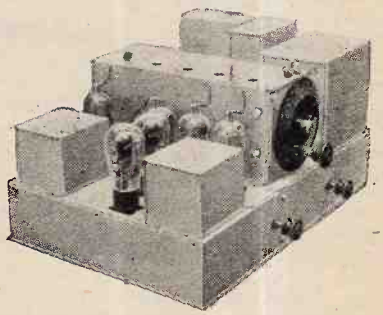
The "Super Screen Grid" A.C. chassis is mounted in various types of cabinet; it embodies seven valves in all, including a power rectifier. There are three S.G. high frequency valves, the first of which is preceded by a capacity-coupled band-pass filter, and is linked to the next by an untuned transformer. This valve is coupled through another band-pass filter to the third amplifier, of which the output is passed to the detector by means of an ordinary tuned transformer. It will thus be seen that there are five tuned circuits in all; their tuning condensers are ganged, and are not fitted with external trimmers, although a compensating condenser is connected in series with the aerial.



Rear view of Majestic superheterodyne.

A screen-grid valve, operating on the anode bend principle, acts as a detector; an H.F. filter is included in its anode circuit, and the rectified output is passed to a pair of push-pull output valves through a transformer, across the primary of which is shunted a resistance and condenser in series for tone-correction purposes. A moving-coil loud speaker is fed in the conventional way through an output transformer.

Pre-detection volume control is effected by the operation of a potentiometer which increases the negative bias of the first and second H.F. valves. The set is provided with alternative terminals for the connection of either long or short open aerials; in addition, there is an extra



Majestic "Super Screen Grid" chassis, with valve screen removed.

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series aerial condenser which may be short-circuited by means of a switch.

A Majestic superheterodyne has just been introduced; full details of this model are not yet available, but it employs a total of seven valves and a rectifier, has a stage of signal-frequency H.F. amplification, push-pull output valves, and a moving-coil loud speaker. An open aerial is used, and the set has single-knob tuning. The "feel" of this control during a hasty trial (without any aerial or earth) leads one to express the opinion that band-pass tuning must also be employed in this receiver, which is mounted in a console cabinet.

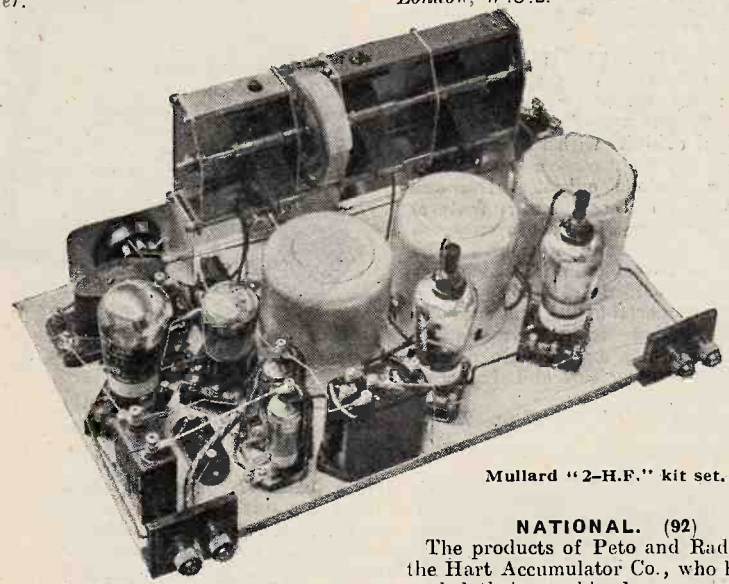
Both sets cover a wave range of 520 to 1,550 kilocycles (195 to 580 metres), and are calibrated in frequencies and on an arbitrary scale.

Majestic Distributors (Manchester), Ltd., 2, Victoria Bridge Street, Manchester.

four-valve Orgola receiver, similarly designed for home construction, is a much more ambitious piece of apparatus: it has two H.F. stages, linked by transformers, and followed by a grid detector, which is coupled by a parallel-fed L.F. transformer to a pentode output valve. Ganged tuning is an important feature of the set; there is a trimming condenser, controlled by an external knob, connected in shunt with the aerial-grid circuit.

This set is normally intended for A.C. mains operation, although it is convertible for battery feed by making a few minor alterations. In both cases battery bias is employed. Pre-detection volume control is effected by variation of screening grid voltage through a potentiometer. In spite of its ambitious nature, it would appear that this receiver should be quite easy to build.

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



Mullard "2-H.F." kit set.

MARCONIPHONE. (38)

The exhibits on this stand are as at Olympia. Visitors should avail themselves of the opportunity of examining the chassis of the new "2-H.F." receiver, type 560, regarding which so many favourable comments have been made.

The Marconiphone Co., Ltd., 210-212, Tottenham Court Road, London, W.

MOORES. (8)

This firm of wholesale distributors are showing a representative collection of receivers and accessories, among which were noticed the products of such firms as Bulgin, Ready Radio, and Garrard. Northern readers will have an opportunity of examining the Sheffield Magnet Co.'s new loud speaker drive units and triple-diaphragm loud speaker chassis, as described in our Olympia Show Report.

J. Moores and Co., Ravald Street Works, Salford.

MULLARD. (45 & 46)

A description of the new Mullard Valves and of the "1931 Orgola" kit set have already been published. The new

NATIONAL. (92)

The products of Peto and Radford and the Hart Accumulator Co., who have now pooled their combined resources, are exhibited on this stand. As stated in our Olympia Report, most of the L.T. cells are supplied with "Tell-Tale" indicating beads showing the state of the change.

National Accumulator Co., Ltd., 50, Grosvenor Gardens, London, S.W.1.

OLDHAM. (42)

This season's Oldham cells have been modified to possess the desirable feature of slow discharge combined with ability to withstand rapid recharging. For instance, a cell designed for dealing with a slow discharge and giving 50 ampere hours may be charged at the comparatively high rate of 2 amperes. Since the Olympia Show it is understood that much interest has been taken in the horizontal glass box-type cells arranged to have a low centre of gravity so that they are not readily overturned. These accumulators, which have double positive plates bridged together, are known as the O and O.G. types.

Oldham and Sons, Ltd., Denton, Manchester.

ORMOND. (64)

A new type of variable condenser has been added to the already extensive range of Ormond condensers. This new component (Model No. 4) is rigidly constructed and has stout bearing supports of high-grade bakelite. Complete with slow-motion dial it costs 6s., and a plain model is available at 4s. The new Type R/360 geared dial is suitable for use with the latter model. It has a 10 : 1 reduction gear which can be thrown out of action when a direct drive is required. The dial is of frosted aluminium and is provided with an earthing terminal.

The Ormond Engineering Co., Ltd., Ormond House, Rosebery Avenue, London, E.C.1.

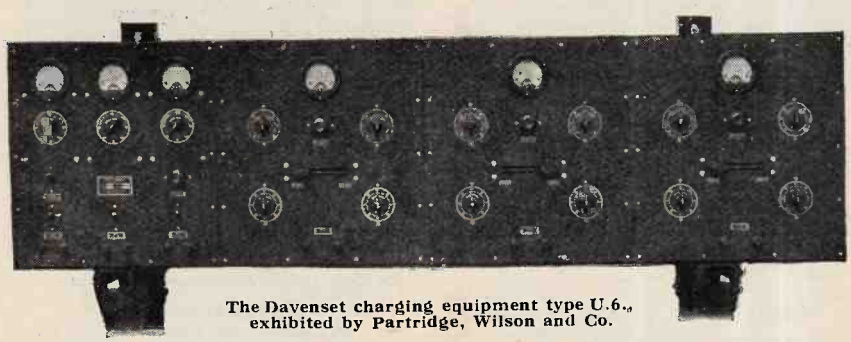
PARFAIT. (60)

Ebonite sheets with a variety of surface finishes are shown. A leak-free surface is claimed with a high polish in black, and a well-coloured mahogany. Mosaic and cube surface designs are also shown. Parfait ebonite is all-British, and it was learned at the stand that this firm is now back again in full production following the recent destruction of their premises by fire.

H. B. Potter and Co., Ltd., Station Buildings, Rochdale.

PARTRIDGE, WILSON. (23)

A well-prepared 58-page booklet by H. G. Wilson is available at the stand, which gives in brief all the essential details bearing on commercial accumulator charging. Partridge, Wilson and Co. manufacture Davenset charging equipments, which are generously designed and employ arc rectification. The majority of other exhibits are as at Olympia.



The Davenset charging equipment type U.6., exhibited by Partridge, Wilson and Co.

Partridge, Wilson and Company, Davenset Works, Evington Valley Road, Leicester.

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PEGASUS. (107)

Two portable sets are exhibited on this stand. The first embodies the conventional 5-valve circuit (two aperiodic H.F. stages, detector, and two L.F. magnifiers), and is fitted with an Ever-Ready H.T. battery and C.A.V. accumulator. Anode feed resistances are fitted, so there are but two H.T. connections. In spite of its low price (9 guineas), this receiver is neatly and solidly built.

The second Pegasus portable is more highly finished and embodies more costly components, but employs a similar circuit arrangement; it costs 15 guineas.

Pegasus, Ltd., 10, *Victoria Street, Chapel Allerton, Leeds.*

PERTRIX. (36)

High-tension batteries and grid batteries of every description are exhibited on this stand. Special emphasis is given to the fact that the electrolyte does not contain sal-ammoniac, and it is claimed that the zinc elements are less liable to local corrosion.

Pertrix, Ltd., Britannia House, 233, *Shaftesbury Avenue, London, W.C.2.*

PHILIPS. (19 & 20)

Philips' receivers show no great change since the introduction over a year ago of those receivers which set a standard for high amplification and single-dial control. Being early in the field with all mains sets of easy operation, this year's designs maintain reliability rather than actual novelty of principle. There are,

Philips three-valve receiver type 2531.

however, several new models—a two-valve set, the type 2523, which operates entirely from D.C. supply. It employs a special detector valve, whilst a considerable volume output results from the inclusion of a pentode. The set may be used as a gramophone amplifier, provision being made for a pick-up. The container is a well-finished mottled moulding. Another newcomer is the three-valve all-electric type 2531, being built as a chassis dropping into a well-finished bakelite case. Three wave ranges are provided covering 200 to 2,100 metres. All rotary controls are on the ends of the container, providing a comfortable operating arrangement. The H.F. detector and output valves are the S4V, 244V and the power pentode PM.24A. This year a radio gramophone has been introduced. It is fitted with the tuner amplifier equipment of the 2511 receiver, but the controls are unique. Operating entirely from A.C. mains, it has an illuminated turntable, automatic break and motor switch, and a new design of pick-up. Volume controls are arranged for both radio and gramophone, and in addition there is a tone brilliancy selector. A moving-coil loud speaker is included with a separately excited field, and the cabinet is of polished mahogany with oxidised silver fittings in striking modern style. A piston action controls a gradual closing of the lid.

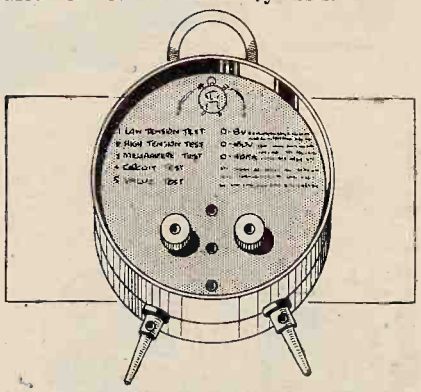
Philips Lamps, Ltd., Philips House, 145, *Charing Cross Road, London, W.C.2.*

PIFCO. (99)

This stand is devoted to the Pifco "All-in-One" Radiometer, a neat multi-range meter and circuit tester. Although at

Pifco "All-in-One" testing meter.

first sight similar to the conventional pocket voltmeter, it should be noted that twin leads with universal connections are provided so that it is not necessary to hold the meter in the hand while testing, say, an H.T. battery. The movement, which is of the moving iron type, is practically dead-beat, and the internal resistance is 200 ohms on the 0-8-volt L.T. scale and 4,000 ohms on the 0-160-volt H.T. scale. There is, in addition, a current scale reading from 0-40 mA. In conjunction with the internal dry cell provided, the instrument may also be used for routine continuity tests.



Valve sockets for testing filament continuity in the Pifco "All-in-One" meter.

Perhaps the most interesting feature of all is the provision at the back of the instrument of sockets for testing the continuity of valve filaments. The sockets are spaced to take the filament pins, and clearance holes are drilled for the other valve pins (including the centre pins of the latest types of indirectly heated valves). All that is necessary is to insert the valve in the sockets and note the meter reading. The price complete with leads and internal batteries is 12s. 6d.

Pifco, Ltd., 71, *High Street, Manchester.*

REDFERN. (33)

Realising the present-day tendency towards the use of smaller—and perhaps, one should add, of more carefully designed—tuning coils, this firm have extended their range of ribbed ebonite formers, which now includes sizes likely to meet almost any requirement.

Redfern's Rubber Works, Ltd., Hyde, Cheshire.

R.I. (83)

The activities of this firm during 1931 are to be concentrated in three main channels, viz.: (1) Radio receivers; (2) H.T. units; (3) L.F. transformers and chokes.

The "Madrigal" three-valve all-mains receiver is shown in its redesigned form with new type triple-gang tuning control, provision for a gramophone pick-up, and AC/PEN power pentode. The price of this receiver for either A.C. or D.C. is £30, and a handsome pedestal incorporating a moving-coil loud speaker is obtainable for an additional 15 guineas.

The two new mains H.T. units are of striking design, and include nickel iron smoothing chokes and a Westinghouse rectifier in the A.C. model. The dimensions are such that the units may be used to replace the H.T. battery in portable receivers. The D.C. model costs £2 12s. 6d. and the A.C. model £4 15s.

Among the numerous examples of the use of nickel iron in transformers and chokes, visitors to the stand will find the following of special interest:—The "Hypermite" L.F. transformer with 50-henry primary measuring only $2\frac{3}{8}$in. $\times 1\frac{3}{8}$in. $\times 2\frac{1}{4}$in.; the "Hypercore" L.F. choke designed to carry 50 mA, and the "Pentomite" tapped output choke for use with the new power pentode valve.

Radio Instruments, Ltd., Purley Way, Croydon.

RIALTON. (117)

An exceptionally interesting receiver chassis, of which an advance model is shown, has just been developed by this firm for inclusion in their radio-gramophones and sets. It is illustrative of present-day tendencies that, among other refinements, it should include a capacity-coupled band-pass filter circuit, which is followed by two tuned H.F. stages and a screen grid detector. A double H.F. filter is interposed between this latter valve and the first L.F. magnifier; resistance coupling is used for this stage, from which no attempt is made to extract any very high degree of amplification. Finally there is a super-power pentode output valve, with 400 volts applied to its anode: again, the intervalve coupling preceding this valve is a resistance, but a grid choke is used in place of the usual ohmic leak in order to prevent choking due to atmospherics or other momentary overloads.

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All four tuning condensers are linked together, and, further, it has been found possible to dispense with trimmers.

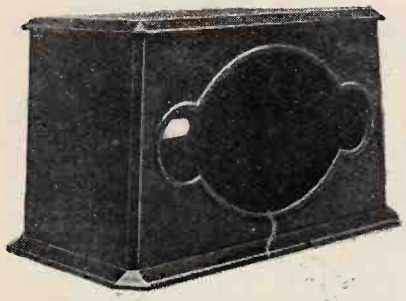
Pre-detection volume control is provided in the form of an H.F. potentiometer.

The Rialton chassis.

The set is designed for either an open aerial or a frame : in the latter case H.F. couplings giving rather a higher stage gain—but less selectivity—are employed, so overall sensitivity remains constant, irrespective of the collector actually used.

This model is for A.C. mains feed, and is intended for operation with a moving-coil loud speaker; the field energising current is taken from the mains H.T. supply.

Rialton Radio, Ltd., 13, 14, *Golden Square, London, W.1.*



Ritherdon metal receiver cabinet.

RITHERDON. (98)

This firm has now firmly established itself in a leading position as manufacturers of sheet metal cases and screens for use in broadcast receiver construction; a number of specimens of their work are shown. These include metal cabinets for receivers, cases for eliminators, aluminium panels, small screening covers, and examples of brackets and other folded metal parts used in chassis assemblies.

All these products are available in a number of different finishes, ranging from dead black to imitation wood or leather.

Ritherdon and Co., Ltd., North Bridge Mills, Bolton.

ROBERTS. (119)

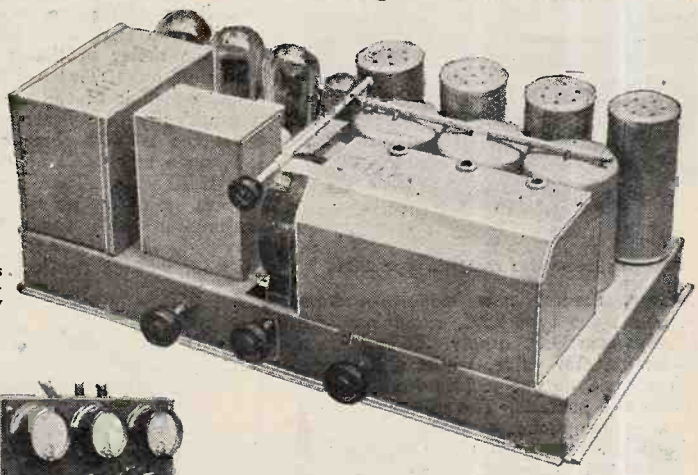
Rotary battery charging equipments of the constant potential type are shown, together with the products of the Lancashire Dynamo and Crypto Electrical Companies. This stand is of interest to the radio retailer concerned with battery charging.

John Roberts, 1 and 3, Bridgewater Viaduct, Knott Mill, Manchester.

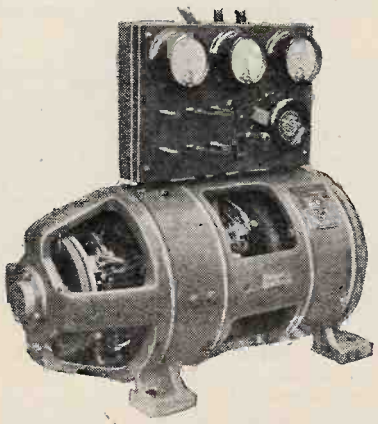
ROTHERMEL. (75)

The name Rothermel is very widely known in this country in connection with Magnavox moving-coil loud speakers. In consequence of the many years that the Magnavox moving-coil loud speakers have been in production, there is little doubt that the models of this year have reached a high stage of perfection. The various models are well finished and nothing has been spared in the cost of tools to permit of a strong assembly from metal pressings. Prices range from £5 7s. 6d. to £9 15s. in the junior and senior models carrying mains equipment. Full details are given of the output conditions of these speakers and their electrical characteristics, so that matching may be facilitated.

The principal attraction at the stand is the Peerless receiver chassis comprising three screen grid H.F. and two L.F. stages, the final stage amplifier being from a pair of valves of generous output connected in push-pull. Single-knob control with illuminated drum dial indicator operates the bank of tuning condensers, which are assembled on a common spindle. This is probably the only receiver of its class which provides reception on both wave ranges. As a distant station receiver with ease of control, it effectively fulfils its purpose, while its liberal equipment places it in the quality receiver class. Complete with moving-coil loud speaker and arranged to obtain its field excitation current from the set, the price, at £38, including valves and royalty, represents good value for money.



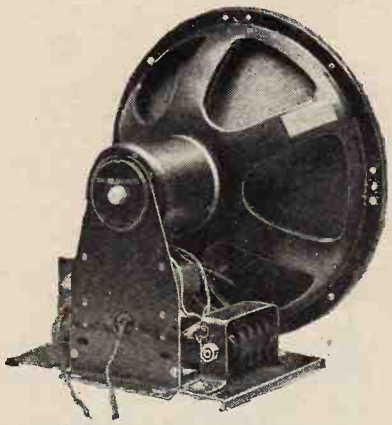
The Peerless chassis exhibited by Rothermel.



Constant potential battery-charging unit—the Hobart—exhibited by John Roberts.

Complete specifications can be had of an extensive range of public-address equipment, suitable for schools, dance halls, etc. In addition, there are rack and panel amplifiers specially designed for centralised radio systems to suit the needs of hospitals, flats and schools. There are

Manchester Radio Show.—
many small components shown of particular appeal to the amateur—vernier geared and illuminated dials, electrolytic condensers, rheostats, resistances and small condensers—all possessing certain characteristics in their design which make a strong



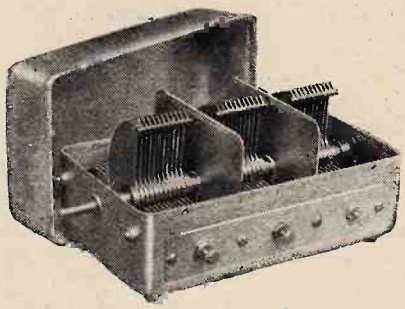
Magnavox moving-coil loud speaker type 415, shown by the Rothermel Corporation.

appeal to the enthusiast. Those interested in the operation of modern A.C. mains sets from D.C. supply might well investigate the suitability of the Janette rotary convertors shown at the stand.

The Rothermel Corporation, Ltd., 24 *and* 26, *Maddox Street, London, W.*1.

ROWLEY. (126)

This firm is the sole British agent for "Pilot" radio components, which are manufactured in the U.S.A. A wide selection of representative types, including L.F. transformers, condensers and drum dials, switches and compression-type resistances, are displayed. The "Resistograd" is of the latter type, and has a range from 40 ohms to 10 megohms. It is capable of dissipating 20 watts, and the metal case is finned to assist radiation.



Pilot "Vaultype" triple-gang condenser. (Rowley.)

The "Vaultype" screened variable condenser units are of interest in view of modern tendencies in circuit design. These are available from single up to quadruple types, and are fitted with built-in balancing condensers.

British-made "Precision" wire-wound resistances are also on view on this stand.

Thomas A. Rowley, Ltd., 59, *Skinner Lane, Birmingham.*

GEORGE L. SCOTT. (102)

This stand should be visited by those interested in insulating materials. Insulating sleeving graded in small differences of size and in various colours is available possessing that almost transparent appearance so attractive compared with the painted type. Insulated 18-gauge wire is shown with a form of covering which is easily removed, pulling away cleanly from a cut without fraying. Insulating paper, silks and cloths are shown in variety suitable in general for use in mains transformer construction. Iron and steel core stampings for all radio requirements are shown, as well as the well-known bakelite Pertinax board.

George L. Scott and Co., Ltd., 86-88, *Acre Lane, Brixton, London, S.W.*2.

SELECTORS. (6)

Portables, all-electric receivers and radio gramophones incorporating the Selector screened-grid circuit are shown on this stand. Since Olympia a new cabinet has been produced for the "Electric 42," which is, however, still available in the original standard cabinet.

Selectors "Model 42" in new-type walnut cabinet.

The new design is executed in walnut and has tapering sides and a redesigned loud-speaker grille.

Selectors, Ltd., 205-7, *Bedford Avenue, Slough Trading Estate, Slough.*

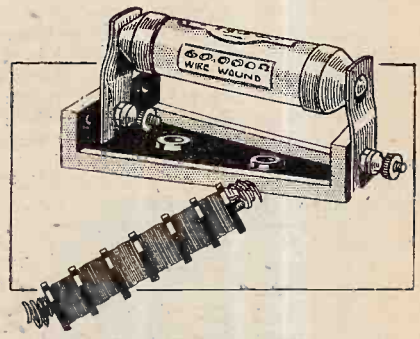
SIFAM. (116)

"Sifam" pocket voltmeters and measuring instruments for panel mounting are already too well known to require detailed description, so also are the range of radio fuses displayed on this stand.

A new component of British manufacture is the "Sifam" circuit Testing Adaptor. Essentially this consists of a single dry cell in an ebonite container which may be connected to any type of pocket voltmeter for the purpose of making continuity tests. A spring-loaded universal ball contact socket is provided which fits the case spike of most pocket meters. Contact with the battery is made through a special washer so that the cell can be reversed to suit meters with either a common positive or negative spike contact. The price is 2s. 6d.

Other components on this stand include a new-type D.3 intervalve transformer and a range of small universal motors suitable for television experiments.

*Sifam Electrical Instruments Co., Ltd., Bush House, Aldwych, London, W.C.*2.



Sovereign wire-wound anode resistance.

SOVEREIGN. (65)

The Sovereign wire-wound resistances, in values ranging between 1,000 and 100,000 ohms, are wound with double-silk-covered wire on a slotted bakelite former. Adjacent sections are in opposite sense, so the units are practically non-inductive. The resistance elements are guaranteed to be within 5 per cent. of their rated value. The components cost from 3s. upwards, and are supplied with a moulded bakelite holder, arranged for horizontal or vertical mounting.

Sovereign Products, Ltd., 52, *Rosebery Avenue, London, E.C.*1.

SQUIRE. (115)

The "Sylphone" moving-coil loud speaker has a novel form of diaphragm suspension consisting of a serrated paper ring, the points of which are attached to the cone about 1in. from the free edge. The moving-coil winding is self-supporting, and does not make use of the usual cylindrical former. The whole loud speaker is mounted on a swivel holder and cast base.

Squire "Sylphone" moving-coil loud speaker.

The "Squire" aluminium cone cradles, which are designed to accommodate the leading makes of loud speaker movements, have been brought up to date by the addi-

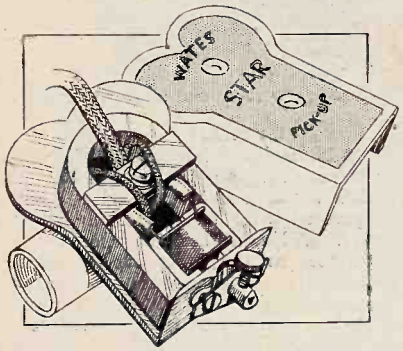
Manchester Radio Show.—tion of another model (99B) for the new Blue Spot units.

Frederick Squire, Ltd., 10, *Leswin Place, Stoke Newington, London, N.*16.

STANDARD BATTERY CO. (61)

A new loud speaker, with a 20in. double-cone diaphragm and mounted in a walnut cabinet, has just been introduced. There is also a new pick-up—the Wates Star—with adjustable damping; a hole of triangular section is provided so that fibre needles may be used if desired.

The Standard Battery Co., 184-8, *Shaftesbury Avenue, London, W.C.*2. (*Northern representative, J. Midgley*, 21, *Pilkington Road, Southport, Lancs.*)



Wates' Star pick-up (Standard Battery Co.).

STRAD. (87)

The "Strad" A.C. radio-gramophone, with a built-in moving-coil loud speaker, includes one H.F. stage, a grid detector, and two L.F. magnifiers, with resistance and transformer couplings and parallel output valves.

Various styles of cabinet work are available, and prices range from 47 guineas. A D.C. model is priced at 42 guineas.

The Strad Gramophone and Radio Mfg. Company, Darwen, Lancs.

TELSEN. (31)

There have been no additions to the range of Telsen components since the Olympia Exhibition, but further technical data concerning the neat and extremely inexpensive H.F. choke manufactured by this firm are now available. Costing only 2s. 6d., this component is stated to have an inductance of 150 millihenrys and a D.C. resistance of 400 ohms.

Red Star receivers are also shown on this stand.

Telsen Electric Co., Ltd., Miller Street, Birmingham.

TRIOTRON. (78)

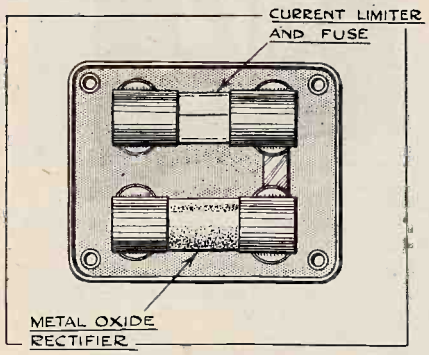
The most interesting feature of the Triotron range of valves for 1931 is the introduction of metal-coated H.F. and de-

"Triotron" metal-coated detector valve and the "Stal" trickle charger.

tector valves. The metal is sprayed on the outer surface of the glass and is in electrical connection with one of the filament pins. The object of so coating the glass is to screen the valve electrodes from stray electrostatic fields which might otherwise produce instability in a multi-stage H.F. amplifier.

The list of battery valves has been augmented by a super detector valve (type SD2) with an amplification factor of 21, and an impedance of 10,500 ohms, and a power output valve (YD2) suitable for portables with an impedance of 3,400 ohms and an amplification factor of 8.5. The current consumption of the latter valve is 7.5 mA. at 100 volts H.T.

Triotron valves are also made for A.C. and D.C. mains. The A.C. valves are in-



Arrangement of components under the base of the "Stal" trickle charger. (Triotron Radio.)

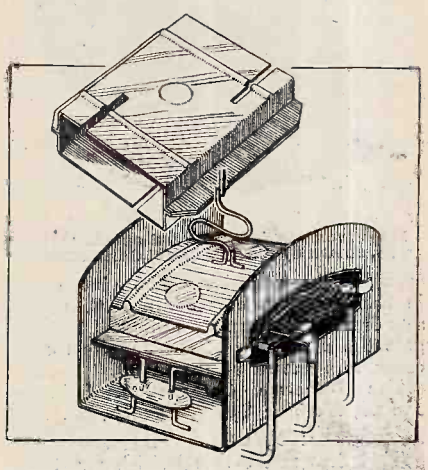
directly heated, and the D.C. valves have 0.1 amp. directly heated filaments.

"Stal" low-frequency transformers and mains equipment are also on view on this stand. There is a new nickel-iron coupling transformer (type "A") with a 3 : 1 ratio at 9s. 6d., and a neat trickle charger for L.T. accumulators at 17s. 6d. A small metal oxide rectifier in the form of a cartridge is housed in the base of the mains transformer, together with a current limiting "barreter" tube which also serves as an emergency fuse.

Triotron Radio Co., Ltd., 91, *Great Russell Street, London, W.C.*1.

TUNGSRAM. (35)

Details of the new-type Tungsram barium valves shown on this stand are given in the accompanying table. Examination of the data reveals that these valves are capable of good performance.



Interior construction of the electrodes in the Tungsram screen-grid valves.

Tungsram valves are fitted with V and N filaments, according to voltage, and it is to be noticed in the screen-grid types that separate grids enclose each limb of the filament. As a stand attraction, a model railway is in operation in which the trains are controlled by intercepting beams of light falling on Tungsram photo-cells.

Tungsram Electric Lamp Works (Great Britain), Ltd., 72, *Oxford Street, London, W.*1.

TUTILLS. (14)

Careful examination of the Tinol Eight in its large mahogany cabinet reveals an interior chassis of most generous design. Three screen-grid H.F. stages are provided, giving stable single-dial control over the full wave range of 200 to 2,000 metres. Following the detector are two L.F. stages, the output being derived from a pair of power valves in push-pull

NEW TYPES OF TUNGSRAM BARIUM VALVES.

Description.	Type.	Price.	Fil. Volt.	Fil. Curr. Amps.	Anode Voltage.	Anode Curr. M/Amps.	Amp. Factor.	Impedance. Ohms.	Slope. mA/V.	Total Emis.	Output. mW.	Grid Bias.
S. Power	P.430	11/–	4	0.3	150–250	25	5	2,000	2.5	100	1,500	20–30
Spec. Power	P.460	16/–	4	0.6	100–220	50	4	1,100	3.5	200	3,000	25–60
Rectifying Valves ..	V.430	10/–	4	0.3	250	25	—	—	—	100	1,500	—
" " ..	V.495	10/–	4	1.1	300	70	—	—	—	200	—	—
" " ..	PV.495	10/–	4	1.1	2×300	50	—	—	—	250	—	—
Sc. Grid	S.210	13/–	2	0.12	100–200	1.5	300	430,000	0.8	20	—	—
" "	S.407	13/–	4	0.07	100–200	1.5	350	400,000	0.8	40	—	—
" " A.C.	AS.4100	16/–	4	1.0	100–200	4	900	600,000	1.5	70	—	—
H.F. R.C.	HR.607	5/6	6	0.07	50–200	2	30	15,000	2.0	30	—	2–6
" "	H.407	5/6	4	0.07	50–200	2	35	25,000	1.4	20	—	1.5–4

Manchester Radio Show.—

This output is delivered to a moving-coil loud speaker deriving its field excitation current from the main rectifying valve. There is one-dial tuning and volume control and simple switch-over to gramophone pick-up. Complete with valves and enclosed in an attractive oak cabinet measuring 33in. × 26in. × 14½in., this receiver is priced at £38 10s.

Moving-coil loud speakers in oak pedestal cabinets are also of moderate price, and one model for A.C. mains working, and including output transformer and rectifier, costs less than £7.

Considerable hobby interest attaches to the home recorder shown on the stand, which is a complete record-making equipment, including microphone, cutter and discs.

Tutills, Ltd., 7 and 9, *Swan Street, Manchester.*

The Tinol Eight shown by Tutills.

ULTRA. (74)

Referring to our description of the Ultra Electric Three, as shown at Olympia, it should have been added that the set is available in a form suitable for D.C. mains, as well as for A.C., and, moreover, that conversion from the former to the latter can be effected at a cost of about 50s.—an important point for potential users whose supply systems are shortly to be changed.

Ultra Electric, Ltd., 661, *Harrow Road, London, N.W.*10.

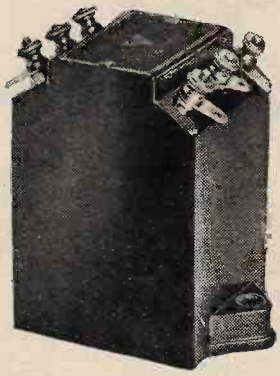
UNIVERSAL ELECTRIC SUPPLY. (85 & 86)

A large section of this stand is devoted to the portables and radio-gramophones of Electrical and Radio Products, Ltd. (E.R.P.), which were recently shown at Olympia, and referred to in these pages.

Universal Electric Supply Co., Ltd., 4-8, *Brown Street, Manchester.*

VARLEY. (56 & 57)

Low-frequency transformers and chokes for coupling and output circuits are an important feature of the display on this



Varley 3-henry tapped choke for tone control circuits.

stand. An interesting addition to the range is a tapped 3-henry choke for tone control circuits. This component provides inductances of 0.5, 1.0, 1.5 and 3 henrys and has a resistance of only 47 ohms.

All-electric receivers and radio gramophones are also shown. The "Senior All-Electric Transportable" has a three-valve circuit incorporating the latest practice and costs £25. The mains supply unit is constructed to facilitate conversion from D.C. to A.C. mains, and a pedestal containing a moving coil loud speaker is available as an accessory.

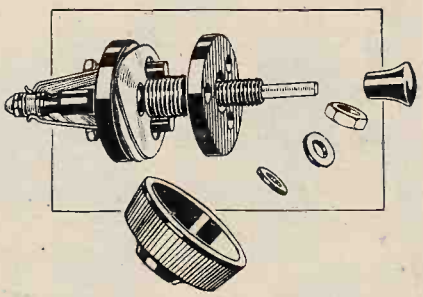
Varley (Oliver Pell Control, Ltd.), 103, *Kingsway, London, W.C.*2.

WEARITE. (34)

Coils and components for home constructors and a new range of mains transformers for Westinghouse rectifiers are important features of this stand.

The new delayed-action switches are of exceptionally neat design.

Another useful component is the type G.26 combined series aerial condenser and switch. The switch is of the conventional push-pull type, and is surrounded by a concentric knurled knob which operates a



Wearite series aerial condenser and shorting switch.

compression-type condenser variable from 0.00005 mfd. to 0.00035 mfd. The vanes are circular and surround the switch spindle thus giving a compact form of construction. The series aerial capacity can be adjusted to give the required degree of selectivity on short waves or short circuited on long waves.

Wright and Weaire, Ltd., 740, *High Road, Tottenham, London, N.*17.

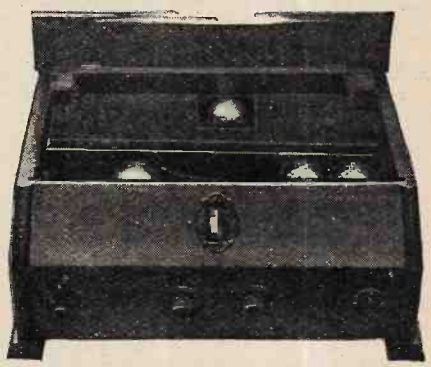
WELLWORTH. (63)

Among the range of apparatus which this firm, as factors, are exhibiting, one notes the Webson moving-coil loud speakers, manufactured by Star Engineering, of Didsbury. A new model was to be seen incorporating one of the latest-

Webson permanent magnet moving coil loud speaker exhibited by Wellworth.

type high-flux permanent magnets. By a well-arranged method of coil suspension a particularly small gap is used, giving a high flux density, and hence a performance parallel with the electromagnetic type. The price is six guineas.

The Wellworth Wireless Co., 8, *Withy Grove, Manchester.*



The Watmel A.C. Mains 3.

ZEITLIN. (84)

This firm are distributors of the Crossley receivers, of which the most interesting model is a three-valve A.C. mains-driven set, with built-in loud speaker of the balanced-armature type. The instrument is completely self-contained except for an external aerial and earth connection and embodies an H.F.-det.-L.F. circuit arrangement with a pentode output valve. There is differential capacity reaction, and the two tuned circuits are separately controlled. Provision is made for a pick-up, with special volume control. The set costs 21 gns. complete.

V. Zeitlin and Sons, Ltd., 54, *Lamb's Conduit Street, London, W.C.*1.

Broadcast Brevities

By Our Special Correspondent.

Scottish Broadcasting Troubles.—Those Dance Tunes.—"Warehouse Time-table."

Vexation in Aberdeen.

One of the B.B.C. stations, viz., Aberdeen, now enjoys the distinction of having no programme staff. The anomaly has arisen through the departure from the B.B.C. of Mr. Neil MacLean, who has been station director at Aberdeen since 1924. And Aberdonians are beginning to show annoyance.

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Main or Relay?

The future of the station is very uncertain. It is recognised that Aberdeen will be on the very edge of the 100-mile radius from the Scottish regional transmitters, and the suggestion has been made, semi-officially, that if regional reception should prove unsatisfactory in the northern city, the station should again be granted the status of a main station, similar to that of Newcastle.

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Can Aberdeen Entertain?

It is still believed that Aberdeen can produce its share of the only sort of talent which can really appeal to listeners in the far north, though on this point there is a school of doubters.

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A Traveller Speaks.

I see that "Travelled Scot," writing last week to one of the Aberdeen newspapers, denounced previous programme efforts at Aberdeen as "uncouth, ungainly, amateurish, and awkward," adding that "only blood relatives of such performers could have tolerated such stuff."

Travellers have been known to exaggerate, but, judging from accounts given to me by independent listeners in the Aberdeen area, there is probably a germ of truth in the above charges.

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A Hint to Scottish H.Q.

Feeling in Scotland is undergoing a marked change towards broadcasting, and the headquarters staff at Edinburgh will have to display greater activity when the regional station is working if they are to satisfy not merely national aspirations, but the aspirations of the guid folk in Aberdeen.

Scotsmen are patient at the moment, but there is no doubt that they object strongly to the preponderance of material coming "through the pipe" from London.

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Was Sir Walford at Winnipeg?

How many persons, broadcasting from a sick-room, could have triumphed in the manner of Sir Walford Davies last week?

Although indisposed, Sir Walford determined not to break the continuity of his new series of talks; accordingly the mountain came to Mahomet. A microphone was installed at his home in Windsor and, if the telephone lines had been kinder, we should never have guessed that he was not in the Savoy Hill studio.

The quality of transmission suggested, not Windsor, but Winnipeg.

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Dance Band Statistics.

Jack Payne has been counting the number of dance tunes broadcast by his band in the space of six weeks. The figures are interesting.

From August 14th to September 26th no fewer than 573 items were given, selected from 128 different tunes. Of these 82 were American, 3 were Continental, and 43 British.

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What the Public Wants.

I notice, however, that broadcasts were not in this proportion, some of the tunes being repeated many times. Actually, 381 American items were broadcast; the British numbered 180.

There is a discrepancy in the ratios, but Jack Payne, who knows the likes and dislikes of his audiences, could probably tell us why. Can it be that American tunes are more popular?

When to Take Notes.

Readers who wish to compare the acoustic qualities of the new warehouse studio with those of the studios at Savoy Hill will be interested in the following table giving the occasions on which the warehouse will be used in the near future:—

October 16th: "Madame Butterfly," at 7.15 p.m. (Regional).
October 17th: "Madame Butterfly," at 8 p.m. (National).
October 19th: Orchestral concert, at 9.5 p.m. (Regional).
October 21st: Orchestral concert, at 7.45 p.m. (National).
October 26th: Symphony concert, at 9.5 p.m. (Regional).
October 28th: Operatic programme, at 9.20 p.m. (Regional).
November 1st: Orchestral concert, at 9.35 p.m. (National).

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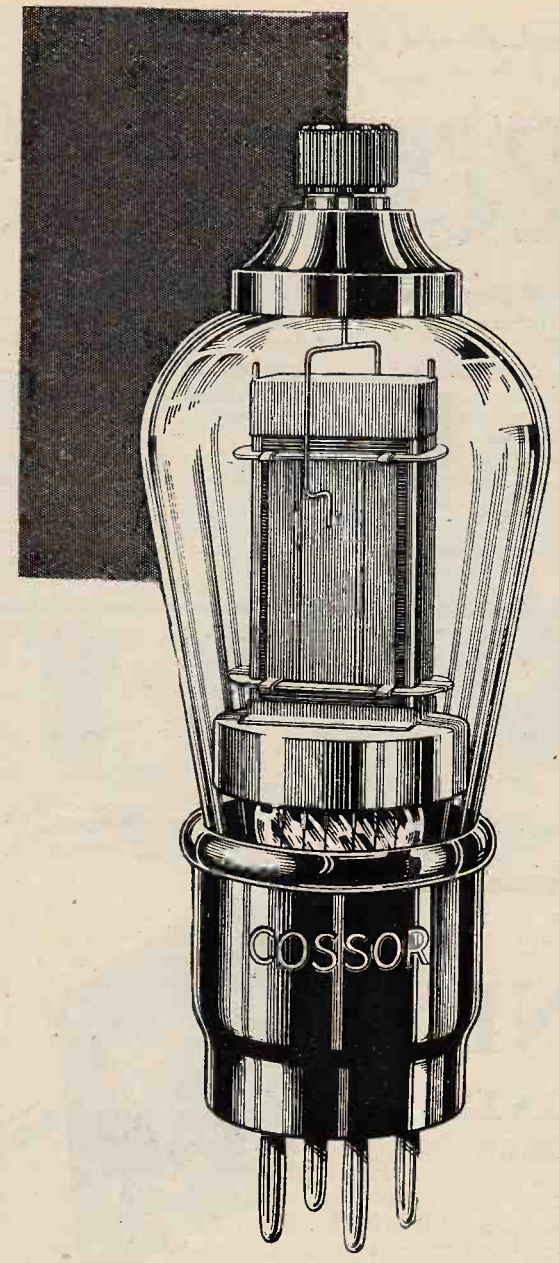
Too Good?

There is a danger that the warehouse may be too good! During the blissful twelve months or so that we are able to enjoy its acoustic merits we may begin to take for granted a beauty of reproduction that even the studios of Broadcasting House may fail to attain. For there will be no room in the new headquarters for any studio approaching the dimensions of the warehouse.

AT THE PARIS SHOW. A general view of the seventh annual Radio Salon which ended a successful fortnight's run last week. The exhibits suggested the partial eclipse of the "superbet" by the straight H.F. receiver.



Highest *effective* amplification

The effective amplification available with any Screened Grid Valve is largely controlled by its inter-electrode capacity. The lower this self-capacity the greater the effective amplification available. In the new Cossor 215 S.G. residual capacity has been reduced to the low order of ·001 micro-microfarads. This is lower than any other Screened Grid Valve on the market. Due to this—and also to the absence of grid current—the new Cossor 215 S.G. permits a degree of effective amplification which, a year ago, would have been considered utterly impossible. Illustrated folder giving full technical details sent free on request.

Cossor 215 S.G. 2 volts, ·15 amp. Impedance 300,000. Amplification Factor 330. Mutual Conductance 1·1 m.a/v. Normal working Anode Volts 120. Positive Voltage on Screen 60-80. Price **20/-**

THE NEW COSSOR 215 S.G.

HIGHEST *ACTUAL* AMPLIFICATION

♡ 63.6

BROADCASTING IN AMERICA TO-DAY

The Menace of Advertising—and Other Matters.

By A. DINSDALE.

ONE has become accustomed, of late, to the frequent castigation in the British Press of American broadcasting, and the large amount of advertising matter with which it is riddled. These attacks have usually been made in conjunction with some laudatory pæan of praise for our wonderful B.B.C., during which a pious prayer of thankfulness is sent up for the fact that (officially at least) our system admits of no commercial advertising.

Frankly, having been to America, I have hitherto always discredited these (to me) wild attacks, and championed the American system as being conducive to better programmes. But to-day I am back in America again, for the first time for about three and a half years, and I must admit that I was not in the least prepared for the state of affairs which I find now.

THE author of this article, Mr. A. Dinsdale, is familiar with broadcasting conditions in this country and has also spent much time in America during past years. His recent impressions of the influence of advertising will be read with interest.

When I was last here, the National Broadcasting Company had been in operation for about a year, and had lost a lot of money. There was a rumour that the Columbia interests were about to set up a rival broadcast chain. When I spoke about this rumour to Merlin Hall Aylesworth, President of the N.B.C., he replied characteristically: "All I'm worrying about is that they may not go through with it. I wish somebody *would* start some competition and keep us busy going one better all the time!" Advertising matter over the microphone was then confined, in the case of the N.B.C., to something like this: "We are now about to commence the Blank Hour, which entertainment comes to you by courtesy of the Blank Company, Inc., makers of the world's finest coffee." No further advertising announcements would be made till the end of the programme, when a closing announcement, similar to the opening one, would be made.

That, however, is all changed. In New York to-day there are four leading stations whose programmes can always be depended upon to be of first-class quality. These are WEAF and WJZ, key stations for the N.B.C. Red and Blue nation-wide networks, WABC, key station for the Columbia Broadcasting Company's network, and WOR, owned and operated by a large department store in Newark, N.J., a city of about two million inhabitants within twenty miles of New York City.

Broadcasting in America To-day.—

The N.B.C. programme technique has changed considerably since last I was here. It is now their policy to divide programme time into definite sections of 15, 30, or 60 minute periods. All items are planned to fit into one or other of these periods; there are no odd-length items such as the B.B.C. broadcasts. In the case of a programme lasting a full hour it will open with a descriptive announcement, followed by the sponsor's advertising announcement. This latter may last as long as two or three minutes. At the end of the first, second, and third fifteen minute periods, the programme is interrupted to enable further advertising announcements to be made, and these also may last two or three minutes. They are frequently direct advertising announcements, and not indirect, as formerly.

To-day the Advertiser Calls the Tune.

When I protested to Mr. Aylesworth about this excess of advertising, he replied that advertisers who sponsor programmes nowadays demand value for money, and as they pay the piper it is no longer possible to prevent them calling the tune. He endeavoured to turn a necessity into a virtue, however, by trying to convince me that listeners have now become educated to advertising announcements, and like them. He pointed out that those who want to be interested, amused or entertained by a magazine do not complain about the advertisements, the revenue from which enables the magazine to be produced. They don't read those which don't interest them, unless they have some special reason for doing so, whereupon the advertisements generally render some service. Mr. Aylesworth contends that the same does, or should, apply to broadcast advertising. Both mediums have the common factor that without advertising they could not exist.

The truth of the matter, however, is that listeners automatically and subconsciously shut their ears to the advertising and wait for the next item of the programme. Or, if the announcement is too long, as in the case of the second-class stations, they tune in another station. However, it is doubtful if broadcasting is listened to at all during 90 per cent. of the time. With stations operating continuously from six a.m. to midnight, the family all-mains radio set is often left on all day and nobody pays any attention to it; the music is just there, as a subconscious background to general household activities. On the other hand, there is a growing body of people who are so tired of advertising that they never switch on at all, if they have not already thrown the radio set into the dust bin.

However, some of these people ought to be treated to a dose of B.B.C. The programmes from first-class American stations are still definitely better in every way than the B.B.C. programmes. It is competition which sees to that. And the N.B.C. is now making a handsome profit.

There are still the inferior stations to be reckoned with, however, and one may expect to hear something like this:

"This is station WKBO of Starlight Park, the Voice of the Bronx. You are now listening to a jazz orchestra playing the latest popular songs. The concert comes to you through the courtesy of the well-known jeweller on West 138th Street, who shows a large display of white-blue diamonds and all other jewellery. If you are contemplating buying a wedding present or a diamond ring for your best girl, I would advise you to go over and see the good value—the prices to suit every pocket-book."

Or this:

"The following concert comes to you through the courtesy of the well-known furniture dealer on Third Avenue, the Bronx, who has been on the same corner for over twenty years. His values are known to all. If you want to furnish your home you will find our prices reasonable. We also allow on your old furniture."

And the following is no doubt calculated to arouse all the devils of local jealousies:

"We have just received the following request numbers by 'phone: Mrs. Schultz, of Bryant Avenue, wants the orchestra to play 'I'm in the Market for You.' Mrs. Campbell, of Yonkers, requests 'Kitty from Kansas City.' We regret we cannot play all the request numbers 'phoned in to-night, but we will play them the same hour to-morrow night."

Blatant Advertising Generally Detested.

It was this sort of thing in particular which Dr. Lee De Forest had in mind when, at the recent Institute of Radio Engineers' Convention at Toronto, he attacked broadcast advertising in his presidential address. He declared that broadcasting in America was headed for Government control, with taxation and possible censorship, unless this advertising evil was voluntarily cured. The use of broadcasting for direct and blatant advertising was a menace, he said, steadily growing greater, more ruthless, more deserving of suspicion, and more generally detested. He predicted that the day was coming when the entry of wired radio into American homes (at a price) would provide entertainment purged of all advertising.

Recorded Programmes.

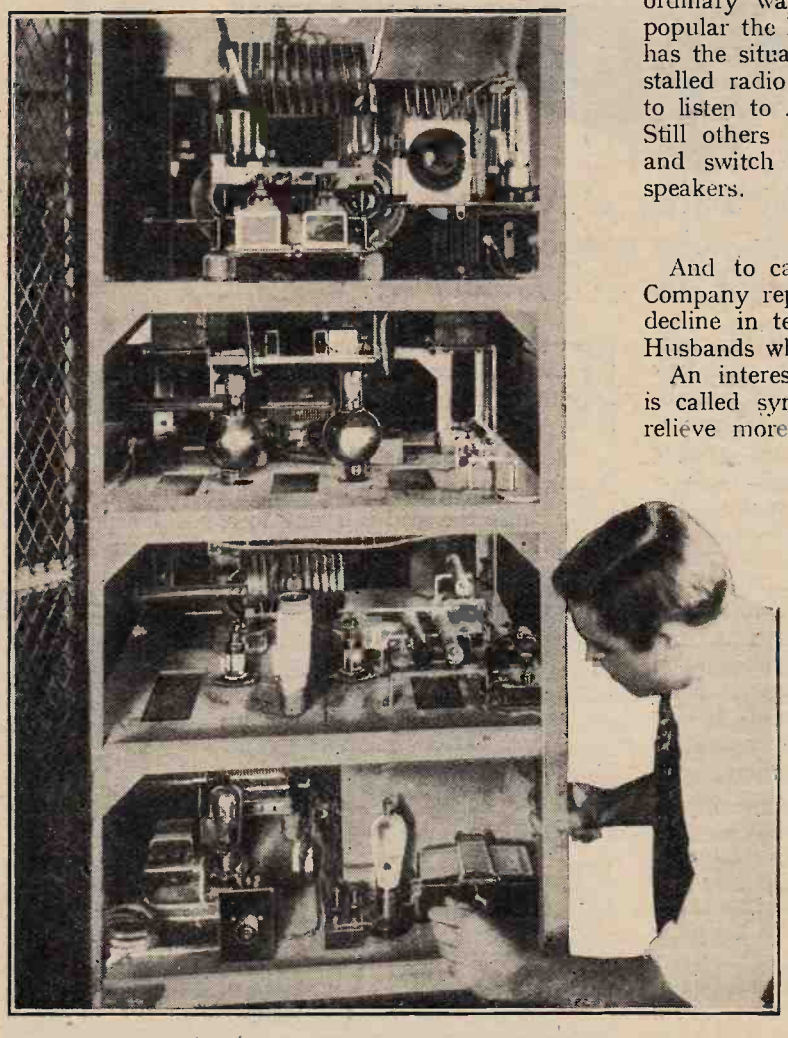
When last I was in America, the announcer attended to the entire production of programmes, including the timing of items and rehearsals. All such production details in the N.B.C. are now handled by a producer, and all the announcer has to do is to announce, and even his announcements are written out for him beforehand. The only time the announcer now shines as an individual is in the reporting of outdoor events, boxing matches, etc.

Station WOR has recently created a furore by broadcasting what it calls recorded programmes. These are first-class programmes, produced in the ordinary way either in the studio or elsewhere at a public performance, which are recorded on gramophone records and then broadcast. In New York, such procedure is generally regarded as retrogressive, expensive, and utterly senseless. Certainly it is difficult to see the necessity for broadcasting such records from New York, but they have definite uses elsewhere.

For example, by shipping records of first-class programmes out to stations buried deep in the country,

Broadcasting in America To-day.—

these latter can have the benefit of the finest programmes without incurring the expense of taking them by land-line. There is also the factor of difference in time to be taken into account. Many excellent programmes which take place in New York early in the evening are being land-lined and broadcast through far western stations some time in mid-afternoon when business



Control apparatus for simultaneous broadcasting employing a quartz oscillator. The apparatus has been developed by the General Electric Company of America.

people cannot listen. Recorded programmes could serve a useful purpose in such cases, provided that their topical value was not too high.

By far the most remarkable phenomenon in connection with American broadcasting to-day, however, is the astounding success of Amos 'n' Andy, two white men who appear before the microphone as black-faced comedians, and broadcast through WJZ every evening between 7 and 7.15. Their "stuff" does not appeal to a foreigner, or even to intelligent and educated Americans for that matter, for it is saturated with the ingrained characteristics and petty foibles of the vast proletariat who are their devoted worshippers.

They are almost a riot. Nothing on earth will stop devotees from getting home in time for Amos 'n' Andy, or if that is impossible, then getting in range of *somebody's* loud speaker *somewhere*. Dinners are eaten early, or postponed till later so that everybody can listen. In making an engagement, "after Amos 'n' Andy," needs no single word of amplification.

Moving-picture theatre managers expect their houses to commence to fill up between 6.30 and 7, in the ordinary way, but since Amos 'n' Andy became so popular the houses remain empty till 7.30. So serious has the situation become that some managers have installed radio sets in their vestibules to induce people to listen to Amos 'n' Andy there before going inside. Still others interrupt the programme, tune in WJZ, and switch Amos 'n' Andy on to their talkie loud speakers.

Synchronised Radio.

And to cap everything, the New York Telephone Company reports a definite and otherwise inexplicable decline in telephone calls between 7 and 7.15 p.m.! Husbands whose wives are non-stop talkers please note.

An interesting development which is in the offing is called synchronised radio. The object of it is to relieve more channels by putting all chain stations taking the same programme on one wavelength. At present, with some 600 stations in existence in America, many stations have to share their wavelength with one or more other stations, and such stations have to "split time" by taking turn and turn about "on the air." As there may be, scattered all over the country, as many as seventy or eighty stations all taking the same programme from one of the chains, it is considered ridiculous that they should occupy seventy or eighty wave channels. If, when a part-time station had to shut down to allow another to use his wave, he changed wave instead and took a chain programme, it is argued that more and better alternative programmes would be available to listeners in the less thickly populated areas.

Experiments to this end are progressing favourably, the method proposed being to transmit, over a second land wire (the first carrying the chain programme) from the key station, a standard frequency, which, on arrival at the local broadcaster, would be sent through frequency changers and caused to keep the emitted wave of the station dead on the frequency assigned for synchronised chain broadcasting. This is reminiscent of the B.B.C. relay station idea, but its importance and interest is more far-reaching in such an extensive country as the United States. The transmission of the standard frequency by wireless is not considered feasible, because of difficulties due to atmospherics, fading, and interference. But a second land-line might be eliminated if a satisfactory frequency outside of the audible range could be found which could then be filtered out of the programme.

QUALITY RECEPTION

Choosing the Intervalve Coupling

The Harmful Effects of Valve Capacities.

By JOHN HARMON.

(*Continued from page 416 of previous issue.*)

IN a set such as is shown in Fig. 17, where the pentode follows the detector, and where a grid leak and condenser are used for coupling, care must be taken in choosing the values of C and R. Since C and R are impedances in series to which an A.C. voltage *e* is applied, the A.C. voltage *v* which acts on the grid of the pentode is less than *e* by an amount which depends on the ratio of the impedance of C to that of R. The ratio v/e, the *efficiency* of transmission of the coupling, is unaltered if we double R and halve C, for this operation results in doubling each impedance, their ratio remaining unchanged; similarly we might use 3R and C/3, and so on. Hence if RC is kept constant, the efficiency of the coupling is unchanged.

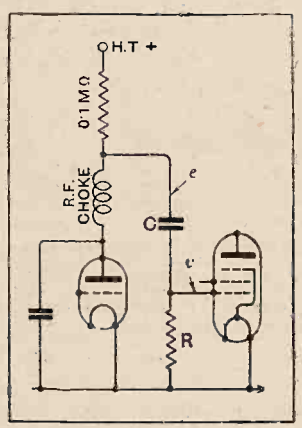


Fig. 17.—Detector coupled to pentode by grid leak and condenser. Incorrect values of C and R will affect the quality of reproduction.

Fig. 18 shows a series of lines, numbered 1 to 5, along any one of which the product RC is constant. These lines are accordingly lines of constant efficiency of coupling. The actual efficiency plotted against frequency is given for each of these lines in Fig. 19. Let us choose, for example, R = 0.2 megohm and C = 0.005 microfarad, which give a point on line No. 5 (Fig. 18), then Fig. 19 shows that this combination transmits 31 per cent. at 50 cycles, and 90 per cent. at 400 cycles.

Evidently the low tones are seriously attenuated. For really good quality we must choose curve 1 or 2. We may say, then, that in Fig. 18 our choice is restricted to the region lying north-east of line 2, and if no other considerations arose we should have the whole of this region from which to choose the grid leak and condenser.

But, unfortunately, pitfalls lie all round us, ready to upset the balance of transmission, and we shall find that the available region in Fig. 18 is much smaller than appears at first sight. Let us examine these pitfalls in turn.

Blocking Effect in Power Valve.

Signals which are strong enough to overload the power valve cause the grid to swing to a positive potential so that grid current flows; as a result the next downward swing carries the grid to a negative potential much below its usual working range, and recovery can only take place by leakage of the excess charge on the grid condenser to earth through the grid leak. The process is illustrated in Fig. 20. Until this recovery is complete, the valve is working on the lower bend of its characteristic, and is practically out of action. The effect is often heard when a loud, sustained note is being played; the periodic blocking introduces a convulsive staccato which is extremely ridiculous.

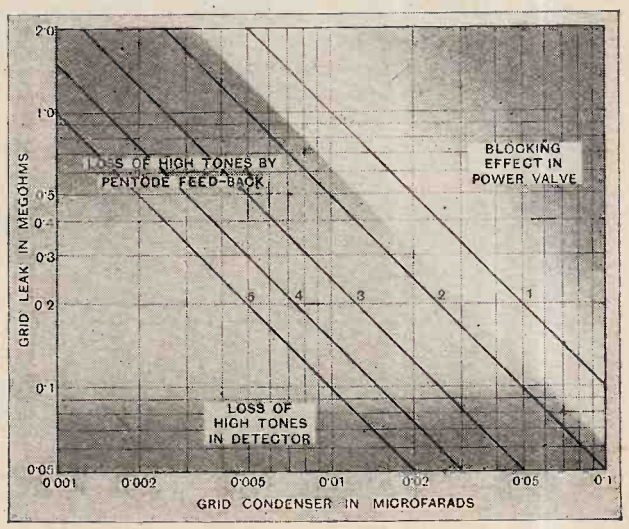


Fig. 18.—The product RC is constant along any of the numbered lines, with a different value for each line. The heavily shaded regions are to be avoided when using the set shown in Fig. 17.

Quality Reception.—

The time required for the charge on the grid condenser to fall to a given fraction of its original value is proportional to the product RC, so that we can guard against blocking by specifying that RC must not exceed

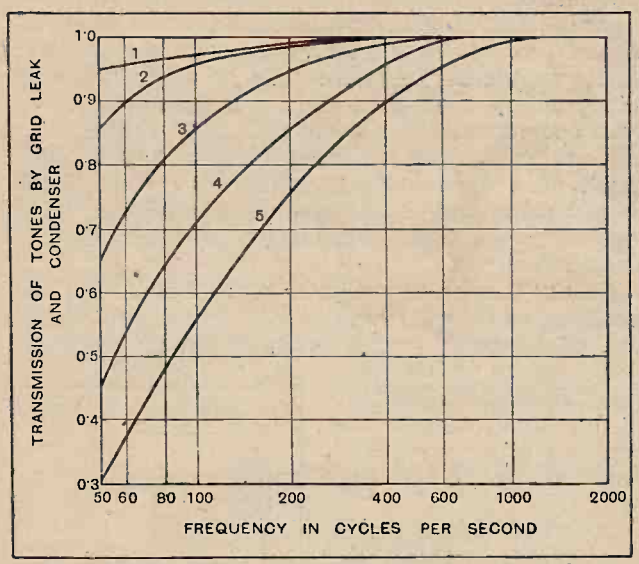


Fig. 19.—Transmission of audio frequencies by grid leak and condenser. The numbers on the curves refer to the corresponding lines in Fig. 18.

a certain value. For triodes and pentodes working on a plate supply of 160 volts this value is about 0.0065 where R is expressed in megohms and C in microfarads.

The region where blocking is likely is shown in Fig. 18, and it limits our choice of R and C to the narrow strip lying between the region of blocking and line No. 2.

Input Impedance of Pentode.

The second pitfall is due to the fact that when the pentode is working with a plate load such as a loud speaker, a large effective capacity appears between its grid and filament. This feed-back phenomenon is well known in the case of triodes; if the plate load of a triode (taken as resistive to make the formula simple) be equal to the valve A.C. resistance, this effective capacity is $\frac{1}{2}\times$ (voltage amplification factor) $\times$ (grid-plate capacity). With a power triode like the D.F.A.9 this becomes $\frac{1}{2}\times 5\times 5 = 12.5$ m.m.f.—quite a small value.

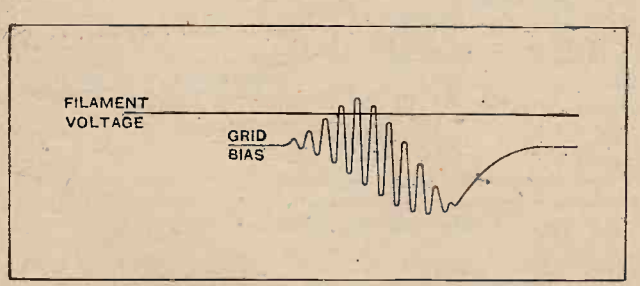


Fig. 20.—Blocking effect in power valve. If the grid happens to swing positive to the filament it becomes charged, and if the product RC (Fig. 17) is too large the valve is paralysed for an appreciable time.

In the case of the pentode, where the plate and grid are mutually screened by two fixed potential grids, it might seem that there can be no plate-grid capacity and consequently no feed-back. This would be true if the plate lead were brought out at the top of the valve, but actually it goes through the glass pinch, and the capacity of the plate-grid leads amounts to 3 m.m.f. Since the pentode is a high-magnification valve, the feed-back will be large compared with a power triode, but the formula given above cannot be safely used, as the curved characteristics of the pentode cause the valve magnification and A.C. resistance to vary considerably over the working path.

Accordingly some experiments have been carried out to settle this point, and will be briefly described later in this article. They give the result that with a P.M.26 pentode having a resistance plate load of 13,000 ohms the effective grid-filament capacity is no less than 90 m.m.f.

This capacity acts as a shunt to the grid leak, its reactance amounting to 0.33 megohm at 5,000 cycles, and, unless the grid leak is less than 0.2 megohm, the loss of high tones will evidently be serious.

Accordingly, in Fig. 18 the region which lies north of the horizontal line indicating a grid leak of 0.2 megohm is to be avoided owing to loss of high tones due to feed-back from the pentode.

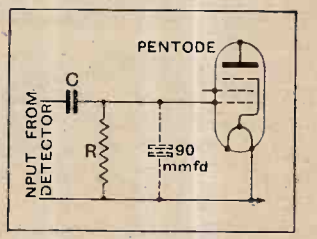


Fig. 21.—Owing to feed-back across the plate-grid capacity of the pentode a large effective capacity appears between filament and grid and tends to shunt the grid leak at high audio frequencies.

High-tone Loss in Detector.

The available region in Fig. 18 has now been seriously diminished, but worse is yet to come. Reference to Fig. 17 discloses that the plate resistance of 0.1 megohm in the detector circuit is shunted by the following grid leak and condenser; this shunting is greater for high audio frequencies, since then the impedance of C is small. Hence high-tone loss will occur in the detector circuit unless R exceeds at least 0.2 megohm as indicated in Fig. 18.

Economy *versus* Quality.

What is now left in Fig. 18? We have been driven to practically one point of refuge lying at R = 0.2 megohm, C = 0.025 m.f. High-tone losses threaten us from north and south, paralysis lies north-east, and low tones suffer if we go south-west.

The fact is that the economy in price and space achieved by making two valves do the work of three has been obtained at the price of diminished quality. The insertion of a first stage of L.F. amplification between detector and power valve will ease the situation considerably; this intermediate valve need only have a small voltage amplification factor, say $m = 10$, and resistance-capacity couplings can be used to couple it both to the detector and the power valve.

The low value of m means that the feed-back capacity

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is now small, so that larger values of grid leak can be used in the detector-1st L.F. stage coupling. It follows that the plate resistance in the detector circuit is no longer heavily shunted by the grid-leak and grid-

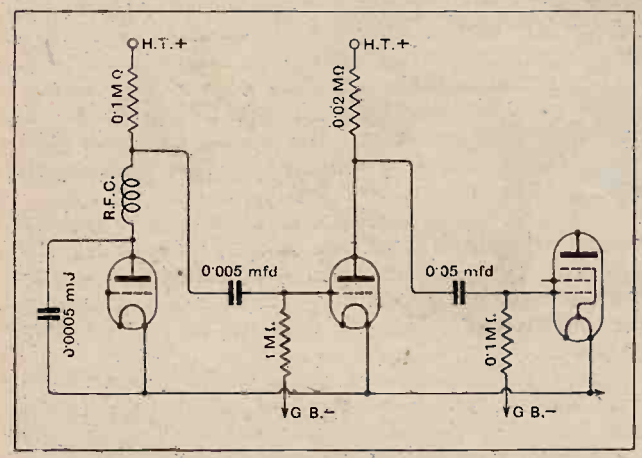


Fig. 22.—Anode bend detector with two L.F. stages. By a suitable choice of components, as explained in the text, transmission losses can be almost completely avoided.

condenser combination, and high-tone transmission is improved.

Fig. 22 shows a schematic circuit for two L.F. stages. The grid leak of 0.1 megohm preceding the pentode is too small to be appreciably shunted by the feed-back capacity of the pentode, and yet is too large to shunt the plate resistance (0.02 megohm) in series with the 1st L.F. valve. Again, the feed-back of the 1st L.F. valve is small on account of its low amplification factor —too small to shunt the grid leak of 1 megohm which precedes it—while this 1 megohm itself is too large to shunt the plate resistance of 0.1 megohm in series with the detector.

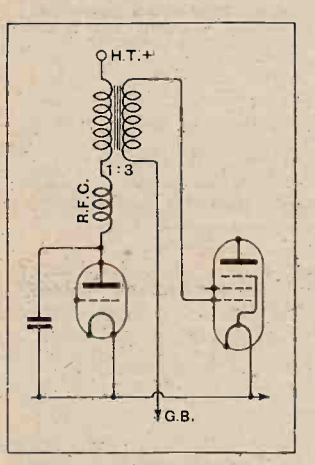


Fig. 23.—Anode bend detector with transformer coupling to pentode.

Transformer Coupling.

In practically all commercial sets comprising a H.F. screen-grid stage, detector and pentode, a transformer is used to couple the detector to the pentode with the object of obtaining a large amount of L.F. amplification. It is true that any transformer mutilates transients, and so is to be condemned when really high quality is being sought, but if we restrict ourselves to the consideration of sustained musical notes from 50 cycles to 5,000 cycles, the transformer coupling turns out to be a remarkably good device, provided that a few simple rules are adhered to.

Fig. 23 illustrates this circuit, and the first point to notice is that no blocking effect can now take place in the pentode, since if the grid should happen to receive a large positive swing it can immediately discharge through the secondary of the transformer.

Care should be taken to use a transformer of high primary inductance in conjunction with a detector of low differential resistance, for otherwise the low tones are attenuated. Good inter-valve transformers with cores of nickel-steel have at least 50 henrys in the primary, giving impedances of 15,000 ohms at 50 cycles, rising to 1.5 megohms at 5,000 cycles. Detectors for anode bend operation are made with differential resistance as low as 15,000 ohms (Mullard PMD or Osram DEL class), even when working on the lower bend of the characteristic, and accordingly the transmission at 50 cycles is 70 per cent., rising rapidly with frequency to 100 per cent.[5]

This is the result which would be obtained if the secondary of the transformer were truly on open circuit. But, as already shown, the feed back through the plate-grid capacity of the pentode introduces a capacity of 90 mmf. across the terminals of the secondary. This is shown in Fig. 24 (*a*).

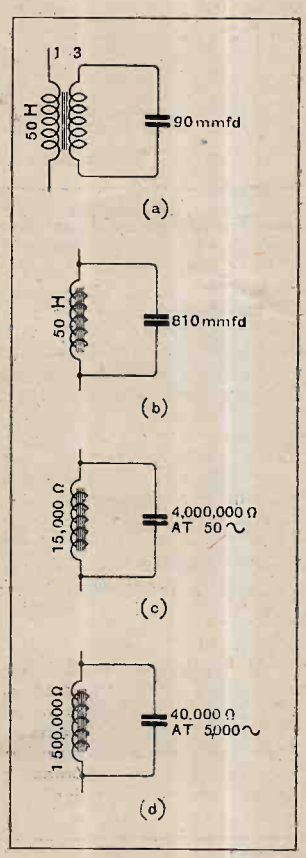


Fig. 24.—The effect of a capacitative load on the secondary of a 1 : 3 transformer.

It is well known that a capacity C across the secondary is equivalent to a capacity n^2C across the primary, where n is the step-up ratio of the transformer. Hence, if we choose a 1 : 3 transformer the equivalent picture is as in Fig. 24 (*b*), where the secondary has disappeared, and we have $3^2 \times 90 = 810$ mmf. across the primary. In (*c*) and (*d*) the corresponding impedances are shown for 50 cycles and 5,000 cycles respectively. In (*d*) the capacity impedance has dropped to 40,000 ohms, and, since the differential resistance of the detector is 15,000 ohms, the transmission is $40{,}000/\sqrt{40{,}000^2 + 15{,}000^2} = 4/\sqrt{4^2+1.5^2} = 0.94$, or 94 per cent. Hence there is a slight loss of 6 per cent. at 5,000 cycles due to the pentode feed back.

In Fig. 25 (1) the trans-

[5] The fraction of voltage transmitted at any frequency by a transformer of primary inductance L henrys in the plate circuit of a detector of differential resistance R ohms is

$$2\pi fL/\sqrt{(2\pi fL)^2 + R^2}$$

In our example this becomes (at 50 cycles)

$$15{,}000/\sqrt{15{,}000^2+15{,}000^2} = \frac{1}{\sqrt{2}} = 0.707.$$

Quality Reception.—

mission curve is given for a 1 : 3 transformer with a 50 henry primary. The full line indicates the efficiency of transmission apart from feed-back effects, the loss due to the latter being indicated by the dotted curve (1).

If a step-up of higher ratio is used the characteristics of the transformer are impaired for two reasons. In the first place, more turns must be wound on the secondary, leaving less room for primary turns, so that the primary inductance is smaller. Secondly, the larger turns ratio means that the feed-back capacity of the pentode must be multiplied by a larger number when it is being transferred back to the transformer primary. Thus, in Fig. 24 if a 1 : 6 turns ratio were used we should have $6^2 \times 90 = 3{,}240$ mmf. in (b) and 10,000 ohms instead of 40,000 ohms in (d). Curve 2, Fig. 25, shows the transmission curve actually obtained for a 1 : 6 transformer. With transformers of greater bulk, such as the Ferranti AF5, which is wound on a stalloy core a primary inductance of as much as 140 henrys can be obtained even when a direct current of 2 milliamperes is flowing through the windings. The transmission curve in this case is shown in Fig. 25 (3).

(To be concluded.)

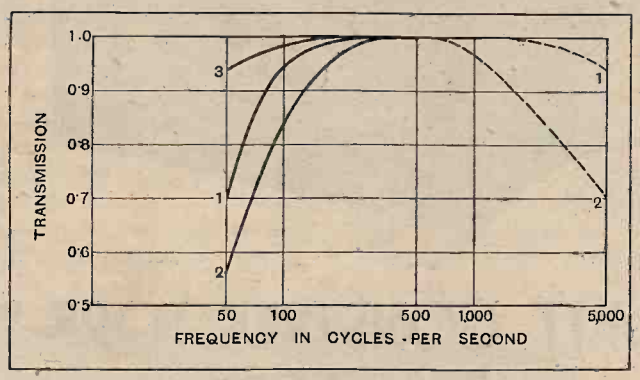


Fig. 25.—Some transformer characteristics. Apart from feed back loss the transmission is unity at frequencies above 500.

CORRESPONDENCE.

The Editor does not hold himself responsible for the opinions of his correspondents.

Correspondence should be addressed to the Editor, "The Wireless World," Dorset House, Tudor Street, E.C.4, and must be accompanied by the writer's name and address.

UNQUALIFIED STAFF AT THE SHOW

Sir,—I was interested in your remarks in the current issue of *The Wireless World* concerning the tendency of stallholders at the recent Exhibition to "take on a temporary staff with little knowledge of the apparatus displayed."

This was the first year that I have visited the Radio Exhibition, and I was very surprised at the number of attendants whose knowledge of the apparatus was limited to the information given in the accompanying leaflets or catalogues.

I must confess I expected to meet experts who knew their respective exhibits from A to Z. Instead, when I enquired for details concerning a certain eliminator the attendant could do nothing until he had consulted a catalogue; he then marked with pencil the model concerned, handed the catalogue to me, and then apparently expected me to go away! Instead I consulted the said "book of words" and informed the gushing gentleman that that was *not* the model about which I was enquiring! To which he replied that he knew nothing about that model, but I should find details on the other side of the stand!

This is only *one* example I came across. One attendant actually confessed that he knew nothing about the apparatus he was showing, but he personally "had sold a large number and had no complaints." He expected us (a wireless friend accompanied me) to be impressed with his cleverness, apparently, when he told us how he had discovered a grid-bias lead plugged into the H.T. battery of a set he had had to repair!

On numerous other stands, too, the knowledge of wireless displayed by the attendants was barely equal to that of a fairly intelligent schoolboy who pursued wireless as a hobby.

Let us hope that the manufacturers concerned will realise the "bad business" of this state of affairs before another Show.

Newark, Notts. S. W. P. HENTON.

PITCH OF THE HUMAN WHISTLE.

Sir,—I happened to see your paper this week and was interested in the article on Quality Reception, by Mr. Harmon. It is a pity, however, that the article which is so good on the whole should be marred by false premises evidently due to a not sufficiently perceptive ear. That this is so is shown by his making the usual mistake of placing the pitch of the human whistle an octave too low. Further, were his assumption, that no note less than 50 cycles is necessary, true, the expensive pedal pipes of an organ would be superfluous. These open wood pipes, far from lacking fundamental power, consist of little else, and it is due to these that the organ possesses that heavy foundation that even a multitude of orchestral string basses cannot produce. I would suggest that Mr. Harmon finds some friend with what musicians call "absolute pitch" to advise him, and he may safely depend on his dictum where sound perception is required. SEYMOUR PILE.

Birmingham.

Sir,—Sir Richard Paget, in his recent book, "Human Speech," put the lower limit of the human whistle at upper C (512 cycles). As I was unable to reconcile this position with my own perception I invited four of my friends who possess absolute pitch to whistle a descending scale, accompanied on the piano, with the result that two of them put the lower limit at middle C, while the other two gave upper C!

During the next three months I tested 53 people of varying degrees of musical ability, with the result that in 45 cases middle C was preferred, only 8 votes being given for upper C. Several observers stated that a low whistle is so complex that they had considerable difficulty in assigning the correct octave.

Were the majority of these people making what Mr. Pile calls a common mistake? Why should their interpretation be called a mistake in the absence of any absolute standard by which the pitch can be ascertained? It is probable that in some cases the complex sound is assigned to its *loudest* component, and to its *lowest* component in others. An oscillograph analysis would give the necessary data on which to argue the question. Anyhow, the readers of *The Wireless World* are now presented with a controversial subject which should afford them entertainment during the winter evenings. JOHN HARMON.

S.W.

"THE GREAT F.R.S."

Sir,—I was very pleased to read Mr. Trevor-Potts' letter about Professor S. P. Thompson's classic, "Calculus Made Easy." Since first meeting it several years ago it has been a constant source of pleasure, and I have developed a great affection for it. There certainly ought to be a "S.P.T. Society" for its study and appreciation!

But we must also be grateful to Professor Perry for his "Calculus for Engineers," another delightful book which also turns the calculus into a "joy for ever" for all who can see the "thing of beauty" in even elementary mathematics.

Your readers will find endless pleasure in these two wonderful books. L. OSWELL.

KIT CONSTRUCTORS NOTES

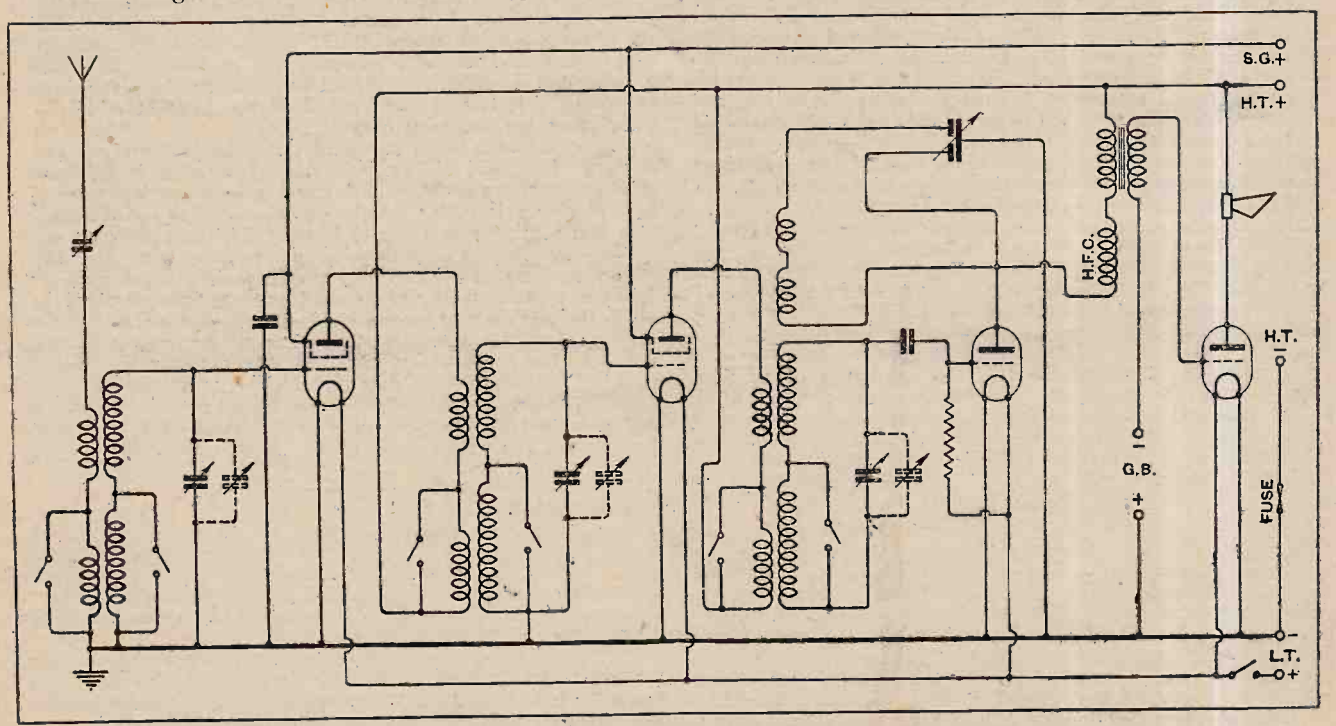
The Osram Music Magnet Four.

THE production of a new Osram Music Magnet is becoming an annual event to which many of us look forward with considerable interest, for the very good reason that each receiver of the series has been not merely up to date but actually ahead of ordinary current technical practice.

In the matter of ganged tuning control the designers are pioneers, as far as "kit" sets are concerned. When the first model was produced the opinion was freely expressed that the inclusion of this admittedly valuable feature in a receiver intended for home construction by even unskilled amateurs would necessitate the sacrifice of a good deal of sensitivity and selectivity. These fears were proved to be groundless, as the performance of the receiver, in spite of its easy operation, was found to compare very favourably with that of many others in the H.F.-det.-L.F. three-valve class.

"Music Magnet No. 2" was similar to its predecessor in all essentials, but was considerably improved in detail: the subject of the present review, which is the third model to be produced, is a much more ambitious set, as it includes two H.F. stages. Those responsible for it have rightly decided, in view of present congestion in the ether and ever-increasing power of transmitting stations, that at least three tuned circuits are necessary for anything approaching satisfactory and consistent long-distance reception. The new set is infinitely more selective, and has an appreciably greater range than last year's model.

A preliminary announcement regarding the Music Magnet Four appeared in *The Wireless World* for August 13th, where brief details and a simplified diagram were published. The complete circuit arrangement is now shown in the accompanying diagram, from which it will be seen that double-wound H.F. transformers are used both for aerial-grid and intervalve couplings. Long-



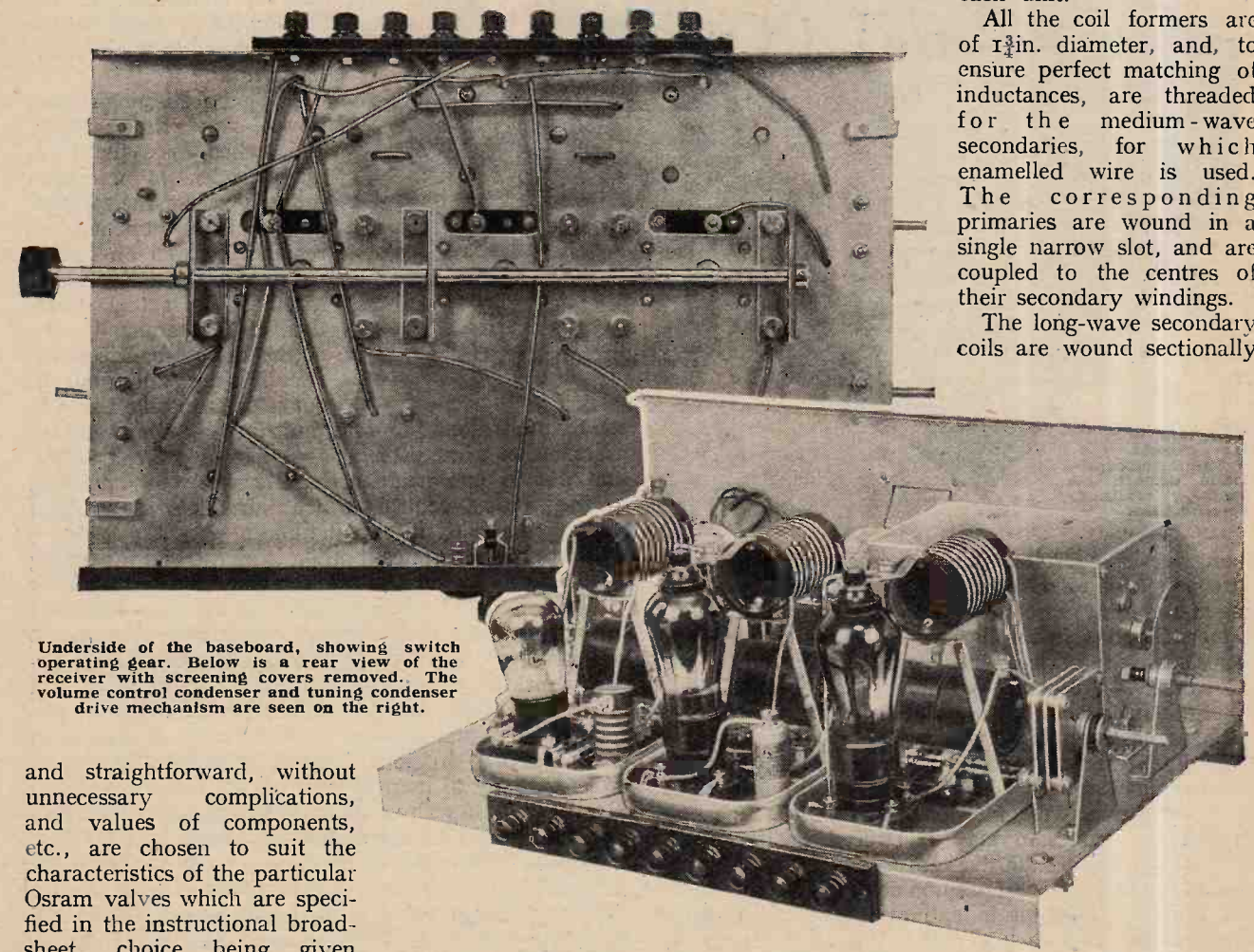
Complete circuit diagram. All wave-range switches are linked together mechanically. Trimming condensers are shown in dotted lines.

Kit Constructors' Notes.—

and medium-wave windings are joined in series, the former being shunted by short-circuiting switches for waveband changing. A grid detector is followed by a single transformer-coupled L.F. stage, and reaction is controlled by a differential condenser, so arranged that its moving vanes may be earthed. Connected in this way, the condenser functions just as well as if it were used in the more conventional manner, and so this plan might well be adopted more widely, especially in the construction of receivers with metal panels.

An input volume control is provided in the form of a series aerial condenser. Each of the three ganged tuning condensers is fitted with a trimmer, and all switches are mechanically linked. The circuit is essentially simple and straightforward, without unnecessary complications, and values of components, etc., are chosen to suit the characteristics of the particular Osram valves which are specified in the instructional broadsheet, choice being given between those with two-, four-, or six-volt filaments.

Details of construction are particularly well thought out, and it is no exaggeration to say that the receiver could be successfully assembled by anyone with common sense, even if he did not know what a valve holder looked like! Components are separately wrapped in labelled packages, and clear instructions are given for each successive stage in the process of assembly and wiring.



Underside of the baseboard, showing switch operating gear. Below is a rear view of the receiver with screening covers removed. The volume control condenser and tuning condenser drive mechanism are seen on the right.

With regard to screening, the essentially modern practice of providing separate compartments for tuning condensers and coils has been followed. The triple condenser assembly, which is supplied complete in an aluminium container, deserves a word of praise for its excellent design and robust though compact construction; the three linked rotors are driven through friction gearing by a knob protruding through the side of the containing cabinet.

Ingenious Wave-change Switch.

Each of the H.F. transformer assemblies is mounted, together with the associated valve, in a shallow tray, which in turn is bolted to the main aluminium baseplate. Removable screening covers are supplied for each unit.

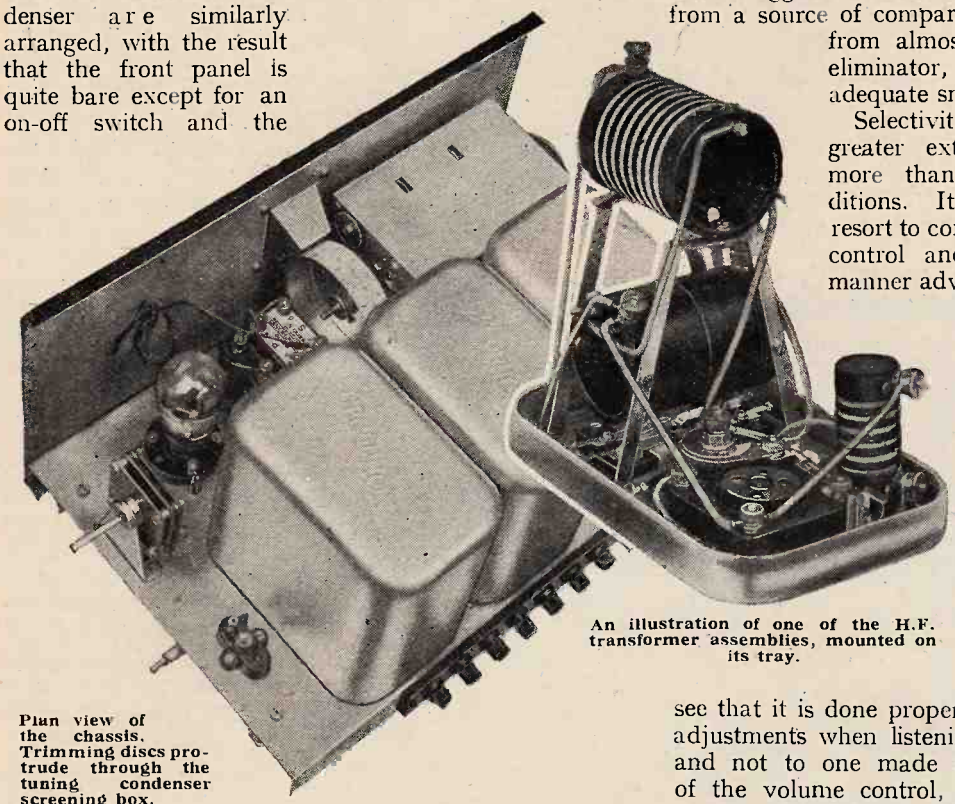
All the coil formers are of 1¾in. diameter, and, to ensure perfect matching of inductances, are threaded for the medium-wave secondaries, for which enamelled wire is used. The corresponding primaries are wound in a single narrow slot, and are coupled to the centres of their secondary windings.

The long-wave secondary coils are wound sectionally in grooves, with primary sections sandwiched between. Pairs of transformers are mounted together on a brass platform, which also carries the switch contacts; these are operated in a most ingenious manner by a rod rotating in bearings mounted under the base. This rod is drilled with three deeply countersunk holes, which engage with steel balls; on rotation of the rod the balls are forced upwards, and their movement is transmitted to the switch contacts in such a way that they are

Kit Constructors' Notes.—

closed for listening to the medium waveband.

It has already been stated that the tuning condenser knob projects through the side of the cabinet; controls for the wave-range switch, the series aerial condenser, and the reaction condenser are similarly arranged, with the result that the front panel is quite bare except for an on-off switch and the tuning scale aperture. This arrangement makes it extremely easy to operate the set, even during a prolonged sitting in search of elusive distant transmissions, as the operator's forearms may be rested on the table. The controls most frequently used—those for tuning and reaction—are in the most accessible positions; this is but one instance of attention to detail in the design.



Plan view of the chassis. Trimming discs protrude through the tuning condenser screening box.

An illustration of one of the H.F. transformer assemblies, mounted on its tray.

When the screening covers are in position very few connecting leads are visible, as they are mostly concentrated under the base. The process of wiring is made easier by drawing the plan so that each wire passing through the baseplate may be traced to its proper terminal by holding the diagram to the light. Instructions as to the length and position of each wire are given.

A deliberate attempt to extract the utmost possible magnification from each of the H.F. valves of any set of this kind would be a mistake, and the conclusion has been reached, after an extended series of tests, both comparative and quantitative, that the best possible compromise has been made. Overall H.F. gain is not particularly high, but is ample for almost any conditions, and, as already suggested, the new set is vastly more sensitive than either of its predecessors; it may definitely be placed in the long-range class, in which, incidentally, very few three-valve receivers can legitimately be included.

It is gratifying to observe that the set is completely stable, and further, that in this respect there is an ample margin of safety; the insertion of high resistance in the common anode feed lead does not tend to produce self-oscillation, either at high or low frequency. This would suggest that the receiver could be fed satisfactorily from a source of comparatively high resistance, that is from almost any type of H.T. battery eliminator, provided that it includes an adequate smoothing system.

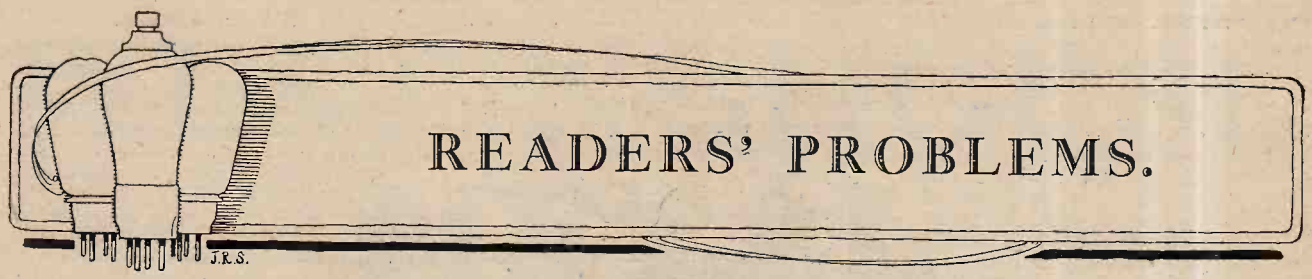
Selectivity is improved to an even greater extent than sensitivity, and is more than sufficient for ordinary conditions. It is but rarely that one has to resort to combined operation of the volume control and reaction condenser, in the manner advocated by the producers of the set, in order to avoid interference.

The ganged tuning system works very satisfactorily, and, when once the trimming condensers have been properly set for the medium band, this adjustment holds remarkably well on changing over to the longer wavelengths. The actual operation of "trimming" each of the three separate tuned circuits is not really difficult, but it pays to take pains to see that it is done properly, and to make the necessary adjustments when listening to a naturally weak signal, and not to one made artificially weak by operation of the volume control, which introduces some slight change of aerial-grid circuit tuning.

Direct wavelength calibration is marked on the tuning condenser dial, which, in addition, has an arbitrary scale of 0-100 divisions. This seems to be a most satisfactory arrangement, as it allows the setting corresponding to comparatively weak transmissions to be recorded accurately for future reference. Further, an extra pair of scales is provided, one of which is calibrated to correspond with actual stations, while the other is marked in condenser-dial divisions. When a station, known to adhere strictly to its proper wavelength, has once been identified, these scales are fitted together, and afterwards other calibrated transmissions can easily be found.

Anode consumption is on the high side for a battery set, amounting to some 15 milliamperes at least when a DEP.215 output valve is used with normal H.T. and screening grid voltages throughout. This figure can be appreciably reduced for local station work by reducing screening-grid voltages. Special high-capacity batteries are being produced by its makers, the General Electric Company, Ltd., Magnet House, Kingsway, W.C.1.

The complete set of parts, including valves and an oak cabinet in sections, but ready for assembly, costs £11 15s. This price seems to be remarkably low, particularly in view of the fact that all components are of high quality, and the chassis and details appertaining to it are beyond criticism with regard to their construction.



READERS' PROBLEMS.

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

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

A Question of Power Output.

The "Regional One" receiver makes a special appeal to me, but I have been deterred from building it because its output is stated to be 400 *milliwatts, and I remember some months ago it was stated in "The Wireless World" that an output of* 1,000 *milliwatts was usually considered to be necessary for undistorted moving-coil loud speaker operation. I am a moving-coil enthusiast, and was very interested, therefore, to see the circuit diagram which you recently published showing how to add an H.F. stage to this receiver, and I propose to build it. Before commencing work, however, I should like to know what output I may expect. I have a good aerial and earth and am situated about thirty-five miles from Brookmans Park.* O. A.

You have evidently not understood the purpose of the added H.F. stage, which cannot in the slightest degree increase the undistorted output of the receiver. No matter whether you increase the detector input by H.F. amplification or by taking the receiver nearer to Brookmans Park, the *undistorted* output cannot be increased. The receiver is intended for operating an ordinary moving-iron loud speaker, which will function well on 400 milliwatts, and the H.F. stage is only of use to those people who by reason of distance or a poor aerial cannot get enough input to load the valve properly. A moving-coil speaker with special pentode speech coil will give surprisingly loud signals with the "Regional One" receiver, provided the detector grid is fully loaded.

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Screening Boxes.

Is there any reason why the screening boxes of the "Band Pass Four" receiver should not be made of tinned steel instead of aluminium as specified? S. M.

The use of this material would tend to alter the constants of the tuning coils, particularly as there is not very much spacing between their windings and the metal. If you decide to use tinned steel, we think it would be advisable slightly to increase the dimensions of the containers.

Pick-up Connections for the Band Pass Three.

I should be glad if you will tell me the best way to incorporate a gramophone pick-up in the "Band Pass Three" receiver. D. R.

We give the necessary connections in Fig. 1. This method of connection is suitable for practically any receiver using leaky-grid rectification. It will be seen that a rapid change from gramophone to radio can be made by moving the switch S from A to B. The 100,000 ohm potentiometer is for the purpose of volume control, and can be mounted on the gramophone itself if desired.

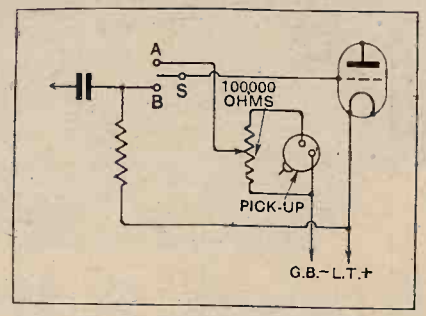

Fig. 1.—Adding a gramophone pick-up to the "Band Pass Three."

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Constructing a Wire-wound Resistance.

I wish to construct a wire-wound resistance for use in the filament circuit of a receiver which will derive all its power from D.C. mains. Can you tell me how to arrive at the correct gauge of wire and how many turns to use to give me the required resistance, which is 800 *ohms?* L. L. R.

We are afraid that the data which you give is insufficient for us to be able to give a definite answer to your question. You omit to state what value of current the wire will be required to carry. This itself depends on the filament current requirements and the proposed filament circuit arrangements of the valves you are going to use. If you can furnish us with this information we will give you definite instructions. Meanwhile here is the procedure you should adopt if you wish to make the necessary calculations yourself.

First ascertain the total current which the wire will be called upon to carry. Since you have stated that the required resistance is 800 ohms, we naturally presume that you have already decided upon the valves to use and the method of wiring them up, and, therefore, will be in a position to arrive at this figure accurately. You should then refer to the wire tables published by the makers of the particular wire which you intend to use, and pick out the gauge of wire which will safely carry the calculated current without developing an unduly high temperature. You will find a special column in the tables which will furnish you with the information. It is then necessary to ascertain the resistance per foot of the particular gauge of wire chosen; this information can be derived from another column of the tables which usually quotes the resistance per thousand yards. With regard to the number of turns which must be employed, this obviously depends upon the dimensions of your winding former, which you do not state. We think that if you will study the details of the "All D.C. Three" receiver, which was recently described in this journal (August 20th and 27th, 1930, issues) the task of making your resistance will be greatly facilitated.

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.*

An A.C. Band Pass Set.

It seems to me that the "Band Pass Three" receiver should be readily adaptable for A.C. mains supply for its filament and anode circuits: if I am correct in this, will you please explain briefly what alterations are necessary. If possible, I should like to use a super-power indirectly heated pentode in the output stage. H. M. P.

This set can quite easily be arranged for A.C. mains operation, and the alterations involved are of a more or less obvious kind.

A skeleton circuit diagram showing points at which these modifications must be introduced is given in Fig. 2, from which you will see that we suggest the use of indirectly heated valves throughout. You do not say specifically if you wish to use automatic grid bias, so the connections for this are not shown: it would probably be convenient, however, to eliminate the bias battery, at any rate for the output valve, and this can be done in the conventional manner.

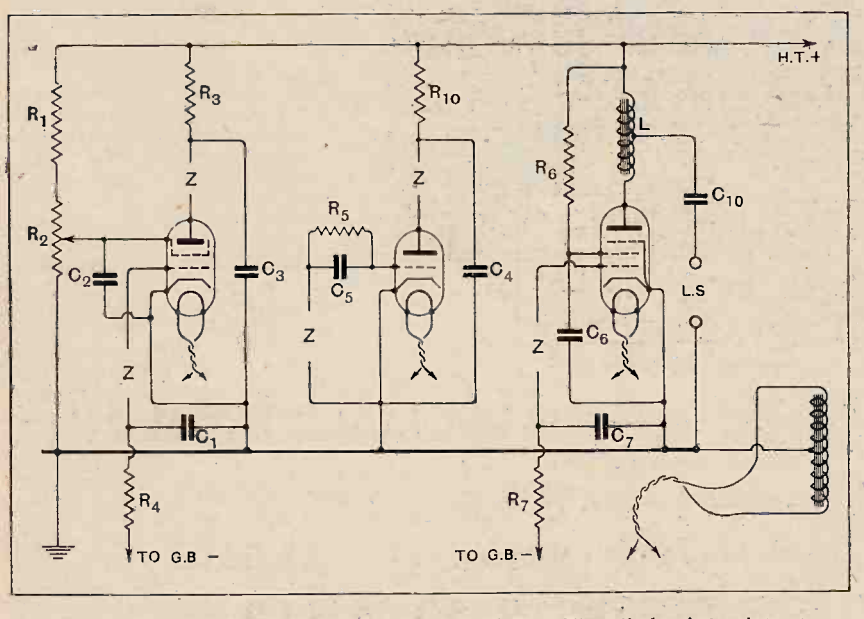

Fig. 2.—Skeleton circuit diagram of the "Band Pass Three" showing points at which modifications must be made for A.C. mains operation.

Referring to the diagram, the resistances R_1 and R_2, which form the fixed and variable elements of the screening grid potentiometer, may have values of 30,000 and 50,000 ohms. R_3 and R_{10} are combined anode feed and decoupling resistances for the first two anode circuits, and their values, depending as they do on H.T. input voltage, must be estimated in the usual way. Similarly, R_6, the feed resistance for the pentode screening grid, will also depend on input voltage, but assuming the normal average figure at about 240 volts, a resistance of 15,000 ohms would be correct. R_4 and R_7, the grid decoupling resistances, will not be necessary unless you use automatic bias; if this addition be made, resistors of 100,000 ohms would do.

For the condensers C_1, C_2, C_3 and C_7, a capacity of 1 mfd. will be sufficient, while C_4, C_5, and C_{10} should be of 2 mfds.

The grid condenser and leak (C_5 and R_5) are shown as being connected in parallel. This method is best if you adopt power grid detection, as you well might do if sufficient H.T. voltage is available.

To simplify the diagram, anode and grid circuit impedances are not shown, but are represented by the letter Z.

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H.F. Transformer and Tuned Grid Compared.

I am constructing a new receiver and am undecided whether to use an H.F. transformer or the tuned grid method of coupling between the H.F. valve and the anode bend detector, and I shall be glad if you will compare the relative advantages and disadvantages of the two methods for me. R. G.

The chief advantage of the tuned grid system is that it is more easily switched, it only being necessary to use a simple loading coil with a single-pole short-circuiting switch in order to cope with both long and short wavelengths. In addition, the coil, if it is to be home-made, is easier to construct as no primary winding is needed. On the other hand, the H.F. transformer is less costly, as a few turns of fine wire for the primary should be far cheaper than an H.F. choke and coupling condenser. Undoubtedly the greatest advantage of the H.F. transformer, however, is the fact that it is possible to achieve extra selectivity—and, if necessary, to attain stability—by removing primary turns. It is true that a similar effect can be produced in the case of the tuned grid by tapping the connection from the coupling condenser down towards the low-potential end of the coil, but only by adding complications to the waveband switching system.

A Fools' Paradise.

Some time ago I constructed an all-mains (50 cycle A.C.) receiver, and it has given very good results indeed, my loud speaker being of the reed-driven cone type. Recently I installed a well-known make of moving-coil loud speaker in an effort to obtain still better quality, but to my dismay I get quite a loud hum. On replacing the original loud speaker the hum disappears. The hum cannot be due to the loud speaker field since the instrument is of the permanent magnet type, and I am very puzzled and shall be glad if you can assist me to elucidate the trouble. G. d'A.

It is very evident that the fault lies in your set. Either your smoothing arrangements are inadequate or faults such as short-circuited turns in a choke or an internal disconnection in a fixed condenser have developed. What has been happening is that your cone loud speaker has, owing to its own shortcomings in the matter of reproduction of the lower musical frequencies, been masking the defects in your receiver. The 50-cycle hum, which is undoubtedly what you are hearing, has been present all the time, but has been inaudible owing to the inability of your old loud speaker to reproduce this very low frequency. You must bear in mind the fact that the better your loud speaker the more hum and distortion it will produce if it is fed from a poorly-designed or faulty receiver, although, of course, this must not be taken to mean that if a loud speaker distorts it is an indication that it is a good one! You are advised, therefore, completely to overhaul the smoothing arrangements in your receiver in order to eliminate any faulty component or to fit more generous chokes and condensers if necessary.

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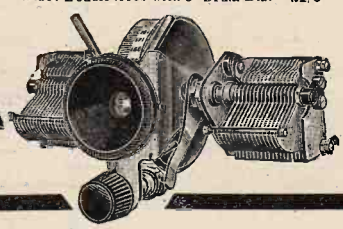

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OSRAM Music Magnet Screened Grid Three, 1928-29 model, with valves, cabinet, £7; 1930 model, as new, assembled, first £8/5.—Davidson, Wireless Dealer, Lochmaben. [1717

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THE Service is as Follows: We can supply practically all the leading lines of radio apparatus on the market at current list prices; if so desired we can accept in part exchange the reputable makes of the following apparatus: Receivers (domestic and portable), radio-gramophones, loud-speakers (cone and moving coil), cone units and chassis, battery eliminators and mains equipment components, battery chargers, remote control equipment, pick-ups and carrier arms, electric gramophone motors, H.F., L.F., and power chokes, condensers (variable, reaction, by-pass and smoothing), measuring instruments (high grade), L.F. transformers, slow motion dials (high grade), modern miscellaneous components; valves and tuning coils cannot be accepted in part exchange except by special arrangement.

IN View of the Difficulty of Making Fair and Definite Offers for Material that we have not inspected, it is requested that apparatus tendered for part exchange be kindly forwarded to us for valuation; no business can be proceeded with in connection with part exchange until material tendered has been examined; in this connection there need be no fear, material is sent to us from all over the world, not a single item of customers' property has ever been lost or mislaid; rejected offers from Xmas last amount to only 3.

IN Order to Furnish a Guide, the part exchange allowance may be gauged as approximately 50% of the list price of the article or articles tendered; for some articles the allowance will be more, and for others somewhat less; the allowance is entirely determined by the demand for individual articles, considering also their condition and production age; amateur constructed receivers cannot be accepted in part exchange as receivers, their value lying wholly in the components contained in them; only modern apparatus in good condition is accepted in part exchange; material cannot be purchased by us for cash.

TERMS of Part Exchange Business: A minimum of 50% of the value of an order, plus carriage charge where due, is payable in cash, unless the value is below £1, when a minimum of 10/- is payable; should the part exchange allowance exceed 50% of the total value of new requirements, the difference will be credited against future orders; material may be deposited against a credit note, which may be utilised at a later date; the maximum amount allowed to stand to the credit of any one individual is £200.

THESE Terms Have Been Made to the Lowest Economic Minimum, to give the customer the best value possible, while enabling us to maintain the standard required of this business.

SPECIAL Notice is drawn to the fact that by stipulating a minimum of 50% cash payable on part exchange orders, which is the same as stating that the part exchange allowance is credited to an order for not less than twice the allowance, you are ensured always of the best offer, as obviously the more we allow you the more you ultimately spend with us, to utilise your credit, if for no other reason; note also the facility of depositing material against a credit note, it can be drawn upon as required, wherever you may be; credit notes worth many thousands of pounds have been duly honoured upon presentation; a credit note on Appleby's is saleable, should the necessity arise, providing notice of transference is lodged with us at the time of sale.

AS Soon as Apparatus is Discarded from Use, dispose of it, don't keep it; it is not only wasteful, but expensive; the longer you keep it the older it is, and the older it is the less value it is; exchange it for a part exchange credit note, the value of which is constant, and can be disposed of if necessary by the holder with greater ease and facility than an article or collection of articles can ever be.

YOU Will Do Well to Deal with Appleby's; there is more in part exchange than the mere allowance; there is that something which begets confidence, that care that makes for efficiency; in the recent words of an old customer: Quite an embarrassing aloofness of purpose and an almost monotonous accuracy; you will know that it is all British—British capital and British behaviour; you will know also by dealing there that you are helping to employ British people.

SINCE the Day This Service Started it has Steadily Grown, not on rash advertising or subscribed capital, but on the volume of attainment only; and in these days businesses do not grow by that means for nothing, therefore we are privileged to invite you to utilise this service, wherever you may live; if you send your material by a carrier, pack it well, carriers are only human, and it is better to be safe than sorry; if you live in London, call to see us, you will like the atmosphere, it savours more of sport and art than the searing curriculum of commerce.

APPLEBY'S, Chapel St., St. Marylebone, London (opposite Edgware Rd. Metropolitan Station, or 4 minutes from Marble Arch, Oxford St.). Tel.: Paddington 8828 (3 lines). [0340

TRUTH ABOUT WIRELESS

Simple facts are often harder to believe than Fairy Tales, and some people can never believe an article is good unless they pay two or three times as much as is necessary.

THE GRAVES 'VULCAN' SET is the ideal installation for the man who wants perfectly satisfactory results for the most moderate outlay. It is made under Marconi License and embodies all the improvements possible in a popular-priced Set. It gives you the National Programmes in perfection and a wide choice of distant stations. Everything about the Set is reliable and first class; there are no complications. Even if you are only a beginner you can start right away to enjoy the wonders of wireless with as much certainty of success as if you had studied it for years. Cabinet Loud Speaker, Aerial Fittings & everything necessary is included. No extras. Full instructions with each Set.

A HANDSOME PRODUCTION. Full size Cabinet (as illustrated) of polished Oak, with hinged lid; all parts (including valves) accessible. Dull Emitter Detector and Power Valves, anti-microphonic Valve holders. No coils to change. H.T. Battery; 2-volt Accumulator; complete Aerial Outfit. Cabinet **LOUD SPEAKER** (as illustrated) in Oak to match set. Unit of the 'four pole' balanced armature type with large magnet.

10/- NOW

Price complete and Carriage Paid £7.10.0

Terms: 10/- with Order, 10/- Monthly

One Owner writes about the 'Vulcan' Set: "We feel we ought to tell you what a wonderful set your wireless really is. Ours is only a 2-valve set, but we get more out of it than many people we know with 4 and 3-valve sets"

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Write for Illustrated Catalogue. Full particulars and specifications of this and other high-class Receiving Sets; including Portable and All Mains Sets. Post Free.

We have **30** years character for honest dealing.

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The Graves Screened Grid 3-Valve Set (not illustrated here) with handsome Oak Cabinet and Cabinet Loud Speaker. Everything of highest quality and all complete and ready to fix. Price **£12.10**
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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

PECKHAM, Dulwich, and Camberwell residents should visit the Universal, 20, Victoria Rd., Peckham, for their radio requirements; thousands of bargains; all the latest components, kits, and sets; cash or terms. [1719

100 Only; 5-valve suit case portable sets, solid hide; astounding bargain, £8/15; cash or easy terms.—Send for specifications and full particulars to Marble Arch Motor Supplies, Ltd., 135, Edgware Rd., London, W.2. [1703

PYE 3-valve All Electric, only 3 months old, as new in every respect; cost £25, special bargain. £19; ready for use.—Baker, Austin's Grove, Sheringham. [1730

MEGAVOX to Specification, professionally built, nearly new, complete with valves and 150-volt W.H. Exide, separate if necessary. £12; new Foreign Listeners' Four, complete with valves and oak cabinet, brand new, professionally built, £18/10; moving coil speaker, constructed from Webson parts, 6 volt 1 amp., pot winding, pentode speech coil, perfect, £3.—31, Bevois St., Southampton. [1778a

BURNDEPT Latest Type Screened Portable, cost £19/19, only in use 3 months, complete, ready for use, with new H.T. battery, £12/12; also Burndept 7-valve Ethodyne, in double door mahogany cabinet, brand new, complete with frame aerials, but less valves, £11; Lissen new 5-valve portable 16 guinea model, slightly soiled, to clear £8/8.—Hughes, 149, Chepstow Rd., Newport, Mon. [1772

PHILIPS 3-valve A.C. Set, type 2531; £20; owner changing to D.C.—Box 7775, c/o *The Wireless World*. [1765

McMICHAEL Super Range Portable, as new; £15. —Box 7774, c/o *The Wireless World*. [1764

HARTCOLLINS Screened Four Portable, as new; £12, cost £22.—Ireland, 20, Wetherby Place, S.W.7. [1761

PHILIPS Receiver, 4-valve, type 2511, for 230-volt A.C., latest model, as new; £26 or nearest offer.—W. Hamer, 51, Deardengate, Haslingden, Rossendale. [1749

EVERYMAN Four, perfect, complete. coils, both wavelengths, 80 amp. Exide accumulator, D.C. eliminator; £8/10.—24, Dane John, Canterbury. [1748

LONG Range Pye 5-valve Portable, in perfect order; cost 28 guineas. will accept 14; any trial.—Hucks, 30, Bassett Rd., Kensington, W.10. 'Phone: Park 5682 for appointment. [1747

3-VALVE All-Mains Receivers, no batteries, required; 6 guineas.—Write Brooks, 3, Anselm Rd., Fulham. [1740

MEGAVOX Three (S.G.-det-Pen.), in mahogany pedestal cabinet, perfect, valves practically new, long and medium wave coils; also 150-volt Exide double capacity H.T. accumulators; cost over £20, accept £14 or near offer.—Walker, 20, Pinfold Rd., Streatham, S.W. [1736

ACCUMULATORS—BATTERIES.

WET Battery Replacements, new process sacs. approximately 30,000 m.a.; 2/6 per dozen; particulars free.—Scottish Batteries, Braeside, Uphall Station. [1728

ACCUMULATOR HIRE.

DON'T Buy Dry Batteries, join our service; we keep you continuously supplied with fully charged C.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 B2, post free.—Radio Service (London), Ltd., 105, Torriano Av., Camden Rd., N.W.5. 'Phone: North 0623 (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."

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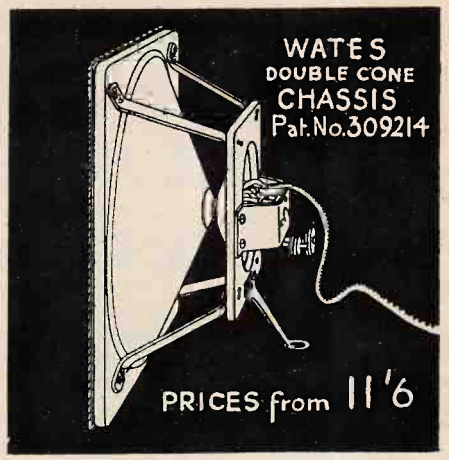

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The Wates 20" super Chassis is capable of great volume, coupled with a purity and realism that surpasses any moving-coil speaker.

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WARNING. — Beware of imitations. Insist on seeing the name Wates.

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14"	12/6	Oak	£4 : 10 : 0
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Above chassis are complete with Universal Bracket.		Wates Star Unit	25/-
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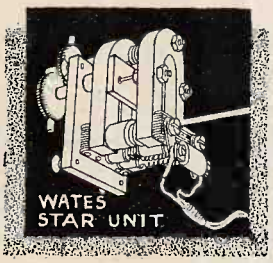

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The One H.T. UNIT WORTH WHILE.

Keeps automatically charged from the L.T. Accumulator or will work from a Trickle Charger. Indestructible Nickel and Iron Plates. Guaranteed for 12 months but will last a lifetime.

MILNES RADIO CO.

COTTINGLEY BRIDGE, BINGLEY, YORKS

Chargers and Eliminators.—Contd.

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 HT., 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

SCHOOLS Demonstration Eliminator, components as specified by "Wireless World" designer; cost £19/16, price, complete with 3 rectifying valves and 1 L.S6A, £11, or without valves, £9.—H. C. Elsden, Fair View Barming Heath, Maidstone. [1660

ZAMPA, the cheapest, best and most silent eliminator kit on the market.

ZAMPA Power Kit, 120h. at 20 mA., with tapping, incorporating Westinghouse rectifiers; 49/6.

ZAMPA Heavy Duty Kit, 200 volts at 28 mA. with tapping; 69/6; sent on seven days approval against cash; full particulars of these and other kits willingly forwarded on request.—Mic Wireless Co., Market St., Wellingborough. [1677

H.T. ELIMINATOR, A.C., any voltage, 3 variable one fixed, 180 volts, 40 m.a., metal cabinet, 55/-; L.T. charge, ½ amp., 12/6.—Thomson, 109, Underhill Rd., East Dulwich, S.E.22. [1733

BRYCE'S.—Mains transformers easily made at home, including "Wireless World" transformers; write for instructions.—Bryce's, 54, Dawson St., Bury, Lancs. [1731

MAINS Transformers; from 15/6; goaranteed; stamp lists.—Edwards, 5, Bradford St., Chelmsford. [1729

BURNDEPT Heavy Duty Wire Wound Resistances in original cartons listed at prices up to 22/6 each; our price 3/- each; No. 1175 tapped for 330, 600, 750, 1,350 ohms, No. 1177, for 540, 1,000, 1,150, 2,150 ohms, No. 1182-2500, 3,000, 5,500 ohms, No. 1185 for 5,000, 7,500, 12,500 ohms, No. 1191 for 62,500, 125,000, 250,000 ohms.—Hughes, 149, Chepstow Rd., Newport, Mon. [1773

SPECIAL Offer.—High quality mains transformers, as used by manufacturer now gone out of business, input 200-250 volts, output 300-0-300, 150 mA., 4 volts 4 amps., 6 volts 1 amp., 7½ volts 2½ amps., all centre tapped; now is your chance, to clear at 30/- each; output chokes, 100 mA., 7/6; A.C. smoothing chokes, 150 mA., 10/-; D.C. smoothing chokes, 100 mA., 9/-.—Hughes, 149, Chepstow Rd., Newport, Mon. [1770

CABINETS.

CABINETS to Your Own Requirements; quotations by return.—Hammonds, 1, Stratford St., Nuneaton. [1234

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 Customers' 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

BEAUTIFUL Portable Cabinets, fancy wood and plain, some inlaid, clearing under cost; also rexine portables (damaged), from 4/6.—Apply 12, Mornington Crescent, N.W.1. 'Phone: Museum 9247. [1441

COILS. TRANSFORMERS. ETC.

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

BAND-PASS Four Coils, complete set; 25/-; c.o.d. or deposit.—Smith, 3, Park Parade, Harlesden, N.W.10. [1590

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. [1670

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., all "Wireless World" coils supplied, choke and resistances for "D.C. Three," first class materials and workmanhip to specifications guaranteed; at reasonable prices; write for list.—Premier Place, High St., Putney, S.W.15. [1742

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

LOUD-SPEAKERS.

EPOCH Moving Coil Speakers.

EPOCH.—Everybody who heard the Model 99 agreed with the "Sunday Observer" that it was the finest Speaker in Olympia.

EPOCH.

EPOCH.—Everybody who heard—who didn't?—agreed with the London "Evening News" that the Super Cinema Model was truly named.

EPOCH.

EPOCH.—But those who managed to hear the new Model 101 (Domino) under fair working conditions will never forget it.

EPOCH.

EPOCH.—They will never rest until one of these Speakers is on their sets.

EPOCH.

EPOCH.—The new 101 (Domino).

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EPOCH.—The new 101 (Domino).

EPOCH.—The greatest advance in the history of energised Moving Coil Speakers.

EPOCH.

EPOCH.—The new 101 cannot be adequately described.

EPOCH.

EPOCH.—All standards of quality reproduction must be revised.

EPOCH.

EPOCH.—Never before has such clarity been achieved.

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EPOCH.—Never before has such sensitivity and power been obtained in a Home model.

EPOCH Model 101.—The speaker of no comparison.

EPOCH.—Epoch Permanent Magnet Moving Coil Speakers; all models greatly improved.

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EPOCH.—First and foremost the Cabinet Models C12, C13, and C14; prices complete from £5/19/6.

EPOCH.—These contain very powerful permanent magnet Moving Coil Speakers.

EPOCH.—They are not just units fitted into cabinets, but are specially balanced as Cabinet Speakers.

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EPOCH.—No drumminess; no box resonance, but clear, sharp, marvellous reproduction.

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EPOCH.—Magnificent woodwork, very compact.

EPOCH.—They cost less than some makes of inferior units without Cabinets.

EPOCH.—Permanent Magnet Moving Coil Speaker Units for portables; £3/15; ready for use.

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EPOCH.—Standard Cross Magnet Permanent Magnet Speaker, price £4/4; the finest of its kind.

EPOCH.

EPOCH.—Permanent Magnet Super Speakers; they are £6/12/6.

EPOCH.—Remember, the famous 66 and 99 Speakers are heavily reduced in prices.

EPOCH.—The 99 is also further improved in sensitivity.

EPOCH Range of Moving Coil Speakers is the largest in the world; a Speaker for every requirement.

EPOCH.

EPOCH.—Send for booklet S4, the most interesting and useful publication on the subject.

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EPOCH.—Send for the 7 days' approval arrangements.

EPOCH.—Send for the H.P terms.

EPOCH.—Call for a demonstration.

EPOCH RADIO MANUFACTURING Co., Ltd., Farringdon Av., E.C.4 (between Holborn and Ludgate Circus). 'Phone: Central 1971 (3 lines). [1628

Loud-Speakers.—Contd.

BAKER'S SELHURST RADIO 36-page Booklet, "Sound Advice in Yours for the Asking"; write now for new edition; see displayed advertisement on page 32. [0231

EPOCH Model 99 D.C. Mains; £3/10.—Bovey, 12, Southern Rd., East Finchley. [1760

SAVAGE'S New Bathurst Speaker Gives Highest and Loudest Notes With Power and Quality, handsome cabinet, 3ft. 5in. high; £4.—Hear it at 18, Bathurst Rd., Hellesley Rd., Ilford, and judge whether you have heard its equal. [1757

MARCONIPHONE M.C. Cabinet Speakers (10-guinea models), two only; £4/10 each; also other gear.—Dismore, 50, Whitegate Rd., Southend, Essex. [1745

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

MARCONI Latest Type Moving Coil Speaker for A.C. Mains, new, cost £12/12, accept £6; Electrogram D.C. moving coil, new, cost £9, accept £2/10; Brown power speaker, £1/10.—Picture House, Bonnyrigg, Midlothian. [1779

GRAMOPHONES, PICK-UPS, ETC.

AS New, Varley 1930 type, 25/-; Celestion Woodruffe, 30/-.—Reply B./PXJV, London, W.C.1. [1716

GARRARD Double Motor, new, unused; 25/6; particulars stamp.—McLellan, 18, Wellington Rd., E.17. [1711

B.T.H. New Type Pick-up and Arm; 21/-.—P. Stillwell, 76, Broadway, Coventry. [1778

PICTURE RECEIVER APPARATUS.

TELEVISION Scanning Discs, special apparatus used by P. D. Walters, Esq., for receiving American transmissions.—Supplied by John Salter, Featherstone Buildings, High Holborn, W.C. [1706

TRANSMITTERS.

EXACTLY as New, B.T.H. ball-bearing rotary converter, 12v. to 600v., cost £20, accept £5; Weston 301 0-25 milliammeter, new, 30/-; Turner 309 0-6 m.a., 0-1.5a, cost 50/-, take 25/-; Peel-Connor announcer's mike, with transformer, cost £3/10, take 30/-; Barr-Stroud key and buzzer, cost 50/-, clear 7/6.—Details, Matthews, "Claremont," Tudor Av., Chelmsford. [1722

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

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

EDISWAN HU235, 15/6; Heayberd transformer (250v. 40c.), 1+1v. 3.5a., 7/6; milliameter 0-300, 7/-; Eureka Baby Grand, 5/-.—Box 7765, c/o *The Wireless World*. [1720

MARCONI 6-1 Ideal Transformer, 10/6; Igranic pick-up and volume control, 12/6; Bowyer Lowe 0.0005 variable condenser, 3/-; Pye differential condenser, 3/-; Junit multi switch, 2/6; R.I. permanent Crystal, 2/-.—Pape, 31, High St., Wisbech. [1713

SPECIAL Heavy Duty Smoothing Chokes, carry 150 m.a., few left; 6/6, post free.—Popplewell, 145, Middlewood Rd., Sheffield. [1712

B.T.H. Mains Transformer (B1), 21/-; Oldham charger, 230v. A.C., 150v. D.C., 30/-; Ferranti A.F.5, 19/-; Blue Spot 66a, 5/-; P.M.3A., P.M.4D.X., P.M.4, 3/6 each; P.M.254, 4/6; P.M.24, 9/-.—Wilkinson, 59, Allerton Rd., Bradford. [1709

AND Now—Stereophonic Coupler, new 1931 super model, type B2; price £5/5 ("W.W." deposit system willingly). Mr. O. H. Peasgood, sub-organist Westminster Abbey, says: "No more resistance, transformer or push-pull for me after the realism of wireless and gramophone reproduction by your latest coupler."—N. Bonavia-Hunt, 96, Broadhurst Gardens, N.W.6. [1704

A.C. Valves, M.H.L.4, new; 10/-; Cosmos A.C./S. and valve holder, little used, 10/-; Edison pick-up, 7/6.—Ferguson, 13, Carshalton Rd., Mitcham. [1725

Components, Etc., for Sale.—Contd.

66K, 14/-; Air crome chassis, 15in.×15in., 19/-; Parmeko A.C. mains valve transformer, 13/-; Celestion pick-up, 27/6, all as new, many other bargains.—24, Mildmay Grove, N.1. [1700

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

RETAILER'S Bankrupt Stock, final clearance prices. —Garrard D.S. gramophone motors, No. 10a; list 53/6, my price 33/6.

OSRAM L.S.5 Valves, 16/6; Mullard D.F.A.7, 16/6; Philips 506 rectifier valves, H.T., 12/6; Philips 328, L.T., 7/-.

MULLARD Permacore L.F. Transformers, 10/6; Cossor, 10/6; Ferranti push-pull A.F.3C, can be used as ordinary, 16/6; Ferranti O.P.4C 25-1, 12/6; all goods sent, satisfaction, or cash refunded.

DUBILIER R.C.C. Units, 3/6; Polar Ideal slow motion condensers, 0.0005, 7/-, or pair 13/-; Hydra condensers, fixed, 2 mf., 650v. test, 2/2; Hydra 4 mf., 500v. test, 3/3; Hyra 4 mf., 375v. working (500v. A.C. test), 4/6; Hydra 0.01, 6d.

GRAHAM Farish Resistances, guaranteed carry 10 m.a., in values, 2.3, 4, 5, 100, 150, 250, 350, 400, 500, thousand ohms; prices 1/6 each up to 150,000, and 1/- each others; all posted per return.—G. A. Ryall, 182, Kennington Rd., London, S.E.11. [1741

FERRANTI A.F.5c, O.P.1.c, push pull, as new, 29/6 pair; Raytheon dry rectifier, 125 mA., guaranteed unused, 27/6; Thordarson transformer and smoothing compact for above, 42/6.—Leaver, Agra, Worplesdon Rd., Guildford. [1726

SPECIAL Offer.—Purchased from manufacturer now out of business; Harlie moving coil loud speakers, 100-volt D.C. field, 20/- each, complete; Harlie pick-up, complete with tone arm, 25/-; screening tins, 5in.×5in.×5in., 9d. each; Emkabe slow motion dials, 1/6 each; fixed condensers, 0.01 and 0.002, 8d. each; Zenite Vitreous resistances in following resistances, 304, 230, 600, 805, 1,573, 1,330, 1,100 and 3,400 ohms; most of these are tapped, 2/- each; Igranic volume controls potentiometer, type 10,000 ohms, 2/6 each; R.I. output transformers, ratios 25 to 1 and 35 to 1, 7/6 each; also the following lines to clear at bargain prices: Burndept Eronide finish loud speaker cone cabinets, 9/6; Burndept suitcase type slightly used portable leather cabinets, 12/6; Burndept oak eliminator cabinets, 5/-; sets of five Burndept concert coils, 6/- per set; all carriage paid.—Hughes, 149, Chepstow Rd., Newport, Mon. [1771

ELIMINATOR, 400 volts 80 mA., 2 variable tappings, input 200-240 volts, £7; R.I. heavy duty adjustable choke, 30/-; R.I. tone arm, 20/-; Pye 350 henry choke, 10/-; 2 6 mfd. condensers, tested 1,000 volts A.C., 10/- each; 2 L.S.6A, 2 M.S.4, AC/SG, S.G.610, 10/- each; P.M.5D.X, P240, P.M.3, P.M.4, 3/6 each.—Rogers, 21, New Rd., Brentwood. [1727

THREE B.T.H. Pick-ups, new, 19/- each; 25-watt A.C. power amplifier, new, complete with valves, commercially built product, £20; 60 watt all A.C., with valves for talkie work, £45.—Picture House, Bonnyrigg, Midlothian. [1780

BLAKEY'S Offer 75% Off List Price 1930 Material; 50% 1928-29 on part exchange terms.—23, Holborn St., Rochdale. [1777a

GOVERNMENT Surplus Mark II 2-valve Transmitters, 10/6; B.T.H. generators, H.T.950, 37/6; Mark III 2-valve sets, 17/6; Veeder counters, 1/-; headphone cords, 6d.; hot wire ampmeters, 3/6; Rotax 8-way switchboards, 2/6; Amplion units, A.R.58, 7/6; 3-valve amplifiers, 17/6; 2 M.F. condensers, 1/6; plus carriage.—Camden Surplus Mart, 25, King St., Camden Town, N.W.1. [1777

A.F.3, 15/-; Lewcos S.P. coils, 4/6; B.T.H. horn speaker, £1; Grambrell Neut, 2/6.—Box 7777, c/o *The Wireless World*. [1767

LISSEN Transformer, 12/-; Dubilier 0.0003, 5/-; Triotron unit, 7/6; Mullard R.C.C. unit, 5/-; P.M.1H.F., S.P.55/R, S.P.18G, 3/- each.—Box 7773, c/o *The Wireless World*. [1763

WESTINGHOUSE H.T.1 Rectifier, with R1 mains transformer for 200-250 volts 40-100 cycles, 3 T.C.C., 4 mfd. condensers; £3/10 the lot, guaranteed O.W.—Maw, Kirkby Rd., Hemsworth, Yorks. 'Phone: Hemsworth 82. [1758

WAVEMETER, in polished portable case, 3 ranges, 3 charts, calibrated by "Experimental Wireless," accurate, with valve, perfect, £3/10; also Westinghouse rectifier, 6v., 0.5 amp., new, 17/6; J.B. log. S.M. condenser and dial, 0.00015, new, 8/-.—Mills, 41, Druslyn Rd., West-Cross, Swansea. [1755

MAINS Transformers and Chokes for Radio and Sound Systems, totally enclosed in cast aluminium plates, guaranteed; write for lists; manufacturers' and traders' enquiries invited.—Eric Cookson and Co., 14, Cambridge Rd., Blackpool. [1754

CELESTION C12, mahogany, £3/7/6; Lewcos Q.S.G. coil, 7/6; Ferranti A.F.5, 20/-; Pye dual tuner, 10/-; all as new.—D. Heybourn, Altwood Bailey, Maidenhead. [1753

TRIOTRON Unit, 6/6; Bluespot 66K, 12/6; Major chassis, 7/6; Lissen latest pick-up, 18/-; volume controls, Lissen 2/9, Igranic 4/-; P.M.5×, 4/6; all perfect.—Briggs, Carlton Rd., Shipley. [1751

EXPERIMENTER'S Surplus.—Trickle charger, 2-, 4- or 6-volt, 240 A.C., ammeter, 19/6; Ferranti A.F.4, 9/6; O.P.2, 15/-; Formo dual Impedance, 10/-; Brown Vee, 9/6; Brown pick-up, 7/6.—Kirton, 82, Mortimer Rd., N.W.10. [1739

Components, Etc., For Sale.—Contd.

P.M.6D, 2 P.M.4D, 2 P.625A, all half price; 8 Exide W.Y.10 units, 56/-.—Chalmers, 169, Villiers Rd., Kingston. [1750

GREAT Radio Sale.—2 valve transmitting sets, new and perfect, 15/-; Morse transmitting sets, new and perfect, 12/6; 1in. spark coils, complete, 6/9; super sensitive microphones, 2/6; microphone transformers, 2/6; television motors, electric, any voltage, D.C., 10/- each; ¼h.p. motors, 110v. D.C., 25/-; 50-75V.4A charging dynamos, 35/-; 20v. 6a., 40/-; 100v. 10a., slow speed, compound, £7; portable telephones, 17/6; earphones, 1/3; telephone H.T. generators, 6/6; Morse tapping keys, 4/-; heavy brass buzzer, 3/-; I.M.F. Mansbridge condensers, 1/3; hand telephones, 5/-; shunt regulators to carry 10 amps., 10/-; other sizes cheaper; 1,000 ohm chokes, 1/-; Ford ignition coils, 4/-; ¼h.p. 220v. motors, 35/-; Mark III Star crystal sets, slightly incomplete, 12/6; D III buzzers, platinum contacts, 5/-; Dewar switches, 1/-; 12v. car dynamos, 25/-; 6v. or 12v. car starter motors, 10/-; new L.F. transformers, 5/6; cash with order or c.o.d.; all goods guaranteed; all letters answered; immediate delivery; full descriptive list now ready.—Galpin, 1, Queen's Rd., Peckham, London, S.E.15. [1746

MARCONIPHONE Pick-up, 1930 model, £2/10; Ferranti A.F.5 transformer, £1; Blue Spot unit, 66K, with chassis, as new, 25/-; large Radiolux Amplion speaker, £2.—McKean, 29, Garnet St., Glasgow. [1738

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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

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

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

WIRELESS Notes.—For all those who want the best in radio, gramophone or television.—Postcard for particulars to Capt. Robinson, Langmead, Pirbright, Surrey. [1723

IRISH Linen for Loud-speakers, 20×20, 1/6; 22×22, 1/9; 24×24, 2/-; post free; or any size.—Irish Linen Warehouse, Hotel St., Bolton. [1718

WESTON Thermo-Galvanometer, 425, unused, 115m.a., approval; £3.—BM/ZLME, W.C.1. [1769

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PATENTS and Trade Marks, British and foreign.—Gee and Co. (H. T. P. Gee, Member R.S.G.B. and A.M.I.R.E.), 51-52, Chancery Lane, London, W.C.2. 'Phone: Holborn 1525. [0001

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CHAS. J. R. Bullough, chartered patent agent.—Patents, designs and trade marks in all countries.—27, Chancery Lane, W.C.2. [1762

PATENTS.

PATENTS and Designs Acts 1907 to 1928.—NOTICE is hereby given that N. V. PHILIPS GLOEILAMPENFABRIEKEN, of Emmasingel, 6, Eindhoven, Holland, seek leave to amend the Specification of Letters Patent No. 278040 granted to Harold Wade for an invention entitled "Improvements in or relating to a device for converting electric oscillations into acoustic vibrations, such as a loud-speaker."

PARTICULARS of the proposed amendment were set forth in No. 2176 of the Illustrated Official Journal (Patents) published on October 1st, 1930.

ANY Person, or persons, may give Notice of Opposition to the amendment by leaving Patents Form No. 19 at the Patent Office, 25, Southampton Buildings, London, W.C.2, within one calendar month from the date of publication of the said Journal.—W. S. Jarratt, Comptroller-General. [1702

REPAIRS.

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

EDES SERVICE.—It will pay you to send your old set to us for repair or to be modernised, expert workmanship, modernised sets returned as new and guaranteed for 2 years, sets constructed to suit your especial circumstances; ask for estimate.—Tel.: Elmbridge 3259. 82, Victoria Rd., Surbiton, Surrey. [1638

GUARANTEED Repairs by Experts.—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 repaired by experts, rewound and overhauled for 4/-, post free.—Walters, 1, Dunn's Terrace, Lower Compton, Plymouth. [1586

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WANTED.

"WIRELESS WORLD," last year or two.—21, Leamington Gardens, Seven Kings, Essex. [1715

PHILIPS 1928 Gramophone Amplifier, also two- or three-valve alternating set; must be cheap.—Box 7776, c/o *The Wireless World*. [1766

WANTED, portable set.—Particulars to Williams, 2, Park Lane, Ystrad Mynach, Glam. [1756

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EXPERIMENTER Offers Exchange New Mullard 84V and 154V, for flush panel mounting Ferranti or Weston milliammeter, reading any of following—0-5, 0-10, 0-200.—Box 7766, c/o *The Wireless World*. [1724

"SNAPPY Part Exchange Bureau."—Send list of your components, stating new requirements for our quotation; valves, batteries not accepted.

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McMICHAEL £27/6 Table Transportable, latest model, unscratched; £18; no part exchange on these.—8, Blue Hall Mansions, W.6. [1752

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. [1735

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WIRELESS, etc., excellent position, good lease and about £600 stock; £500 lot for quick sale; lease alone worth the money; ill-health.—333, Goswell Rd., E.C.1. [1759

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EARN Big Money in the Wireless Trade! Become a trained salesman and radio expert. A short training enables you to qualify for a really big job with good salary, ending in an introduction to prospective employers. Write P.C. for syllabus of special 6-weeks' course of instruction in the evenings, commencing shortly.—Dept. T.C.3, The London Telegraph Training College, Ltd., Morse House, Earl's Court, S.W.5. (Est. 34 years.) [0342

LONDON Firm of Cabinet Manufacturers Require Representative to Travel in Wireless and Radiogram. Cabinets, mahogany, walnut and oak; must be well acquainted with the best wholesale houses and manufacturers.—Apply, in confidence, to Box 7780, c/o *The Wireless World*. [1776

RETAIL Manager, S.W. London, experienced, sales and technique; salary £4 p.w. and commission.—Write fullest particulars and copies of references, Box 7727, c/o *The Wireless World*. [1701

Situations Vacant.—Contd.

ATTENTION!!! Buying agents wanted!!!—2-valve A.C. and D.C. receivers, complete; £5!! Approval against cash.—96, Brockley Rise, S.E.23. [1744

MANAGER Required for Old Well-established Wireless Manufacturing Concern, must have had some years' experience in the trade, with knowledge of latest methods of production, tools, etc., and real organising ability; only men with the highest references and abilities need apply.—State salary, experience, etc., to Box 7778, c/o *The Wireless World*. [1768

SITUATIONS WANTED.

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ADVERTISER Seeks Berth, electrical, wireless, photographic business, practical knowledge.—Ryall, 42, Dewhurst Rd., West Kensington. [1714

YOUNG Man Desires Situation as Tester, previous experience, talkie and public address amplifiers and radiograms, A.C. and D.C.—Please write R.G.R., "Fairwood," Holly Park, Crouch Hill, N.4. [1708

ELECTRICIAN, 11 years experience, 2 years amateur radio transmitter, requires situation in London, electrical or radio.—Box 7763, c/o *The Wireless World*. [1707

PRACTICAL Wireless and Gramophone Specialist Seeks Change, charge or bench, well recommended, proved salesman, abstainer, 42, progressive situation preferred.—Burton, 10, Wymering Rd., Portsmouth. [1743

ASSISTANT Manager, 23, salesman and general repair, instal sets and eliminators, knowledge German, drive car, excellent references, seeks as representative or in shop.—Hennings, 35, Ayrsome Rd., N.16. [1737

DESIGNS for Components, sets, radio-gramophones, talkie installations developed; secrecy guaranteed; send details of requirements.—BM/PXDD, Monomark House, London. [1774

ADVERTISER, experienced in designing broadcast receivers, good correspondent, experienced sales manager, requires opening affording scope for energetic and creative mind.—Box 7779, c/o *The Wireless World*. [1775

BOOKS, INSTRUCTION, ETC.

FREE: Inventor's Guide on Patents.—T. A. A., 253, (W), Gray's Inn Rd., London, W.C.1. [6373

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PARIS RADIO SHOW.

The Wireless World AND RADIO REVIEW

4D

The Paper for Every Wireless Amateur

Wednesday, October 22nd, 1930.

No. 582. Vol. XXVII. No. 17.

RELIABLE RECTIFYING VALVES

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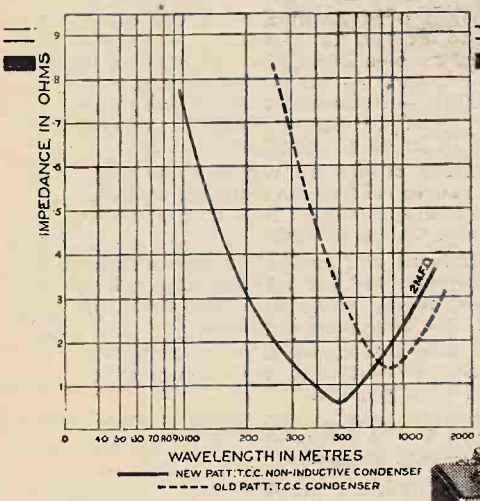

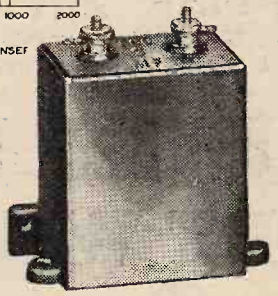

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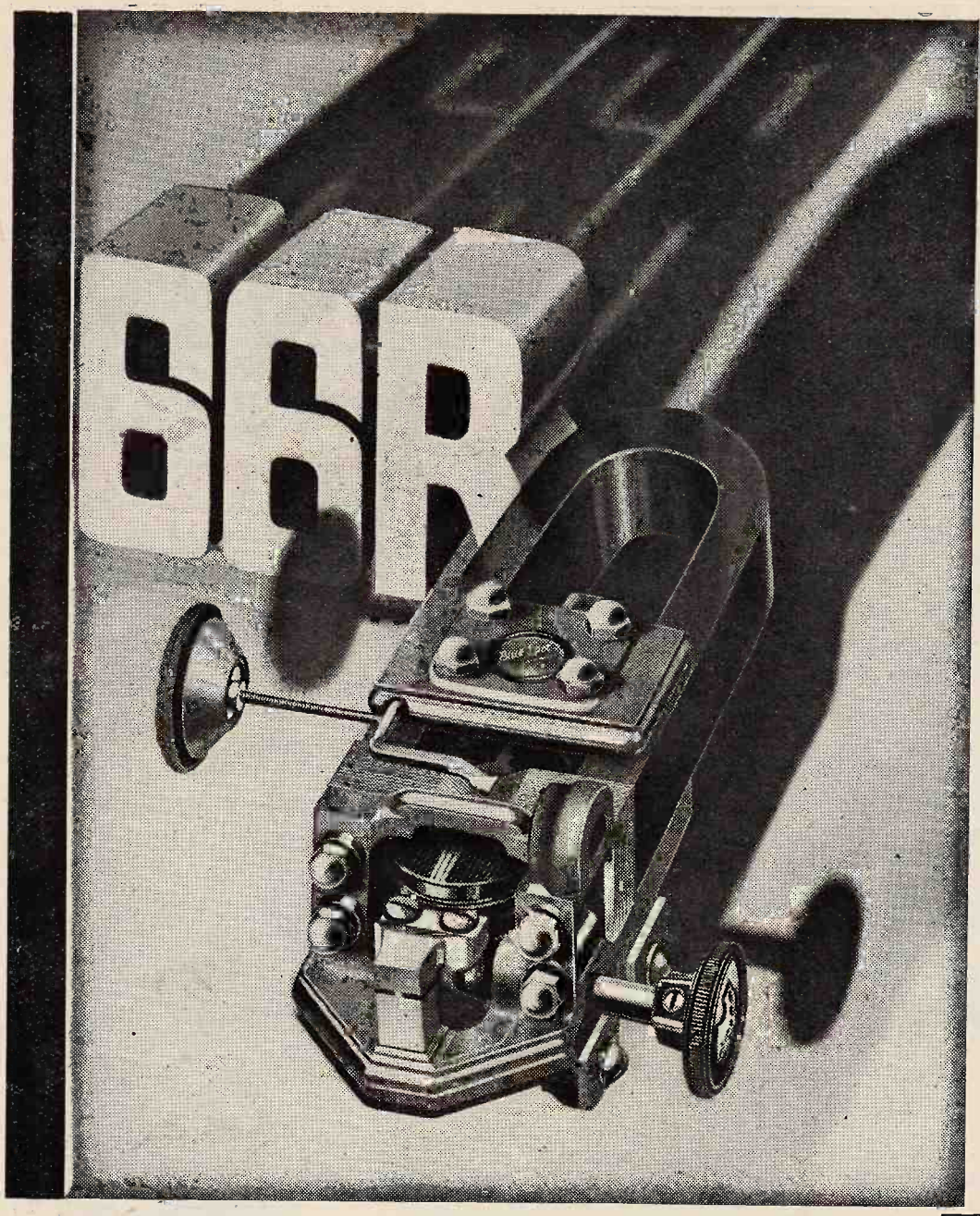

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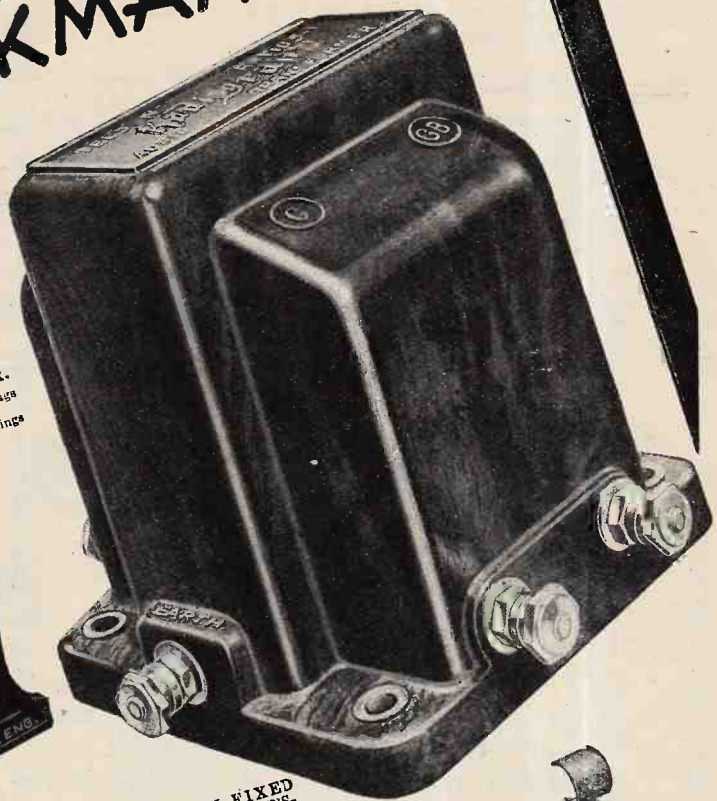

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Radio Servicing

IN May of this year *The Wireless World* drew attention to the inadequacy of the service side of radio salesmanship, and pointed out that, after allowing for outstanding exceptions, the service given by the average retailer was unfair to the manufacturer as well as to the buyer.

Since we raised the subject a great deal of progress has been made in various directions. Several manufacturers have undertaken the training of their service agents, notably the Gramophone Company and the Marconiphone Company, whilst at least one school, the old-established London Telegraph Training College, has started a special course of instruction intended to cover this field.

An important contribution towards solving the problem of service has been made by the Gramophone Company, who have introduced into their school a system of coloured wiring, so coded that the dealer who handles their sets is enabled to trace every wire without difficulty by colour. We do not believe that any monopoly of this idea is claimed, or that the adoption of the scheme universally by set manufacturers would be resented. We would heartily recommend that the fullest consideration should be given by such bodies as the Radio Manufacturers' Association to the scheme, with the idea of putting it forward for adoption by its membership.

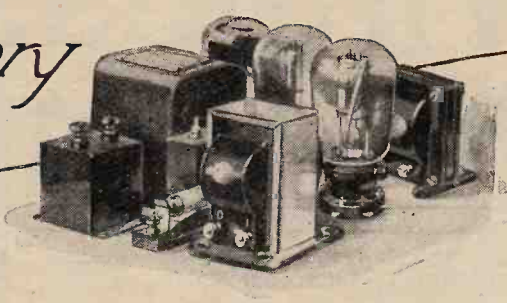
Any proposals which may tend to simplify the problem of servicing should be given the full attention which the subject deserves. We believe that confidence in service after sales can contribute very largely towards increasing the popularity of listening. Manufacturers, we know, are doing all they can to eliminate unnecessary servicing by increasing the standard of reliability of their receivers so that after-sales trouble is reduced to a minimum.

But however perfect the final production of sets may become, the problem of servicing must, we think, always remain, for servicing does not mean merely repairing faults; it embraces the much larger question of advice on technical points, on the choice of apparatus associated with the receiver, and effecting improvements by the substitution of new types of valves or additional accessories.

Some organisation of service seems to be desirable, in order that the public may be able to distinguish between those in whom they can place their confidence and those who are not to be so trusted. The highest recommendation for a retailer is represented in the satisfaction of his customers over a period of years. There must be a host of service men who can claim this qualification, and there should be some means of distinguishing them from others who have not earned such confidence by their endeavours; those who join the ranks of the service man on the merits of technical knowledge and training alone should also have some recognised certificate of competence to give confidence to the public.

In This Issue

The Theory of the Valve Amplifier



A Simple Explanation of the Underlying Principles.

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

THE amount of energy picked up by the tuned aerial circuit of a receiver is extremely small even when the transmitting station is only a few miles distant. If power is drawn from the tuned circuit to operate directly a sound reproducer of any kind, the load thrown on the tuned circuit not only seriously reduces the selectivity or sharpness of tuning, but the amount of power available may be barely sufficient to operate even the most sensitive telephone receivers. A large volume of sound from a loud speaker represents the expenditure of a great deal more energy than is ever picked up by the aerial, and therefore the energy supplied to the loud speaker must be drawn from some local source at the receiving end and the rate of expenditure of this local energy must be controlled or modulated in such a way that it varies as nearly as possible in exact accordance with the varying amplitude of the high-frequency voltage generated in the aerial circuit by the oncoming waves.

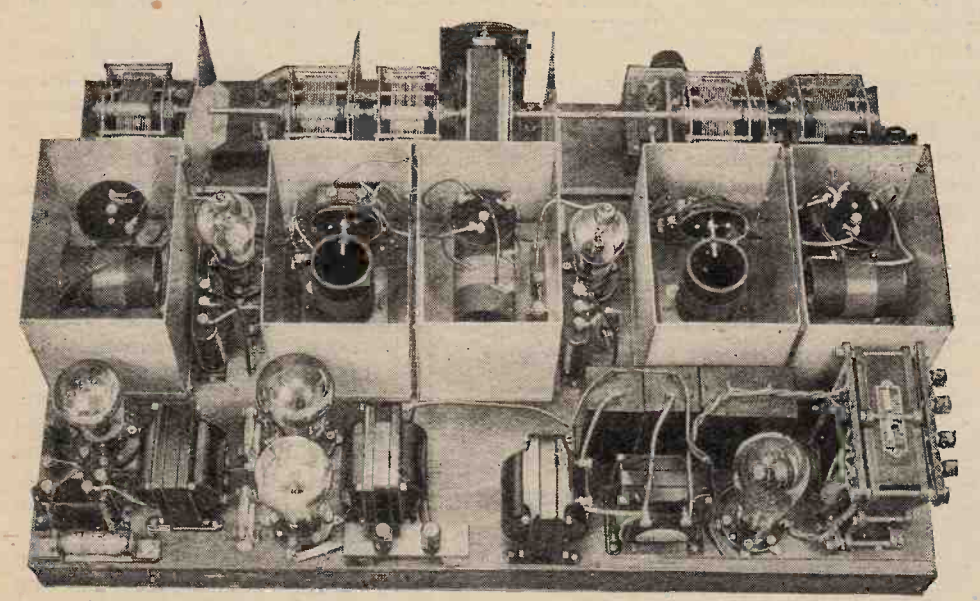
These are the functions of a valve amplifier, and the object of this and succeeding articles will be to give a simplified explanation of the principles involved in the various circuit arrangements available for coupling two or more valves in succession or cascade in the different types of amplifier. The conditions leading to highest efficiency will be discussed and numerical examples will be given throughout.

The general principles of alternating current circuits and tuned circuits as apart from their relationship to valve circuits were treated at some length by the writer in a series of articles which commenced in *The Wireless World* on September 29th, 1929, under the title of "Wireless Theory Simplified." These previous articles should prove useful to established readers, but, particularly for the benefit of new readers, no vital principle will be left unexplained in the present series even though it might have been dealt with at some length previously.

General Considerations.

The electrical variations representing speech or music have frequencies ranging between 25 and 8,000 or 10,000 cycles per second, and these are conveyed across the space intervening between the transmitting station and the receiver by means of a radio-frequency wave, that is, by a "carrier wave" whose frequency is greater than 30,000 cycles per second or so. For a wavelength of 300 metres the radio-frequency involved is one million cycles per second or 1,000 kilocycles per second, the frequency being inversely proportional to the wavelength. The amplitude or strength of the high-frequency wave is varied or modulated in accordance with the wave shapes representing the matter broadcast.

Every receiver possesses a detector or rectifier which performs the essential function of separating out the low-frequency electrical variations from the radio-frequency or carrier-frequency oscillations. Without this separation it would be impossible to operate any electro-mechanical



The "Band Pass Four" receiver recently described in *The Wireless World*. The high-frequency, detector and output valves are arranged to function in accordance with the latest accepted practice.

The Theory of the Valve Amplifier.—

reproducing device. The detector thus really forms the nucleus of every receiver, and one of the first points in designing a receiver is the attainment of efficient and satisfactory rectification.

The efficiency and general performance of a valve detector depend to a very large extent on the value or amplitude of the high-frequency voltage applied to its grid circuit. In general the voltage developed across the tuned circuit associated directly with the aerial is too small to enable the rectifier valve to function properly if the latter is connected directly to the tuned aerial circuit. Only when the station being received is powerful and moderately close is satisfactory rectification under these conditions attainable.

For the reception of distant stations which produce extremely feeble oscillations in the aerial tuning circuits one or more valves are employed between the aerial tuning circuit and the detector valve in such a way as to produce high-frequency voltage oscillations of greatly increased amplitude at the grid of the detector; the high-frequency oscillations are virtually amplified before being applied to the grid circuit of the detector, but it will be realised presently that the energy represented by these oscillations of increased amplitude is drawn from a local source of supply such as a high-tension battery.

The so-called amplified oscillations are really a new set in a separate circuit quite distinct from those in the aerial circuit, but are controlled by the aerial oscillations through the medium of the amplifying valves in such a way as to have the same form and frequency.

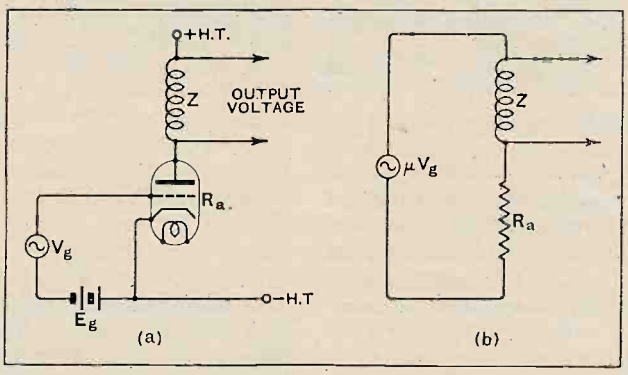


Fig. 1.—For a valve to act as an amplifier of voltages a high value of impedance, Z must be connected in the anode circuit. The simplified circuit shown at (b) is equivalent to the anode circuit of the valve as far as the alternating components are concerned. The amplification factor of the valve is μ.

Progress in Valve Design.

Whether high-frequency amplification before the detector stage is employed or not, the low-frequency power output available in the anode circuit of the detector valve is not usually sufficient to operate a loud speaker, and one or more stages of low-frequency amplification are nearly always employed after the detector valve to enable a sufficiently high power input to the loud speaker to be obtained.

Both for high-frequency and low-frequency amplification the main principles involved are essentially the same, but there are many practical considerations which render the two categories widely different both as regards the types of valves most suitable and the characteristics of the intervalve couplings. Remarkable progress has been made during the last two or three years in the design of valves, the two outstanding steps forward being the introduction of the screen-grid valve for high-frequency amplification and the independently heated cathode valve for A.C. mains operation.

Another important advancement has been the practical application of the coupled circuit or band-pass filter system to receiving sets, enabling high selectivity to be obtained without attenuation or weakening of the higher note frequencies relatively to the lower ones. With the multiplicity of circuit arrangements available and the wide range of components on the market, there is an amazing diversity of designs of receiving sets available both to the set constructor and to the purchaser of commercial models.

But in spite of all these changes there has been very little change in the fundamental principles involved in amplifier design, although certain new principles have been added and the constants of tuned circuits have been revised to suit the newer types of valves.

In the first place we shall give a brief summary of the chief properties of an amplifying valve and then consider the ordinary three-electrode valve as a high-frequency amplifier, dealing in particular with the methods of coupling to a succeeding valve, subsequently extending the treatment to include refinements such as methods of maintaining stability, etc. The same general principles apply to both the indirectly heated cathode or A.C. valves and the filament type of valve.

If a three-electrode valve with the cathode heated to the normal operating temperature has the anode potential and grid voltage adjusted so that the corresponding point on the grid voltage/anode current curve lies on the straight, steep part of that curve, any small change in the value of the grid voltage will produce a corresponding change in the anode current, one being proportional to the other. Now the change of anode voltage that would have to be made to give the same change in anode current would be several or many times greater than that at the grid. The ratio of the change of anode voltage to the change of grid voltage having the same effect on the anode current is the *amplification factor* of the valve, being denoted by the greek letter μ. Thus if one volt change in the grid potential alters the anode current by 2 milliamps. with the anode voltage maintained constant, and if 10 volts change in the anode voltage with the grid potential constant also makes a 2 milliamp. difference in the plate current, then the amplification factor of the valve is $\mu = 10$. This is the maximum voltage amplification the valve itself is capable of giving under theoretically perfect conditions. In practice the actual amplification obtained from the valve always falls short of μ, but a further gain might be obtained through the step-up effect of a special tuned circuit or transformer. In any case, the amplification obtained is always proportional to μ.

Another very important "constant" of an amplifying

The Theory of the Valve Amplifier.—

ing valve is the A.C. resistance between its anode and cathode. The A.C. resistance is simply defined as the ratio of a small change of anode voltage to the corresponding change of anode current in amperes. Thus in the example given above a change of 10 volts in the anode voltage was assumed to cause a change of 2 milliamps. in the plate current. Such a valve would have an A.C. resistance of $R_a = \frac{10}{0.002} = 5{,}000$ ohms.

The A.C. resistance R_a and the amplification factor μ are the two most important constants of the valve, and knowing these the actual voltage amplification obtained with any known impedance connected in the anode circuit can be calculated.

Voltage Amplification.

If a small alternating voltage whose R.M.S. or effective value is V_g is applied to the grid of the valve an alternating voltage μV_g is in effect injected into the anode circuit, and this causes an alternating component of current, over and above the mean or D.C. value, to flow round the anode circuit. Provided there is no external impedance connected in the anode circuit the alternating component of the plate current will be $\frac{\mu V_g}{R_a}$ amperes, by Ohm's law, but under such conditions there would be no voltage variation at the anode, and therefore no voltage amplification whatever would occur—a varying current in a conductor without impedance or resistance is absolutely without effect of any kind.

In order to obtain a voltage variation over some part of the external anode circuit an impedance must be connected somewhere in that circuit, the usual place being between the anode of the valve and the positive high tension supply terminal. In Fig. 1 (a) is shown a simplified diagram in which an impedance Z is connected in the anode circuit of a valve. The grid is maintained at a definite mean negative potential through the agency of the grid bias battery E_g, and a source of alternating voltage V_g is also included in the grid circuit.

The resulting equivalent alternating electromotive force set up in the anode circuit is μV_g volts where μ is the amplification factor of the valve. As far as the alternating components only of the current and voltage in the anode circuit are concerned, the anode circuit itself is electrically equivalent to the circuit of Fig. 1 (b), where R_a represents the A.C. resistance of the valve. The alternating current set up round the closed circuit is given by dividing μV_g by the *total* impedance of the anode circuit, and this total impedance is the effective value of R_a and Z in series. Whether R_a and Z can be added together by simple arithmetic or not depends on the nature of the impedance Z. In fact the very properties of the combined circuit depend on the kind of impedance for which Z stands. For instance, it may stand merely for a simple non-inductance resistance or for a more or less complicated tuned circuit.

Whatever the nature of the connected impedance Z might be, when an alternating component of current flows round the anode circuit an alternating voltage is naturally set up between the ends of the impedance, the magnitude of this potential difference being equal to the product of the current and the impedance. And this is the useful output voltage which can be applied between the grid and cathode of a succeeding valve.

Consideration will next be given to the particular case where the external impedance Z takes the form of a simple resistance, and attention will be drawn to the method whereby the alternating voltage built up across this resistance is transferred to the grid of the next valve. This represents the simplest case.

(To be continued.)

Radio Amateur Call Book.

The autumn issue of the "Call Book" has now been issued, and copies may be obtained from Mr. F. T. Carter, Flat A, Gleneagle Mansions, Streatham, S.W.16, for 4s. 6d., post free, or 14s. 6d. for the four quarterly issues.

The list of call-signs of all known amateur transmitters of the world has been carefully revised and brought up to date; in fact, it has now grown so long that it has been found necessary to omit the supplementary list of short-wave commercial stations. We feel that this is a matter for regret as the section, though admittedly only a modest selection from the ever-increasing number of short wave stations of general interest to amateurs, was undoubtedly of great service; however, we do not doubt that the omision was only decided upon by the publishers after much consideration and in order to keep the book within reasonable bounds.

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Working on 1,750 Kilocycles.

Members of the Monmouthshire Transmitters' Society are returning to the 170 metre waveband, and have successfully

TRANSMITTERS' NOTES.

worked with OK3SK in Neu Ebersdorf, near Olmuetz, Czechoslovakia. During the nights of Sunday and Monday, October 5th and 6th, the following stations were in communication with him: G6PA, G2QI, G6ZR, G6RB, G2IP, G2PA, G6DR, G6UJ and G6FO. The Czechoslovakian station was working on 1,750 kc. with an input of 13 watts. Mr. Austin Forsyth (G6FO), the chairman of the Monmouthshire Transmitters' Society, says that the noteworthy feature of these contacts was the ease with which they are effected, signals being reported by OK3SK as generally about R5, QSA4. Conditions on the Sunday night were rather better than on Monday, and G2QI was able to get through on telephony. The stations belonging to members of the society—G2PA, G2QI and G6FO, all in Newport, Mon—were working within 10 watts. Mr. Forsyth hopes that the favourable results obtained will encourage other amateurs, both in Great Britain and on the Continent, to give the longer wavelengths a trial.

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New Call Signs and Addresses.

G2QH	C. Hewins, Garwick, Cross Coates Road, Grimsby, Lincs. (Change of address). Station temporarily closed owing to change from D.C. to A.C. mains.
G2SJ	K. Franklin, 16, Cannon Street, Dover, Kent.
G2WQ	A. Brown, 7, Stanley Road, Broughton Park, Manchester.
G6MR	International Marine Radio Co., Ltd., Endersleigh Gardens, London, N.W.4.
G6XB	G. E. Jones, "Brynawel," Redruth, Cornwall. (Change of address).
2ABS	J. Hunter, 63, Hervey Road, London, S.E.3.
2ARB	(ex 2PF), R. B. Jeffries, Lynn Drive, Mount Hill, Kingswood, Bristol.
2AVF	J. Norris, 16, Gorse Street, Stretford, Manchester.
2AWA	A. W. Allan, 3, Lansdowne Terrace, Gosforth, Newcastle-on-Tyne.

CORRECTION.

The call-sign of Mr. L. C. Cooke's station at Harrowdene Road, Wembley, is G6CZ, and not D6CZ as printed in error in our issue of September 3rd. We trust that no foreign transmitters have been misled by this misprint.

PARIS SHOW

Straight H.F. Amplification *versus* Superheterodyne.

By A MEMBER OF THE STAFF.

LAST year the Paris Radio Exhibition rubbed shoulders with the Motor Cycle Show in the Grand Palais, Champs Elysées; in consequence its visitors included a jaded and unprofitable overflow from the other section. This year's exhibition, held from September 26th to October 9th, stood splendidly exclusive in the Artists' Quarter, Boulevard Raspail, Montparnasse, with the noticeable result that most of the visitors were real enthusiasts, there being fewer of the army of catalogue hunters. Some two hundred firms were represented,

A compact three-valve all-mains receiver by Lemouzy.

and from the very large attendance it is safe to conclude that the Exhibition was successful.

Those who have followed *The Wireless World* reviews of the French Show from year to year will have heard the lament that nothing but superheterodynes could be found on the set-makers' stands, and the repetition of the same circuits for a number of years brought forth the comment that this type of set would appear to have assumed a life eternal. Owing to the difficulty of obtaining permission from landlords to erect outside aerials and to the fact that there are some six transmitting stations in Paris, it had been thought, apparently, that a superhet. provided the only solution to the reception problem in these rather difficult circumstances.

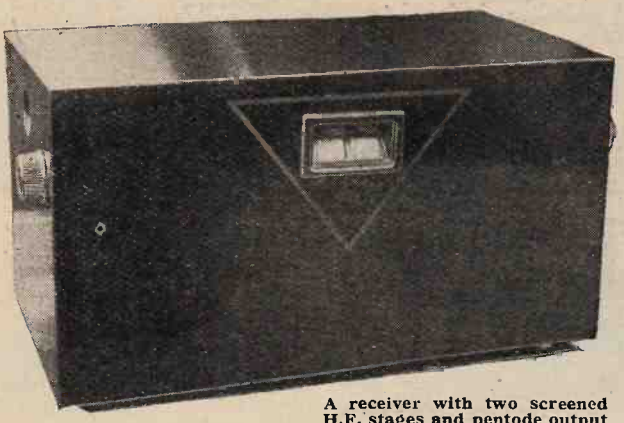
A new influence bids fair to change this fashion. The French have seen lately how well the highly specialised American receiver functions—that type with a straight multi-stage H.F. amplifier—how selective it is, what excellent signal strength can be got with an indoor aerial, and, last, but not least, that the quality of reproduction is considerably better than that from the average superhet. Not that there is any inherent defect causing distortion in this receiver when modern methods of inter-valve coupling such as band-pass filters are pressed into service, but it must be conceded that it is essentially for use with distant transmissions and never has lent itself well to local station reception.

At last there is a strong rival to the hitherto ubiquitous superhet., and most of the set-makers are marketing for 1931 at least one receiver with a number of stages of straight H.F. amplification. The commendable practice of ganging the tuning condensers to give

Péricaud E3 receiver with single screened H.F. stage and variometer plate coupling.

Paris Show.—

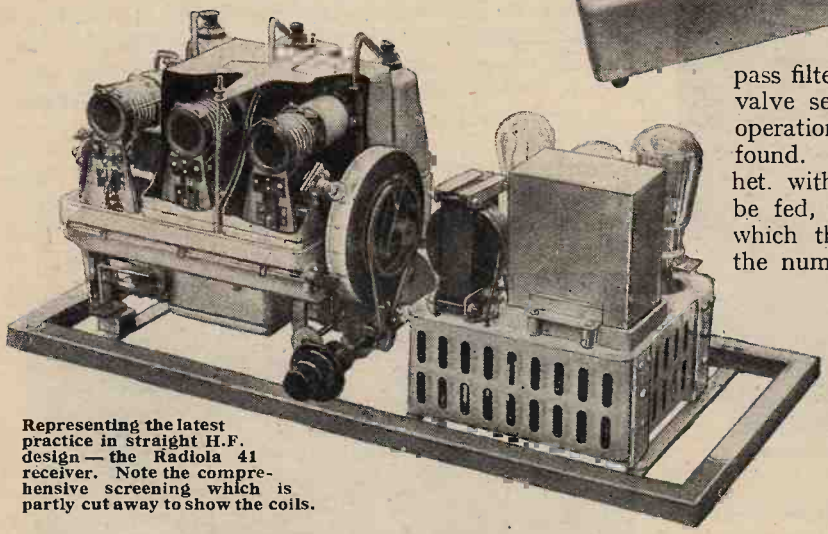
one-dial control and of providing separate screening compartments for both valves and coils is to be seen in a number of cases. From the foregoing it must not be taken that the superhet. is rapidly dying, but that the public now have the choice of two receiver types, and



A receiver with two screened H.F. stages and pentode output —the Alterna 404.

their verdict after a period of trial may cause a large reduction in the interest shown in the superhet. at next year's show. The number of sets called by trade names ending in "dyne" is still formidable.

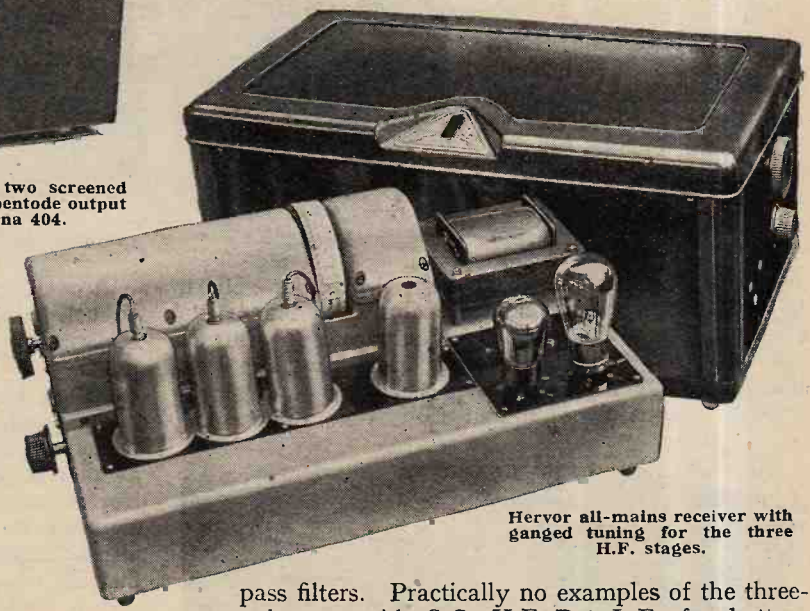
There were only two or three kit sets to be found, and from the paucity of really good components one must conclude that home construction still has not a very great following. Portable sets appear to have increased in popularity, there being a number of new models on view. Much attention was being paid to the British Rees Mace sets exhibited by Rees-Radio.



Representing the latest practice in straight H.F. design — the Radiola 41 receiver. Note the comprehensive screening which is partly cut away to show the coils.

All-mains sets are much in evidence, the key to the position being the general release of a new series of indirectly- and directly-heated A.C. valves by some four or five valve manufacturers. It has been found possible to produce an A.C. *bigrille* (two-grid) valve. This in the battery-heated category has been extremely popular for superhets., in which it is used as combined first detector and oscillator. To maintain absolute freedom from hum in a seven-valve all-mains superhet. is no mean feat, and this may be another reason why the straight H.F. set with fewer valves is receiving so much attention at a time when A.C. sets are in demand.

As in this country, the tuning range in all sets must cover both medium and long broadcast waves. It is an open secret that in the long-wave units which have been added to certain imported American sets, the problem of obtaining selectivity with quality with the large number of powerful long-wave stations has only been solved after much experiment in elaborate band-pass filters. Practically no examples of the three-valve set with S.G. H.F.-Det.-L.F. for battery operation, so popular in England, were to be found. The equivalent would be a modest superhet. with one of the complex *bigrille* circuits, to be fed, if possible, from H.T. accumulators, of which there is an abundant supply judging by the number of stands devoted to their sale.



Hervor all-mains receiver with ganged tuning for the three H.F. stages.

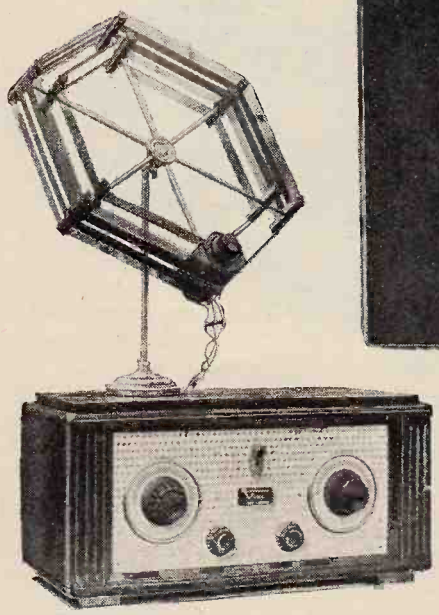
Moving-coil loud speakers, which hitherto have been rather restricted in use by patent royalty, are now to be seen in the most ambitious receivers and in many radio-gramophones. The adoption of the Westinghouse metal rectifier on a large scale for mains-rectifying equipment has given an impetus to the sale of speakers with A.C. field excitation. Permanent magnet moving-coil speakers do not seem to be on the market yet, but reed-driven cones, on the other hand, could be seen all over the exhibition. Owing to the voltage fluctuation of mains supplies it is becoming common practice to include a regulator to maintain a constant pressure in order to prevent damaged valves and varying sensitivity. This usually consists of a barretter containing an iron wire element in hydrogen.

Paris Show.—

Cabinet work in general was superb, more attention being paid to external finish than in this country. Frame aerials incorporating waveband switches are sold by most component makers, and in one or two examples the winding is held inclined to the vertical, to avoid, so it is claimed, parasitic disturbances.

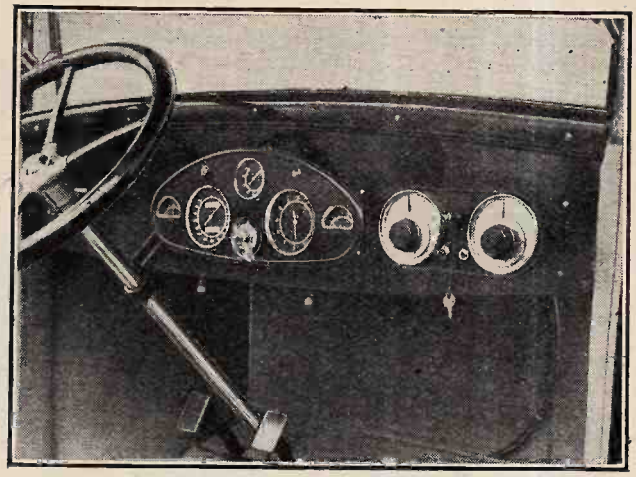
Some receivers, which are illustrated herewith, and are likely to appeal to the British amateur, will now be briefly reviewed. The Radiola-41 is an all-mains, multi-stage, straight H.F. receiver built around the new Dario valves. There are three ganged H.F. stages giving one-dial control, and coils, condensers and valves are contained in separate screening compartments. Such a receiver is abreast of the times, and nothing but favourable comment can be made concerning the advanced technique employed. The inter-valve inductances are wound on 1½in. formers, and a line voltage regulator is included in the mains eliminator.

An interesting but less ambitious receiver is the Péricaud E3, containing a screen-grid H.F. stage with anode variometer. It is mains-operated, and contains smoothing and rectifying equipment in a separate metal compartment in the base. The price complete is 1,859 francs, or £15, which represents good value for money. On the Hervor stand (Herbolet et Vorms) was a highly specialised set with three screen-grid stages. The screening, albeit carried to perfection in the case of coils, valves, and condensers, is extended even to the wiring. The receiver is, of course, all-mains operated, and has, by virtue of the ganging of four condensers, bunched into groups and shielded in earthed flexible metallic tubing.



(Above) Radio-L.L. Synchro-Secteur—a typical superheterodyne set.

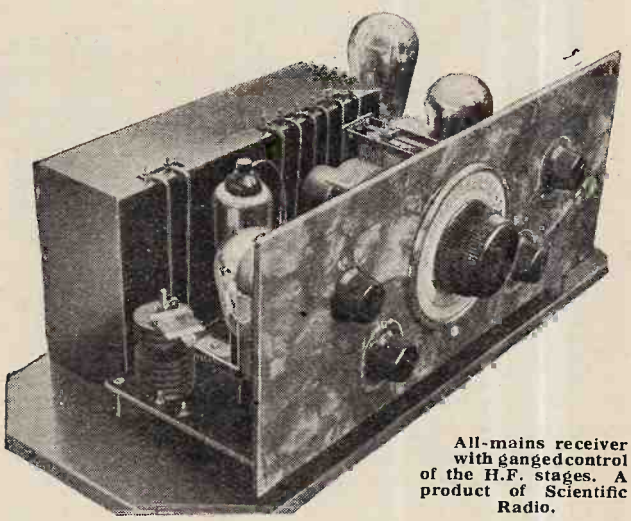
(Left) Six-valve receiver by Radio-Viel. Note the inclined frame aerial.



Showing the controls on the instrument board—the Radio-L.L. car set.

one-dial control. A moving-coil speaker is provided with a speech coil to match the single low-frequency valve.

On the stand of Etablissements Radio L.L. could be seen a comprehensive range of all-mains superhets. The Synchro-Secteur-Six has one-dial control and an indirectly heated two-grid valve as frequency changer, followed by two A.C. triodes for the intermediate-frequency amplifier. The second detector and first L.F. valves are indirectly heated, while the output valve has a filament heated with raw A.C. A car set, the controls of which are fitted to the instrument board, is of interest, first, because of the elaborate precautions taken against mechanical vibration by suspending the receiver proper on springs, and, secondly, in view of the methods used to prevent electrical interference. Resistances of 80,000 ohms are interposed in each sparking plug lead and condensers of 2 mfd. by-pass any H.F. oscillations produced by make-and-break contacts. Wiring is



All-mains receiver with ganged control of the H.F. stages. A product of Scientific Radio.

A very compact three-valve, all-mains set housed in

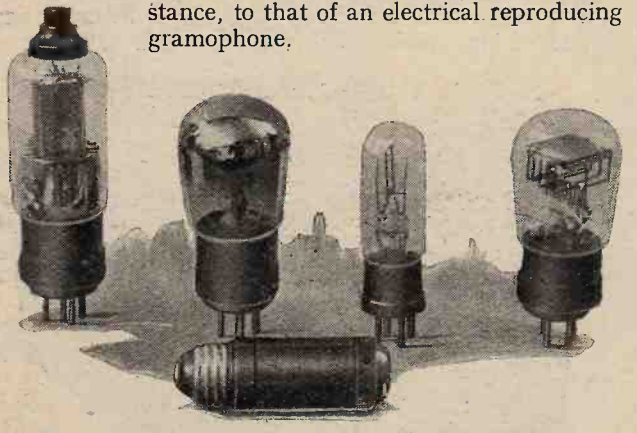
Paris Show.—

a handsome cabinet and typical of British practice is the Lemouzy S.331. A series of receivers with three screen-grid H.F. stages were being shown by Radiophone-Viel, and a frame aerial adjustable in two planes forms part of their equipment. These receivers, by reason of their selectivity and sensitivity, are a direct challenge

A miniature portable superhet. by Etablissements Horace Hurm.

Ondia four-valve receiver. A pressed-steel mass-production model with straight H.F. amplification.

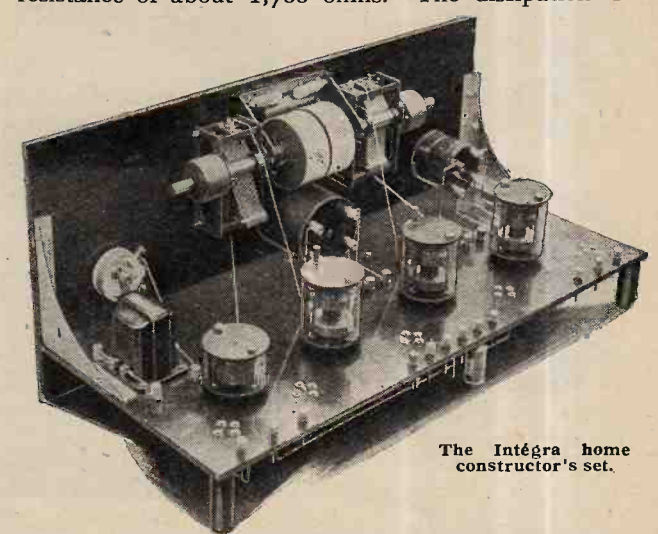
to the superhet. Push-pull output now gaining in popularity in France is used in a number of this firm's sets. On the stand of Etablissements Horace Hurm was a miniature portable set built into a suit-case. A test soon convinced one of the extremely selective properties of the superhet. circuit—stations embracing never more than two degrees on the tuning dials. Although only for 'phone reception as it stands, it is easy to pass on the signals to an amplifier—for instance, to that of an electrical reproducing gramophone.



Dario valves. (Left) Battery screened valve, general purpose valve, line voltage regulator and power output valve (right). In the foreground is a colloidal rectifier.

Judging by the difficulty in approaching the stand of Intégra it was evident that the home constructor's set being demonstrated was popular. It cannot be described as a kit set in the sense usually understood in this country, for, by rearranging the various components on a large baseboard, any one of the twelve circuits described in the catalogue can be followed. The small slab coils in circular celluloid containers, clearly seen in the illustration, point to the difference in technique in the two countries. The straight H.F. sets in pressed steel cases by Ondia mark a distinct advance in receiver design. They bear a striking similarity to certain receivers seen at Olympia.

With regard to valves, mention should be made of the products of Fotos, Dario, Visseaux, and Métal. In this season's new models there are counterparts to every type of valve on the British market, except the indirectly heated pentode. There are low- and high-voltage pentodes and A.C. screened valves. The latter do not appear to have attained the same efficiency as those seen at Olympia, the inter-electrode capacity being about 0.01 micro-microfarad as against an average of 0.003 micro-microfarad for our valves. A remarkable new output valve (three-electrode) is the Fotos F.10 with a mutual conductance of more than 5 mA. per volt and an A.C. resistance of about 1,700 ohms. The dissipation is 8



The Intégra home constructor's set.

watts at 250 volts H.T., and with but 18 volts negative bias the output is as large as that from a power pentode. The filament consumption is only 0.5 amp. at 4.0 volts.

Now that attention is being paid to the composition of valve bases with a view to avoiding unnecessary high-frequency losses, considerable interest attaches to the quartz valve-holders shown by Etablissements S.I.F.-R.A.Q. These consist of skeleton structures with the very minimum of solid material. The power loss factor of quartz is far less than that of ebonite, and, incidentally, the general physical properties are highly satisfactory. For screen-grid valves and detectors these holders should find wide application.

There are few innovations of interest to the constructor on this side. Comparisons may be odious, but with thoughts of Olympia fresh in his mind, perhaps the critical visitor to Paris may be forgiven for a *sotto voce* word of congratulation to the amateurs of Britain.

The Wireless World Four

SPECIFICATION.

Selective band-pass tuning.
Single dial control without trimming condensers.
Pre-H.F. volume control.
Critical regulation of regeneration at point of maximum amplification.
Complete coil and valve screening.
All H.F. above baseboard with distribution circuits immediately beneath.
Tuned grid intervalve couplings.
Ganged wave change switching.
Distortionless power grid detection.
High voltage compensated pentode output.
Complete smoothing and decoupling with a minimum of apparatus.
All mains operation.
Provision for gramophone and designed for housing in a standard radio-gramophone cabinet.
Easy access to all components and straightforward wiring so that but few leads appear above the baseboard.
No components to be home constructed.
Lowest possible cost.

Practical Hints on Construction.

By F. H. HAYNES.

(*Concluded from page 431 of previous issue.*)

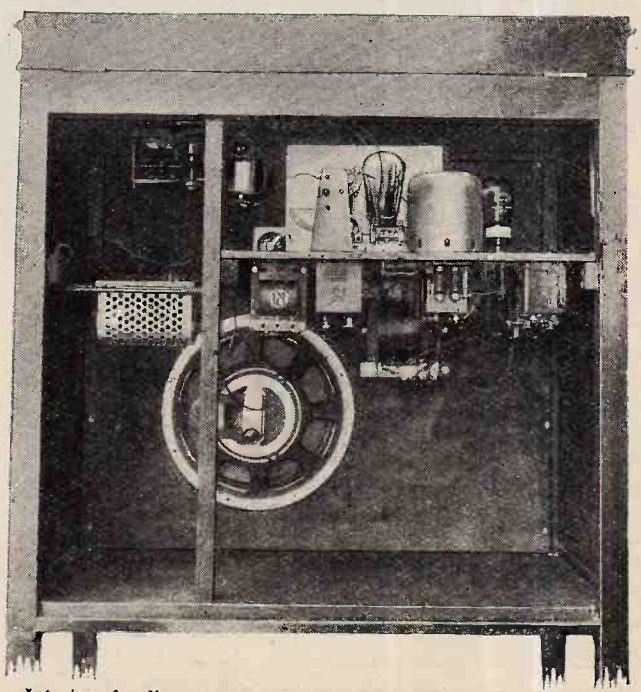
IN the process of developing the layout of the components and general make-up of the receiver two sets were built side by side. By this means alternatives could readily be tested and comparisons made. At the same time tests could be made as to just how far one might go in simplifying the layout, modifying the wiring, and cutting down the size and number of components used.

While, in the majority of cases, the working drawings are sufficient guide to construction, a description of the procedure adopted will probably simplify matters.

Above Baseboard Assembly.

Seven-ply wood is used for the baseboard, $\frac{3}{8}$in. in thickness. It measures 16in. × 18in., and is therefore just 1in. deeper than a standard which has been adopted in radio-gramophone cabinets, an unavoidable modification, but one to which a cabinet maker can readily conform. A sheet of tin plate held down by $\frac{1}{2}$in. round-headed screws covers the entire surface. Bends once made in this sheet of tin cannot be readily removed, and if it should become accidentally bent or marked a new piece might be fitted.

Using pencil or scratch lines for setting out the positions, locate the base covers of the four coils. With a round-headed screw holding each cover, secure the coils accurately in position, having first linked them together. Frequently test the switch action for freedom as the screws are tightened, and if a reasonably correct alignment is maintained the switch spindle will operate quite freely. Next proceed with the valve positions, and for this purpose it is as well to completely dismantle one valve holder and use it as a template. Good appearance calls for accuracy in setting out, and the positions of all holes once determined should be



Interior of radio-gramophone showing the supports for the chassis with the loud speaker and gramophone motor in position.

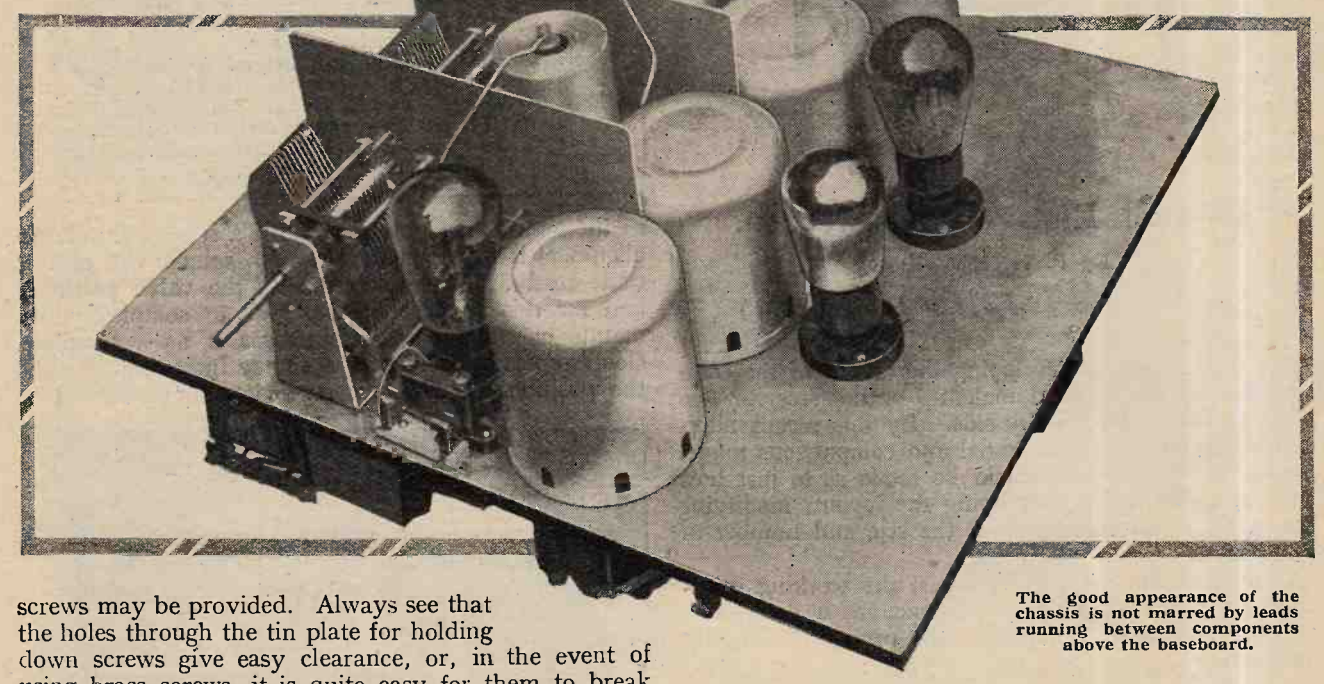
The Wireless World Four.—

lightly marked with hammer and centre punch and a pilot hole may then be made, using a short $\frac{1}{16}$in. drill. All valve-holder terminals are reversed so that the stems carry through to the underside and the knurled heads are discarded, with the exception of the grid connections of the detector and H.F. valves, these remaining the top side. Holes $\frac{3}{8}$in. in diameter are carefully taken right through the base to give ample clearance to the connecting screws.

There is little difficulty in setting up the four tuning condensers, which are carried on a pair of end brackets, after which the three screens are carefully centred and the positions for the fixing holes marked. A pair of small brackets made from sheet aluminium support the two variable resistances used to control volume and regeneration, and holes for the fixing screws may be provided. Always see that the holes through the tin plate for holding down screws give easy clearance, or, in the event of using brass screws, it is quite easy for them to break off when being driven home.

Other holes required for down-going leads are four within the coil bases. Reference to the wiring diagram shows that these are made adjoining terminal No. 5 on the second coil from the front, terminals 5 and 6 on the third coil, and terminal No. 6 on the fourth coil. Holes are also drilled to accommodate short round-headed screws and tags near terminal No. 6 in order to provide a point of earthing within each coil. Three other holes are made immediately to the rear of the two valve screens in order to carry through points of earthing from the top to the underside by means of four B.A. bolts. Another hole is made through in a corresponding position behind the detector valve which, by the use of a 1in. screw and four nuts, provides support in addition to a point of earthing to the anode by-pass condensers adjoining the H.F. choke.

Having drilled all holes and remedied any slight errors, perhaps, with the aid of a small round file, all apparatus is removed, the sheet of tin plate unscrewed from the plywood so that metal clips lodged under the tin may be taken away. The baseboard having been cleaned down with fine glasspaper and the edges of all holes cleaned off with a sharp drill or rose bit, a coat of shellac varnish might be applied to both sides. In the course of construction it was found convenient to put through two additional holes in each of the side edges about $\frac{5}{16}$in. in and 2in. from front and back. These were used to secure two pieces of rough wood, 6in. wide and $\frac{3}{4}$in. thick, running down the two edges so as to give support to the set with all the underside apparatus clear of the table. The four holes provide a fixing to the cabinet.



The good appearance of the chassis is not marred by leads running between components above the baseboard.

Components in the Underside.

With the board clear, attention may be turned to securing the condensers, resistances, etc., on the underside. Avoid the ruling of guide lines in exposed positions on the wood. The components once on need not be removed. It will be noticed that the components fall in line, and that those associated with the detector and H.F. stages are suitably located to provide short earthing wires. Stand all components in their correct positions, using the rule to check accuracy of spacing and alignment. Make the positioning look symmetrical and pleasing, taking care to avoid the obstructing of the $\frac{3}{8}$in. holes through which the valve-holder screws are to pass.

It is now an easy matter with bradawl and screws to fix all components, using round-headed $\frac{3}{8}$in. No. 6's for the condensers and resistances, heavier screws if

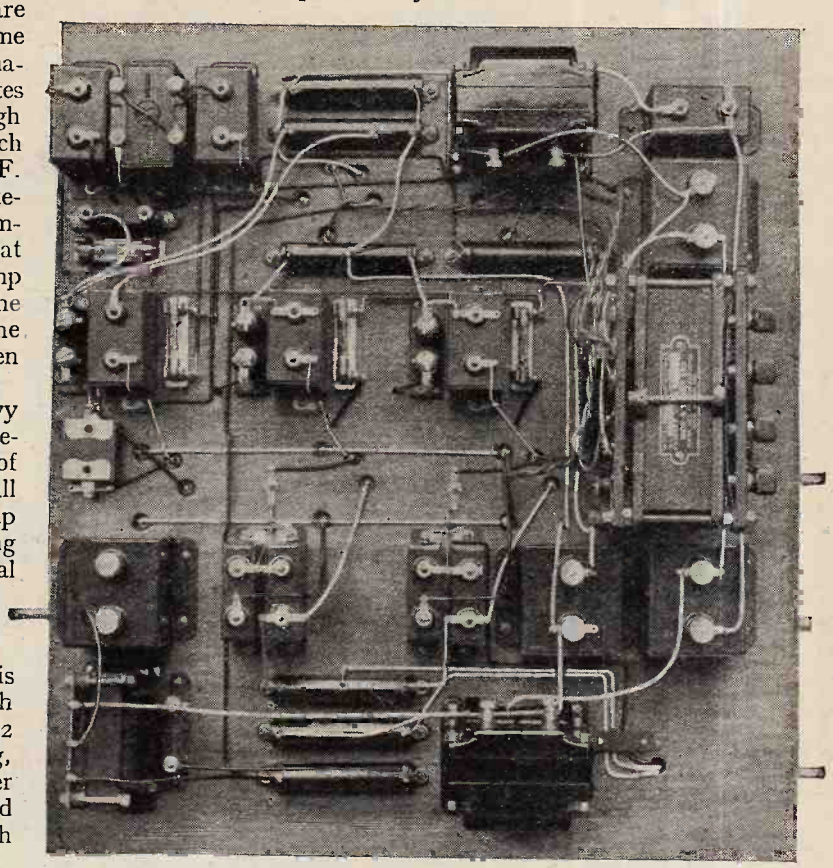
The Wireless World Four.—

necessary for the mains transformer and L.F. chokes, and smaller but longer ones for the porcelain leak holders and H.F. chokes. One might be cautioned not to accidently catch the resistances with the screwdriver during fixing, for while this class of resistance is perfectly durable and has a heavy watts rating, its fine wire, which is left almost exposed to facilitate cooling, is readily damaged.

As more than fifty parts are used, the possibility of a faulty component being encountered might be worth guarding against. Mains condensers are roughly tested by connecting them to some 200 volts from a battery or mains eliminator, allowing to stand for a few minutes and then short-circuiting them through a coil of wire and noting that they each give a snappy spark. Chokes, both H.F. and L.F., are tested for continuity, likewise the feed resistances, using a milliammeter and battery, bearing in mind that for every volt of the battery 1 milliamp will pass through 1,000 ohms. Thus the battery voltage approximately equals the number of thousand ohms resistance when 1 mA. is recorded.

Omitting, for the time being, the heavy mains transformer, attention can be resumed to the top side, noting, first of all, that no screw points protrude. All the tuning components can now be set up permanently in position. Before fixing down valve holders see that the terminal screws and nuts are really tight, while the nickelling might be filed away and the ends of the screws well tinned in readiness for wiring. Nothing else is worthy of comment in the assembly, which is really quite straightforward. No. 22 tinned wire, straightened by stretching, is used for all wiring except the heater circuits of the three indirectly heated valves, these being run straight through with No. 18.

The bulk of the wiring is kept down near the baseboard, but there is little point in dropping a lead which runs between two elevated points. It should be noted that no common earthing wires occur in the H.F. circuits, the cathodes of the three indirectly heated valves are taken straight to their respective tags, while seven condensers facing toward the line of indirectly heated valve holders are earthed on their own cases and then taken across to cathode or earthing tag. Short earthing wires are run under the coil covers from the top of every earthing condenser, which, with its bend-up tag, is carried on terminal No. 5. It should be noted that it is the first two earthing condensers which have a capacity of 0.005 mfd., the other two being 0.01 mfd. Direct earthing wires about 3in. in length are run between soldering tags under screen-fixing screws and the fixed tag to which the braided pigtail of the condenser is soldered. Whether wiring from the practical or theoretical diagram it is worth while carefully inking over each line in red as a lead is run. An omitted lead is not always easy to trace and may not entirely prevent the set working. Resin-cored solder is a great aid to making good connections, using just a trace of Fluxite on iron and tag. An acid flux must not be used. Good appearance is obtained by using a small size of sleeving only just large enough for the wire and selecting coloured silk rather than the painted variety. Gramophone pick-up connections are, obviously, omitted until after a preliminary test.

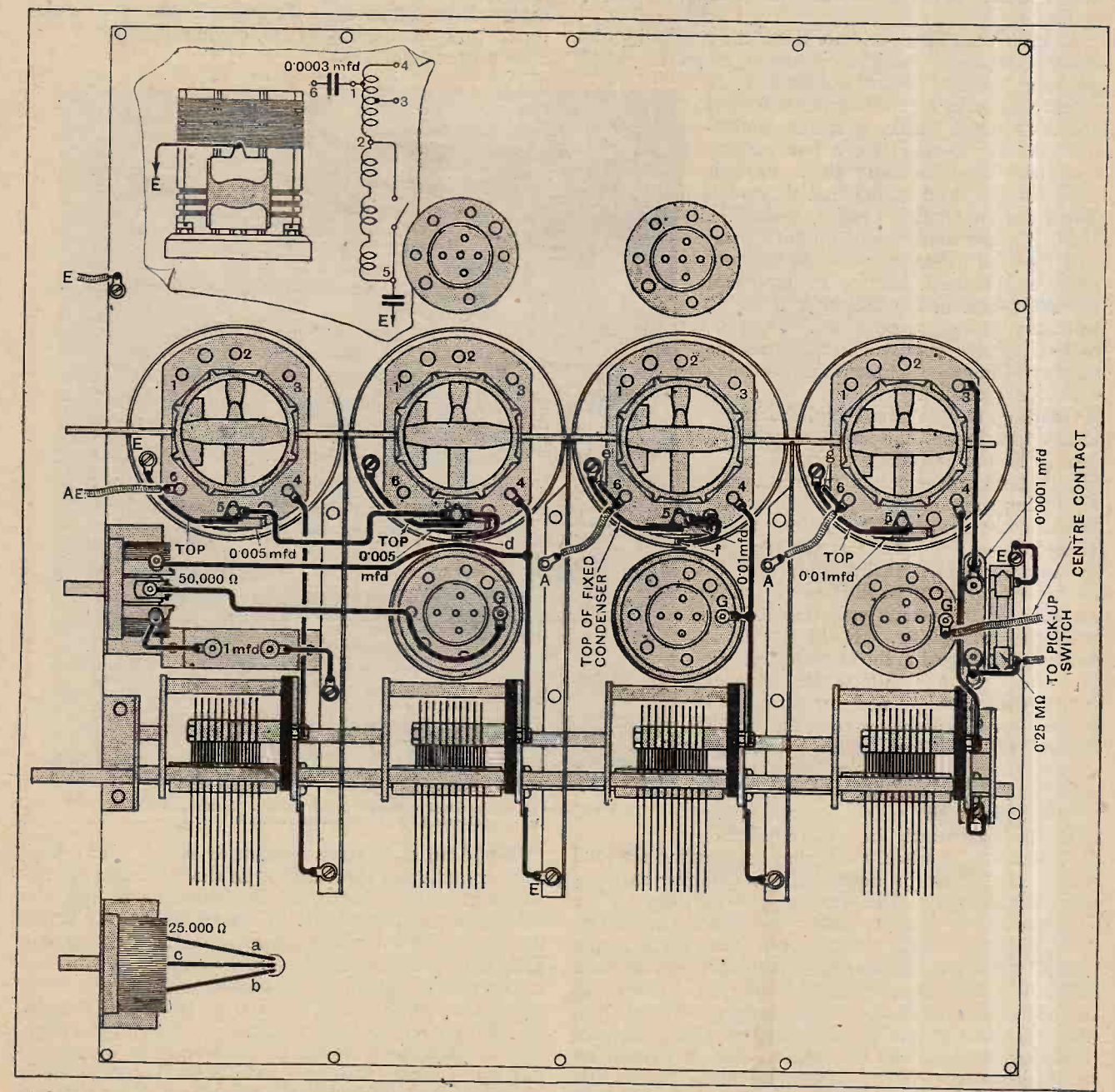


Plan view of the underside showing the wiring. Leads are run in sleeving by the shortest routes.

Should an error have been made in the wiring such as to create a full short circuit on the H.T. supply, this would result in destroying the emission of the U.5 valve. It might be advised, therefore, to test across the first 4 mfd. condenser with an H.T. battery and note that only the small current associated with the screen voltage potentiometer is passed. The valves used are Mazda AC/SG and AC/HL in H.F. and detector stages, and the Mullard P.M.24A in the output stage, with a Marconi or Osram U.5 rectifier. In placing on the coil covers, and the receiver will not function should one of them be loose, a piece of card should be placed over each of the earth-circuit condensers to prevent them making contact on the covers. No H.T exists above the baseboard other than the two leads which run almost direct to the anodes of the S.G. valves.

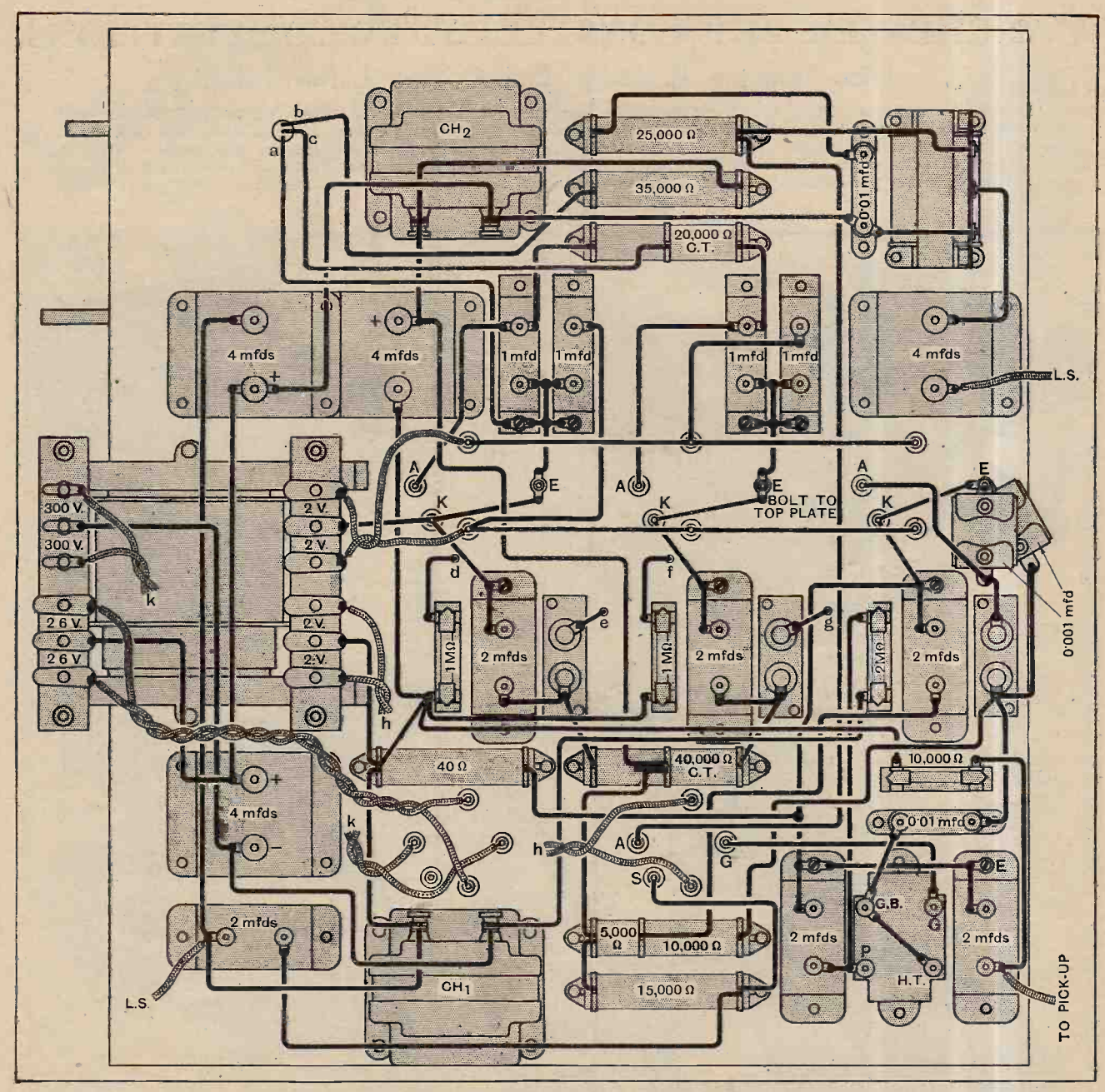
The Wireless World Four.—

As no fault is likely to be met with other than that due to a component or wiring, reception can be expected on switching on. The action of the volume controls is that the left-hand one prevents local station overloading, and the right-hand one controls the sensitiveness of the set. For distant station reception it is better to cut down volume if necessary by the screen feeble distant station tuned in by operating the earthed moving plates individually. It should be found that the settings coincide. Straight-line capacity condensers would, of course, compensate for differences in stray capacity, in that a capacity correction would remain constant over the tuning scale. In addition the condenser assembly could be set up so that the weight of the moving plates could be balanced, and that when one



A fixed capacity condenser of 0.0001 mfd. is inserted in the aerial lead. Note the 1 mfd. condenser connected in the earth lead of the H.F. volume control. (This was omitted from the circuit given in the previous issue.)

volts control. The condenser assembly provides access to the grub screws holding the moving plates to the spindle. These may be slightly slackened off and a set was lifting, another set could be falling, thus permitting of any dial being used even though the friction drive be weak.



While it is advisable to adopt the branching points shown, the leads are, of course, run by the most direct routes.

The type of cabinet chosen is not unduly tall, and permits of set and gramophone motor being assembled side by side. A stout upright supports a cross-batten on to which the receiver slides so that the operating spindles pass through clearance holes in the front panel. In order to clear the under apparatus of the baseboard, the loud speaker is mounted towards the side of the grille. The direction of connecting the leads to the gramophone motor may, perhaps, be a consideration should a slight hum be experienced, though this difficulty has not been met with in sets built to this specification. It is necessary to earth the frame of the gramophone motor. A double-pole "on and off" switch breaks both main leads and is assembled on the front panel to balance the wave change switch.

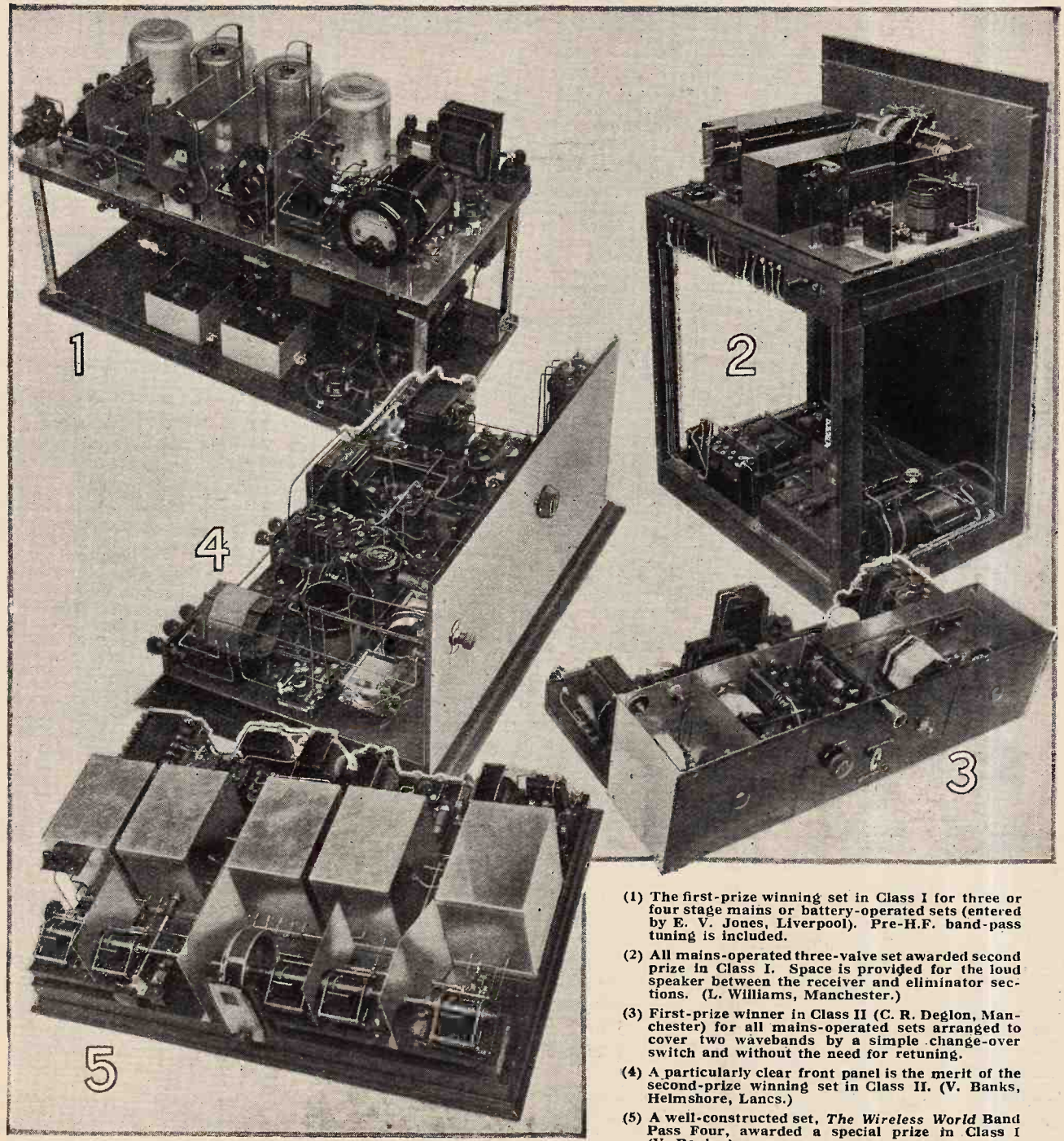
Good reception of European stations is easily obtained on 6ft. of indoor wire, and that this performance is duplicated in various sets was demonstrated in that two receivers placed side by side and connected to independent 6ft. aerials gave identical results going round the dials and on the weakest of foreign stations.

This receiver is available for inspection at the offices of "The Wireless World," 116, Fleet Street, London, E.C.4.

MANCHESTER SET CONSTRUCTION COMPETITIONS.

Prize Winning Receivers Embody the Latest Ideas.

Year by year a steady advance has been made in the standard of the entries to the "Evening Chronicle" constructional competition which is held in connection with the Manchester Radio Show. This year, however, a marked change has come about and the sets entered have reached a remarkably high standard as regards design, circuit principle and workmanship. Without exception the winning sets included all those modern features which are at present attracting amateur interest such as band-pass tuning, power grid detection, all mains operation, screening of tuning coils and valves under metal covers, ganged wave-change switching and one-dial control.



(1) The first-prize winning set in Class I for three or four stage mains or battery-operated sets (entered by E. V. Jones, Liverpool). Pre-H.F. band-pass tuning is included.

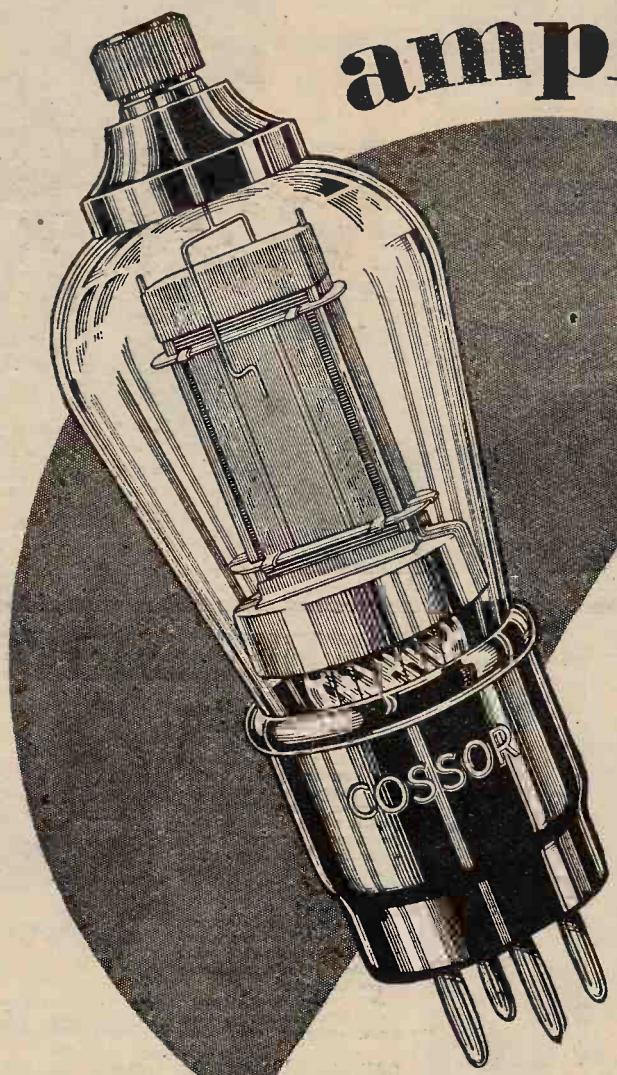
(2) All mains-operated three-valve set awarded second prize in Class I. Space is provided for the loud speaker between the receiver and eliminator sections. (L. Williams, Manchester.)

(3) First-prize winner in Class II (C. R. Deglon, Manchester) for all mains-operated sets arranged to cover two wavebands by a simple change-over switch and without the need for retuning.

(4) A particularly clear front panel is the merit of the second-prize winning set in Class II. (V. Banks, Helmshore, Lancs.)

(5) A well-constructed set, *The Wireless World* Band Pass Four, awarded a special prize in Class I (V. Banks.)

Highest effective amplification



Greater *effective* amplification is definitely ensured by the New Cossor Screened Grid Valve. This is due to its minute inter-electrode capacity which has been reduced to the order of .001 micro micro-farads—lower than that of any other Screened Grid Valve on the market. Because of this and because grid current has been eliminated, the use of this New Cossor Valve will considerably increase the efficiency of your Receiver.

Write for free fully descriptive Folder on "How to increase the range of your Receiver," mention No. L35W.W.

Cossor 215 S.G. 2 volts, ·15 amp. Impedance 300,000. Amplification Factor 330. Mutual Conductance 1·1 m.a./v. Normal working Anode Volts 120. Positive Voltage on Screen 60-80. *Price* **20/-**

THE NEW COSSOR 215 S.G.

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

6104

CURRENT TOPICS

Events of the Week in Brief Review.

CONSTANTINOPLE CALLING.

Stamboul, after a period of silence, is again functioning on 1,200 metres.

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WIRELESS ROOM IN A LIBRARY.

A special wireless room has been set apart in the Burnley (Lancs) Public Library for group listening to the B.B.C.'s adult education talks. The Carnegie Trustees have installed the broadcast receiver.

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TWO SETS: ONE AERIAL.

An uncommon case was heard in the Nottingham Summons Court a few days ago when John Cooper was fined 5s. for operating a set without a licence. The accused pleaded that he thought one wireless licence was sufficient although there were two sets in the house working off the same aerial. One set belonged to his wife's sister.

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BROADCASTING FROM A ROOF GARDEN.

"Radio House," in Berlin, illustrated in our issue of October 8th, is expected to be ready for occupation before Christmas. This home of broadcasting is one of the largest buildings to be constructed in the capital in recent years. The façade has a frontage of 168 yards. Above the five storeys a terraced garden will be available for meetings and public concerts.

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"RADIO WIZARD" CAUGHT.

A man said to be known internationally as a "radio wizard" and "wanted" by France and England for infraction of radio laws, was among the persons apprehended by the Brooklyn police when they raided a rum-runners' wireless station at Coney Island on September 27th. The transmitting apparatus, valued at £3,000, was used for regular communication with rum-running vessels outside the 12-mile radius.

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ANOTHER "FIVE YEAR PLAN."

Five years is a period which has special attractions for the Soviet Government. We understand that in addition to the famous economic "Five Years' Plan," Russia is preparing a special five-year programme for the development of communications, including wireless. The scheme includes a network of sixty-two radiotelegraph stations situated at strategetic points, besides a system of "wired wireless" for the distribution of broadcast programmes.

The complete communications scheme will involve a capital outlay in excess of £135,000,000.

HEAR STRASSBURG SOON.

Radio-Strassburg, whose début has been expected every week for the past month or two, will, it is officially announced, give its inaugural transmission on Armistice Day. We understand that the wavelength will be 345 metres.

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FIRE!

One thousand radio receivers, adjudged obsolete, went up in flames at Philadelphia recently during "the biggest burning of obsolete radios in the history of the industry," writes a correspondent. The ceremony was staged

A TANK AERIAL. — This Vickers-Armstrong tank is equipped with a Marconi 8-metre transmitter, and the aerial consists of a flexible copper-plated steel rod, 12 feet high, which is almost invisible.

near the City Hall by the Philco Co., which is organising an up-to-date radio campaign, and was presided over by a representative of the Mayor's office.

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STATE BROADCASTING IN N.Z.

Better times for New Zealand listeners are promised by Mr. Donald, the Postmaster-General, who informed the House of Representatives last week that the Government would take over the control of all stations from the Radio Broadcasting Company in January, 1932. The existing stations are at Auckland, Christchurch, and Dunedin.

BORDEAUX SHOW.

Bordeaux's second annual wireless salon opens on Sunday next, October 26th, and will run for a week.

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39,152.

There are 39,152 shops in the United States selling radio apparatus, according to the latest survey of the U.S. Department of Commerce.

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I.E.E. WIRELESS SECTION.

The opening meeting of the Wireless Section of the Institution of Electrical Engineers will be held on Wednesday, November 5th, when the inaugural address will be given by the chairman, Mr. C. E. Rickard, O.B.E.

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WIRELESS AND UNEMPLOYMENT.

Statistics from U.S. Government departments indicate that radio is comparatively unaffected by the world trade depression. The Department of Labour reports that forty-four radio manufacturers employed 32,103 workers in August, an increase of 25.8 per cent. over the figures for July.

Although figures are not available it would be safe to assume similar conditions in the British radio industry, which is contributing no small share to the reduction of unemployment.

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"WIRELESS WORLD" DIARY.

"The Wireless Amateur's and Experimenter's Diary and Note-Book" is issued this year in a slightly larger form to accord with the other diaries published by Iliffe & Sons Ltd. The information contained follows generally the lines of previous issues, as this has been found to meet the wishes of the majority of our readers as far as the necessarily limited space will permit.

Every section has been carefully revised and brought up to date. The useful formulæ and Abacs have been considerably amplified. The typical wireless receivers and circuit diagrams have been largely rewritten in the light of the latest modern practice, and a new feature has been introduced in the form of practical hints and tips for set builders and set users, based upon the various questions propounded and difficulties experienced by our numerous correspondents during the past year. A complete list of the broadcasting stations of Europe and of the principal short-wave broadcasting stations of the world will be found invaluable by broadcast listeners and short-wave experimenters, and the final pages are devoted to a very comprehensive list

of the valves of British manufacturers, giving, in tabular form, all the necessary technical data and preceded with a few words of advice upon the choice of valves for any given purpose.

"The Wireless World Diary" is strongly bound in leather, with pencil inserted, and the price is 1s. 6d., or post free 1s. 7d.

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THE SCIENCE MUSEUM RECEIVER.

In the simplified circuit diagram of the Science Museum receiver, described in our issue of July 30th last, the LS5 anode resistance was erroneously shown with a value of 5,000 ohms. The correct resistance is 25,000 ohms.

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RADIO CHAOS IN AMERICA.

Fourteen American broadcasting stations now use or have been authorised to use the maximum power of 50 kilowatts and twenty-seven others are applying for the privilege.

During the coming three months, writes our Washington correspondent, the Federal Radio Commission will have to consider more than 300 applications for changes of station ownership, wavelength and power. It is predicted that most of the applications will be summarily refused owing to the tremendous amount of congestion already prevailing.

The present basis of private ownership in America is probably responsible for the fact that the Federal Radio Commission is a much more harassed body than the Union Internationale de Radiofusion, although the latter controls all the broadcasting stations of Europe!

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AURORA BOREALIS AND SHORT WAVES.

That the aurora borealis induces a kind of temporary paralysis on the short-wave lengths was affirmed by M. Paul Heilbronner at the last meeting of the French Academy of Science, writes our Paris correspondent. The speaker produced reports from the Company Radio-France showing that on a particular night in September the "northern lights" gravely affected 30-metre communications on the Paris-New York service necessitating a change-over to 17,000 metres. The Marconi Company had also reported that reception of short-wave stations on the night in question was next to impossible.

Signals were also affected on the Franco-Japanese and Franco-South American routes.

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COLUMBUS STAMPS.

We are indebted to Senor Eduardo Navarro, of Madrid, for sending us a complete set of the new Columbus postage stamps, now in circulation in Spain, to commemorate the discovery of America.

ENTHUSIASM *EN MASSE*. Members of the Incorporated Radio Society of Great Britain photographed at the Institution of Electrical Engineers on the occasion of the recent Fifth Annual Convention. Immediately in front are Messrs. E. D. Ostermeyer (Hon. Treas.), J. Clarricoats (Hon. Sec.), G. Marcuse (President), and H. B. Swift (President-Elect).

NEWS FROM THE CLUBS.

Olympia Dissected.

"Olympia, 1930, All That is New," was the title of a talk given by Mr. A. Freeman at a recent meeting of Slade Radio (Birmingham).

A full description of the arrangements, methods of advertising, etc., was followed by a comparison of this and last year's exhibition.

Descriptions of the Ekco A.C. mains set, G.E.C. Music Magnet 4 A.C., and Philips 3 A.C., were followed by a demonstration of these models. The speakers used were a Celestion and the Lamplugh Inductor Dynamic, the latter to demonstrate this particular type of speaker.

Hon. Secretary, 110, Hillaries Road, Gravelly Hill, Birmingham.

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Croydon's Wireless Hospital.

Wireless men of Croydon flocked to the Surrey Drovers Hotel on Tuesday, October 7th, for the reopening of the South Croydon and District Radio Society.

With Mr. F. Nightingale temporarily in the chair, the past year's balance-sheet was presented by the treasurer, Mr. J. W. Scholes, and after some discussion this was passed.

Mr. F. Nightingale was asked to accept the post of chairman for the ensuing season. It had been learnt with much regret that the Society's usual chairman, Mr. G. Vellacott, would be unable to attend many meetings owing to pressure of work.

Mr. C. M. Fairweather, who has done much yeoman service for the Society in the past, received the post of vice-chairman, Mr. J. W. Scholes was re-elected treasurer, and the secretary, Mr. E. L. Cumbers, was also re-elected. Mr. E. Remington again accepted the post of technical adviser to the Society. Any owner of a defective wireless set in Croydon need only apply to this Society, and Mr. Remington, with a willing band of helpers, will soon be on their track!

Hon. Secretary, Mr. E. L. Cumbers, 14, Campden Road, South Croydon.

Round Table Discussion

The Bournville Radio Society held the opening meeting of the season on Thursday, October 9th, when a round-table discussion took place between the committee and members.

The membership of the Society is limited to employees of Messrs. Cadbury Bros., Ltd., but visitors are welcome at the Lecture Room, Dining Block, Bournville Lane, on Thursday evenings.

Hon. Secretary, Mr. J. F. Cleaver.

FORTHCOMING EVENTS.

WEDNESDAY, OCTOBER 22nd.

North Middlesex Radio Society.—At 8 p.m. At St. Paul's Institute, N.21. Lecture: "H. T. Eliminators," by Mr. E. H. Laister.

Muswell Hill and District Radio Society.—At 8 p.m. At Tollington School, Tetherdown, N.10. Third lecture on "Some of the Elementary Principles of Radio," by Mr. Leonard Hartley, B.Sc., A.I.C.

THURSDAY, OCTOBER 23rd.

Slade Radio (Birmingham).—At 8 p.m. At the Parochial Hall, Broomfield Road, Erdington. "Radio Record," a film display by Messrs. Ensign, Ltd.

FRIDAY, OCTOBER 24th.

Wembley Wireless Society.—At 7.30 p.m. At Park Lane School. Ordinary meeting.

TUESDAY, OCTOBER 28th.

Bec Radio Society.—At 7.30 p.m. At Bec School, Beechcroft Road, S.W.17. Lecture (for Beginners): "The Generation and Propagation of Radio Currents." At 9.10 p.m., Demonstration of Small Power All-mains Receivers by Mr. S. Perkins.

Kentish Town and District Radio Society.—At 8 p.m. At Carlton Road School, Kentish Town, N.W.5. Ordinary meeting.

Radio Reminiscences.

At a meeting of the Bristol and District Radio and Television Society held at the University on October 10th, a lecture was given by Mr. Gough, of the General Electric Co., on the development of radio reception from the early days of Eiffel Tower and Writtle up to the present Regional scheme. This interesting lecture was followed by a demonstration of the latest models of G.E.C. productions, the 3- and 4-valve A.C. models, the 4-valve kit set, and the G.E.C. Moving Coil Speaker.

Hon. Secretary, Mr. S. T. Jordan, 1, Myrtle Road, Cotham, Bristol.

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A Good Start.

The autumn session of the Muswell Hill and District Radio Society opened auspiciously with a dinner at the Florence Restaurant, Rupert Street, London, W., on October 1st. Mr. E. H. McCormack was in the chair, and among those present were Capt. H. J. Round, M.C., M.I.E.E., President of the Society, and Mr. P. K. Turner. After dinner and the loyal toast, the Chairman proposed the toast of "The Society," which was responded to by Mr. Turner, who congratulated the Society on the excellence of their syllabus, which includes lectures and demonstrations by such notable firms as the Gramophone Co. (H.M.V.), the Marconiphone Co., and Murphy Radio, to name but three.

There was then an intermission for a short time, after which the orchestra, which had been discoursing semi-classical music during the dinner, showed its versatility by supplying dance music until an early hour of the morning. Thus ended the first of the many social functions which are invariably part of the syllabus of the Muswell Hill Radio Society.

Anyone wishing to join the Society should write to Mr. C. J. Witt, at 39, Coniston Road, Muswell Hill, London, N.10.

COLUMBIA MODEL 307

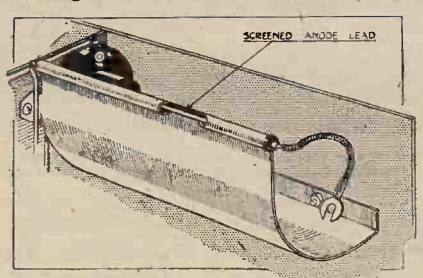
A New Three-valve Receiver for A.C. or D.C. Mains.

Technical Details and Performance of the A.C. Mains Model.

IN the Columbia range of broadcast receivers the Model 307 occupies an intermediate position between the simple two-valve twin-station Model 309 and the long-range 3-H.F. Model 304, which was reviewed in the November 27th, 1929, issue of this journal.

The three-valve circuit comprising a screen-grid H.F. amplifier, detector and pentode output valve is an arrangement which has proved itself capable of meeting present-day demands of selectivity, range and volume at a reasonable price, but careful attention to detail on the part of the designer is essential if the requisite degree of selectivity is to be attained with only a single H.F. stage.

In the Columbia Model 307 there are only two tuned circuits—an input tuned circuit across grid and filament of the screen-grid valve, and a simple tuned anode circuit in the output. Both circuits are tuned by side-by-side drum dial condensers which can be operated independently or simultaneously at will, and the anode condenser on the right is calibrated in wavelengths. The requisite degree of selectivity is obtained by loose-coupling the input tuned circuit to the aerial. This is done in two ways, (1) by tapping in the aerial feed at a point near the low potential end of the coil; (2) by controlling the aerial coupling through a three-electrode differential condenser. This condenser, which is of the solid dielectric type, is housed in a moulded case on the aerial terminal panel at the back of the set, and, once adjusted in relation to reception conditions in the neighbourhood and to the electrical constants of the particular aerial in use, requires no further attention. The advantage of the differential aerial condenser is that a satisfactory compromise between range and selectivity can be obtained without appreciably affecting the capacity across the aerial tuning circuit. The condenser can, therefore, be used also as a volume control for local station reception without disturbing the setting of the left-hand tuning dial.



Method of screening the anode lead to the H.F. valve. The screen is cut away in the sketch to show the centrally spaced wire.

As an indication of the effectiveness of this arrangement the short-wave performance of the receiver on a 50ft. outside aerial at a distance of five miles from Brookmans Park may be cited. The best setting for the aerial condenser, having regard to the retainment of adequate range, was found to be the first division from the zero or minimum (¼ full scale), and with this setting the Regional transmitter (356 metres) occupied a band from 325 to 375 metres and the National transmitter was confined to the lower part of the tuning range from 275 metres downwards. That this satisfactory state of affairs was not obtained at the expense of range is indicated by the fact that thirteen foreign stations were tuned in clear of the local transmitters with the same setting of the differential aerial condenser. For the above results, of course, the best possible use was made of the reaction control.

Two Pre-detector Volume Controls.

The selectivity on long waves is not of such a high order as on short waves, but is, nevertheless, sufficient to separate Radio Paris and Daventry 5XX. In all, seven stations were received at good strength on the long waves.

It has already been pointed out that the differential condenser can be used as a volume control, but an independent volume control described as an "Intensifier" is also incorporated in the aerial circuit. This takes the form of a high-resistance potentiometer across the tuned aerial circuit and regulates the proportion of the voltage induced across the aerial coil which is passed to the grid of the screen-grid valve. It follows that this volume control does not affect the input from a gramophone pick-up, and an additional external volume control is necessary when reproducing from records.

A compound switch similar in design to that used in the Model 304 serves to connect the pick-up in the grid circuit of the detector and also to change from long to short waves. Normally, the detector functions as a leaky-grid rectifier, and gramophone leads are short-

circuited to prevent interference from low-frequency induction in the pick-up leads. The operation of switching in the pick-up also changes the detector valve bias and so converts it to a L.F. amplifier. Incidentally, the grid bias for all three valves is derived from a common potentiometer, each tapping being thoroughly decoupled.

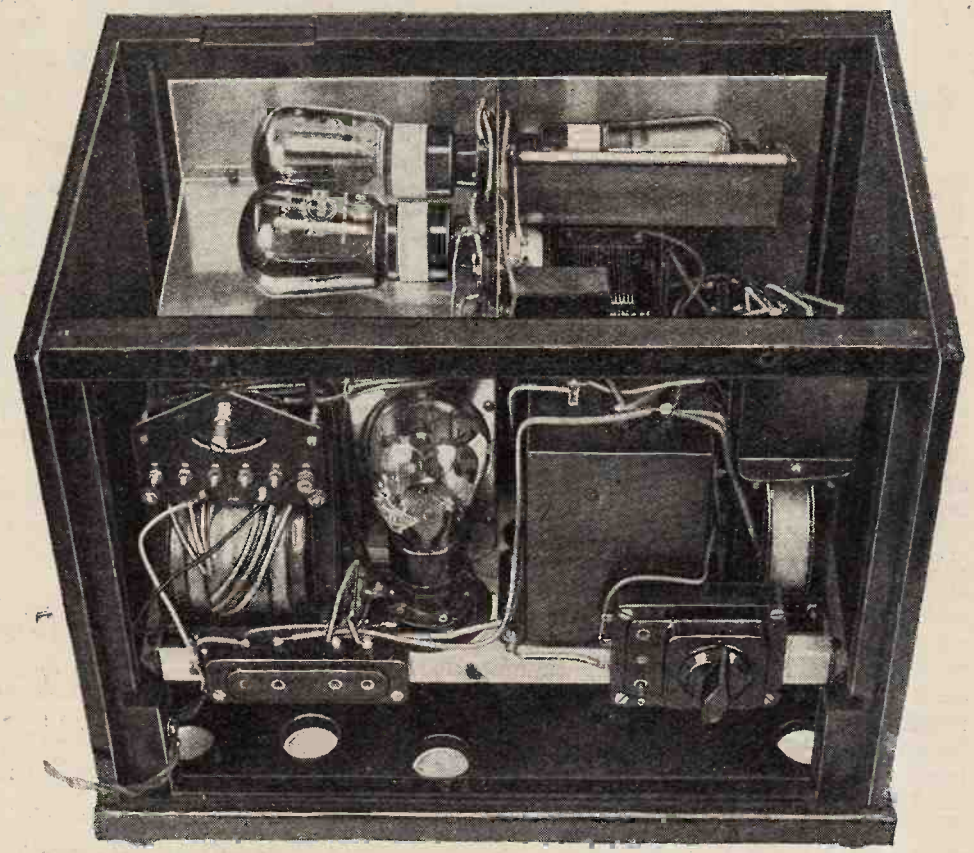
A resistance-capacity filter in the detector anode circuit deflects D.C. from the high-permeability type L.F. transformer coupling the detector and pentode power valve. The loud speaker terminals are connected directly in the anode circuit of the P.M.24 output valve.

It is well known that accentuation of the high frequencies is a characteristic of the performance of pentode valves, and for this reason a filter, consisting of a condenser and resistance in series, is connected between the anode of the valve and earth. The values of resistance and capacity have been chosen to give the high note correction required by the Columbia 325 and 326 loud speakers, and it is emphasised in the instruction booklet that unsatisfactory results may ensue from the use of other types of loud speaker. This point was borne out by experiments with a loud speaker having a good response up to 6,000 cycles which gave undue prominence to the sibilants in speech and needle scratch in gramophone records. It would appear that the filter circuit has been adjusted to give only a moderate restriction of the upper frequencies.

In the A.C. model tested the mains transformer is suitable for supply voltages from 195 to 245 volts with a total of six alternative primary tappings. A filament circuit potentiometer or "hum adjuster" is mounted on the same panel as the primary tappings and may be adjusted with a screwdriver from the back of the set. This component does its work adequately, and a well-defined minimum is easily obtained, at which point there is no trace of 50-cycle hum in the loud speaker.

The H.T. current is supplied through a Cossor BU/624 full-wave rectifier, and is very completely smoothed by chokes and a T.C.C. condenser bank. Both the screen grid and detector anode circuits are decoupled, and the screen grid potential is derived from a potentiometer consisting of two cartridge type resistances in series.

The arrangement of compartments in the aluminium chassis is well thought out, and it is interesting to note that a subsidiary screen is provided to prevent interference between the H.F. choke in the detector anode circuit and the tuned circuits associated with the H.F. valve. Another constructional feature worthy of mention is the method of screening the lead to the anode of the H.F. valve. The edge of the screening trough surrounding this valve has been turned over to form a tube and the anode wire is supported inside concentrically by small ebonite end bushes. The exposed end of the anode lead is, therefore, little more than an inch in length.



Back view of the Columbia Model 307 with top and back panels removed. Note the differential aerial condenser on the aerial terminal panel in the bottom right-hand corner.

The cabinet work is unusually sturdy, and both the top and back panels are easily removable, giving ready access to the receiving and rectifier valves respectively. Adequate ventilation of the interior of the cabinet (an important point where use is made of indirectly heated A.C. valves) is provided by large diameter holes drilled in the base and a long slot in the back panel.

A model designed for D.C. mains is also available, and the price of both A.C. and D.C. models is 20 guineas in oak and 21 guineas in mahogany. The same chassis is obtainable in a pedestal type cabinet, together with a built-in four-pole balanced armature cone loud speaker, the price being 30 guineas in oak and 31 guineas in mahogany. The makers are the Columbia Graphophone Co., Ltd., 102-108, Clerkenwell Road, London, E.C.1.

BROADCAST BREVITIES

By Our Special Correspondent.

Mystery of "London National."

No one who has attempted to seize the inner meaning of recent happenings in connection with the Brookmans Park station can fail to note that the National transmitter has fallen from grace. At first the premier station of the two, it now plays second fiddle.

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Sad Reflections.

The B.B.C. engineers came out into the open last week with the statement that it had been decided to use the Regional rather than the National when any one programme is being radiated for the reason that, beyond a radius of 15 or 20 miles, the London Regional is heard better than the London National.

This casual statement has probably a very sad significance.

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Too Low a Wavelength.

If they had wished to be blatantly truthful, the B.B.C. might have added that this country is possessed of a wavelength unsuited to the uses required of it. Experience is showing that the 261-metre wave is too low for a station with regional, not to mention national, aspirations.

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A Wrong Choice.

No other European station with so large a service area appears anywhere near London National on the wavelength chart; the nearest stations of any consequence are Horby (Sweden), on 257 metres, and Helsinka (Finland), on 221 metres. Both these stations employ a mere 15 kW., and are obviously not intended to cut such a figure as Brookmans Park with its 68 kilowatts.

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An Exchange of Wavelengths?

Perhaps if London National were to exchange with the relay stations the British common wave of 288.5 metres the results would be less disappointing.

As things stand at present one of the best British transmitters is being partially wasted.

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Heterodyning.

It is a pity to break in upon the romantic thoughts associated with the lengthening winter evenings by talk of Continental heterodyning. But there can be no doubt that the better receiving conditions are also revealing culprits who were undetected during the summer.

Several of the British stations have been affected.

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B.B.C. Sufferers.

For example, disturbance on Daventry National transmissions has been traced to far-away Angora; the National common wave has been jolted several times of late by Radio Lyons. Even London Regional has been jammed by a whistle ascribed to the third harmonic of Hilversum.

These and other cases of interference with B.B.C. transmitters have been traced by the Tatsfield receiving station. Full details have been sent to the Brussels office of the International Broadcasting Bureau, whose duty it is to straighten ether tangles with firmness and tact.

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A Challenge Accepted.

I hear that Mr. Cleghorn Thomson, the Scottish Regional Director, is to take up the recent challenge anent the organisation of broadcasting in Scotland. In his annual talk from Scottish stations on his plans and policy for the coming year, Mr. Thomson will, on November 1st, have several important things to say, quite apart from the question of programmes.

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Worth Listening To.

The Scottish H.Q. have been accused of (*a*) being too dependent on Savoy Hill, and (*b*) too independent of Savoy Hill. Mr. Thomson's task of satisfying both sets of critics should give his talk a piquant flavour. If you can tune in a Scottish station on November 1st, the opportunity should not be missed.

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From Durham Cathedral.

The National Service on October 26th comes from Durham Cathedral, which has not been used as much as most Northern cathedrals for broadcast purposes. The address on "Christian Citizenship" will be given by the Dean (Bishop J. E. C. Welldon).

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Making Our Flesh Creep.

The idea has been fostered in certain sections of the daily Press that the "B.B.C. Green Van" spends its time chasing unlicensed listeners. Such an exhilarating function is, of course, quite outside the scope of the broadcasting organisation. The van in question is used exclusively for outside broadcasts, and is often to be seen at strategic points on high days and holidays.

It might spoil the pleasure of these occasions if the spectators associated it with other duties.

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Black Magic.

The Post Office Direction Finding Van is the vehicle that strikes terror into the hearts of unlicensed listeners. Naturally, the P.M.G. refuses to disclose the magical process of detection.

I see that this "Black Maria" is setting out on a tour round Cardiff.

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Revue Over Transatlantic 'Phone.

The high-speed revue, "Give me New York," is to be re-broadcast nationally on November 13. This is in a sense a new broadcast, as the author, Holt Marvell, has revised the first edition, which was given two years ago, and new music has been written.

The idea of the revue is that an English impresario, being anxious to place a London play with a New York theatre manager, submits specimens of it over the transatlantic telephone. The call costs £3 a minute, hence the speed of the show.

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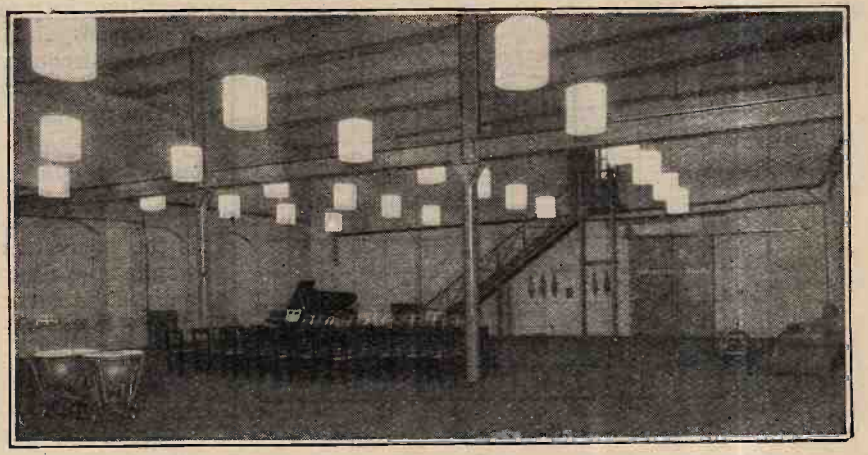
A Musical Fighter.

Another of those periodical wrangles between the B.B.C. and the music interests seems to have been settled by the new arrangement whereby eight of the Hallé concerts may be broadcast during the 1930-31 season.

Sir Hamilton Harty, like Sir Thomas Beecham, has shown himself to be a redoubtable fighter, but all musically minded listeners will be glad that the recent contention has not led Sir Hamilton to turn his back on the microphone in the manner of his illustrious contemporary.



WORLD'S LARGEST BROADCAST STUDIO. This photograph gives some idea of the vastness of the converted warehouse on the south side of the Thames, now used by the B.B.C. as a studio to accommodate the National orchestra and chorus, comprising more than 350 performers.

QUALITY RECEPTION

H.F. AMPLIFIER AND THE DETECTOR

By JOHN HARMON.

(*Concluded from page 453 of previous issue.*)

MUCH has been written on the comparative advantages of "anode-bend" and "leaky grid" detection, and a fair statement of the position to-day would seem to be that while the former has a decided superiority from the point of view of good quality, yet the latter is still employed by the great majority of set users. The reason is simply that the reaction which can be, and almost invariably is, associated with this method increases amplification to an extent which makes it possible to dispense with a H.F. amplifying stage, or to conceal inefficiency in such a stage when it is used. This amplification by reaction, however, is dearly bought. Since grid current is always flowing in the detector a resistive load is thrown upon the preceding H.F. tuned circuit, leading to loss of both amplification and selectivity, and it is the aim of reaction to counteract both these defects. Now, although amplification may thus be restored to its original value, the selectivity curve suffers a distortion, which is illustrated in Fig. 26.

Here the full curve represents the transmission of sidebands by a H.F. tuned circuit. When this is loaded by a leaky grid detector and the amplification is brought back by reaction to the original value the broken curve is obtained showing an increased loss of sidebands up to 10 k.c. on either side, and a decreased selectivity in the region beyond (which is just the region where increased selectivity is required to cut out adjacent stations).

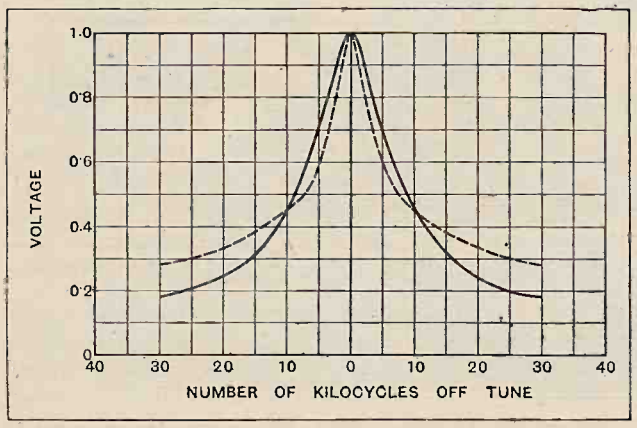


Fig. 26.—Full curve: selectivity of a tuned high-frequency circuit. Broken curve: effect of loading this circuit by a leaky grid detector and bringing up the amplification by reaction.

In addition to reaction distortion there are losses of low and high tones in both the grid and plate circuits of a leaky grid detector, and we must conclude that this method is unsuitable for reproduction of high quality.

It should be noted, however, that a new era seems to be opening with "power grid detection" (see *The Wireless World*, May 7th, 1930, p. 474 and p. 479), where distortionless reproduction is obtained by a grid detector using 300 volts H.T. This method of rectification has been employed successfully in a number of receivers lately described in this journal.

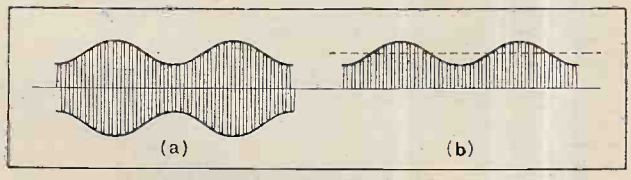


Fig. 27.—(a) A high-frequency modulated voltage signal. Since its average value is zero it cannot give any effect in a loud speaker. (b) The same signal after passing through a detector valve. It has now become a unidirectional pulsation, and when the H.F. variations are smoothed out the signal varies at audio frequency.

Anode Bend Detection.

The function of a detector is to rectify the incoming high-frequency carrier wave which is modulated at audio frequencies, and so allow the latter to be separated from the high-frequency wave and applied to the sound-reproducing device.

The modulated carrier is in envelope form as shown in Fig. 27 (a), the amplitude of the high frequency varying at audio frequency. In order to make use of this by the L.F. amplifier it must be cut in halves and one half discarded, the result being as in Fig. 27 (b), which is the equivalent of a pulsating direct current which would have a mean steady value, as shown by the dotted line, if the carrier wave were unmodulated, but which varies below and above this value if modulation is present.

We now come to the case of the anode bend rectifier. Fig. 28 shows a typical grid volts-plate current curve with (a) modulated, (b) unmodulated carrier waves applied to it, and indicates the manner in which the plate current varies when there is no plate load present.

In order to make use of these changes of plate current

Quality Reception.—

for the purpose of operating the L.F. amplifier we must insert some sort of coupling device. In resistance capacity coupling a high resistance is inserted in the plate circuit and a grid leak and condenser are used to couple to the following L.F. valve.

The presence of the resistance introduces some new conditions which must be considered (Fig. 29). The first is that the grid volts-plate current curve is now less steep, but, on the other hand, it is straighter, and the effect of the curved lower part is less marked. It is

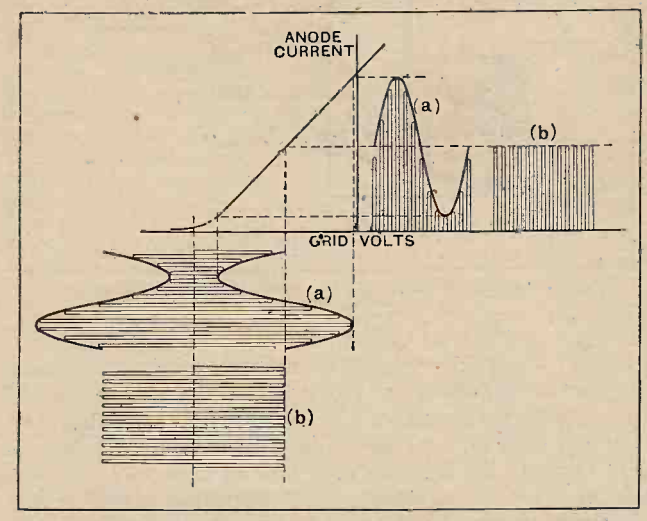


Fig. 28.—Anode bend detection. The plate current corresponding to (a) a modulated H.F. grid signal, (b) an unmodulated signal.

evident that the variations of plate current are now much smaller than in Fig. 27. Since we are dealing with rectified current, of which only one-half is used, the root mean square value will be 0.35 of the maximum at any point, as shown by the dotted curves in Fig. 29, and this value (in amperes) multiplied by the resistance in ohms will give the volts output.

If now we shunt the plate resistance with a condenser of suitable value, the high-frequency variations are smoothed out to a considerable extent, making the mean value much higher, and since the plate resistance is still of the same value the low-frequency output is increased.

Care must be taken to see that the condenser which shunts the plate resistance does not interfere with the low-frequency characteristic, i.e., cause the output to be deficient in the higher audio frequencies. For this reason the impedance of the condenser should not be less than about four times the valve A.C. resistance as measured under working conditions; this condition gives $4 \times 15{,}000 = 60{,}000$ ohms, which will be satisfied at 5,000 cycles by a 0.0005 mfd. condenser.

This by-pass condenser passes most of the H.F. current, but in order to make sure that as little as possible gets through to the plate resistance, and so to the following L.F. valve, it is necessary to insert a radio-frequency choke as in Fig. 17. Even when transformer coupling is used the choke is still necessary, for although the inductive reactance of the primary offers an obstacle to H.F. currents there is enough capacity between primary and secondary to transmit quite a lot of H.F.

Large Detector Input for Good Quality.

In the days when H.F. amplification was a difficult and ineffective business, the peak swing on the grid of the detector rarely exceeded a volt, and in consequence the valve acted only on the strongly curved part of the bottom bend; distortion was unavoidable in such circumstances, and anode bend had nothing to recommend it in preference to the leaky grid method. Nowadays, with screen-grid H.F. amplification giving a single stage gain of 50 or more, the detector grid can be swung up to ten peak volts at a distance of 100 miles from Daventry. With such large swings the straight line part of the characteristic is utilised, the bottom bend being only a small part of the whole path and, as Fig. 28 shows, the plate current faithfully follows the grid swing.

The possibility of such large detector grid swings is a direct, though perhaps unforeseen, consequence of modern methods of H.F. amplification, and marks the most notable advance towards high-quality reproduction that has been seen in recent years.

High-frequency Amplification.

When high-frequency tuned circuits are used both preceding and following a screen-grid valve, the coils of these two circuits being well designed for low losses, we must expect the high audio frequencies to be attenuated owing to cutting of sidebands. Fig. 30, curve 1, shows the selectivity curve due to two such circuits in combination, and it appears that the voltage transmission drops to 0.5 at 5 kilocycles off tune. This is a serious attenuation of the high tones, but fortunately the curve can be improved by judicious detuning of the circuits in opposite directions. Curve 2 shows the effect of detuning one circuit by 5 k.c. to the right, and the other by an equal amount to the left. The process is continued in curves 3 and 4, and evidently an excellent curve is obtained at some stage, such as curve 3, where

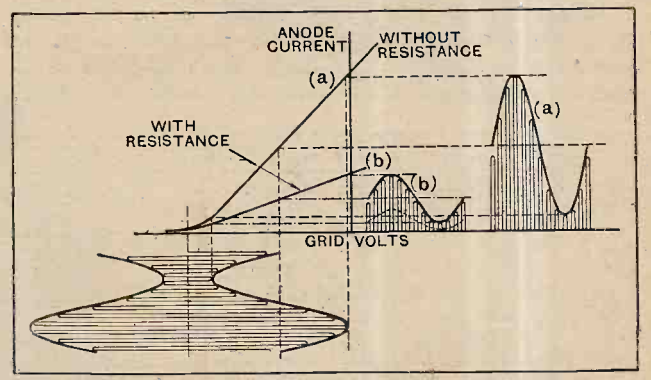


Fig. 29.—Anode bend detection. The effect of plate resistance in the detector valve circuit.

the variation over the audio range does not exceed 6 per cent. The process of detuning is too delicate to be carried out by ear alone, but is a simple matter if a milliammeter is used in the plate circuit of the anode bend detector valve. Each circuit can be accurately tuned by observing when the needle indicates the maximum detector current, and then the condenser dials

Quality Reception.—

should be rotated equal amounts in opposite directions till the best effect is obtained.

Often the H.F. grid circuit is so heavily loaded by the aerial that its selectivity curve is much flatter than that of the plate circuit; in this case the result of detuning is not so good, but it is usually possible, while still retaining sufficient signal strength, to couple the aerial so loocely to the grid circuit that the curves are nearly identical.

Input Capacity Due to Feed-back.

It now remains to describe the experiments previously referred to in this article on the effect of feed-back from the plate load of the pentode through the residual plate-grid capacity which exists between the plate and grid leaks in the glass pinch and the valve-holder. This feed-back results in the appearance of a large effective capacity between the grid and filament.

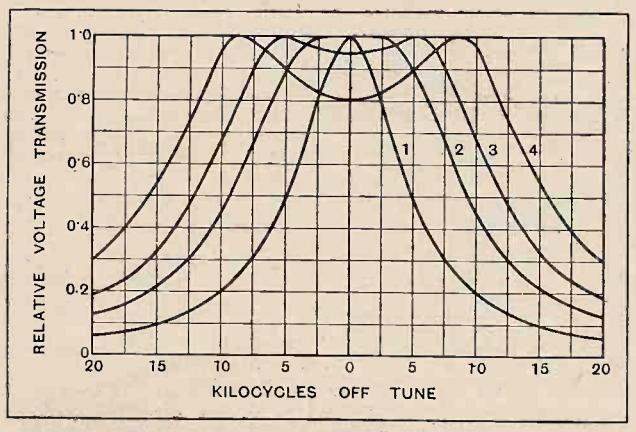


Fig. 30.—Resultant selectivity curve of two identical H.F. tuned circuits: (1) Both circuits on tune. (2) Each circuit detuned by 5 k.c. (3) Each circuit detuned by 7 k.c. (4) Each circuit detuned by 10 k.c. In this example the ratio reactance/resistance of each coil is taken as 100 and the carrier frequency is 1,000 k.c.

An audio-frequency generator (Fig. 31) of the heterodyne type, which produced frequencies between 50 and 5,000 cycles at constant voltage, was connected to the primary of an equal ratio transformer across the secondary of which a wire-wound megohm resistance was inserted. A thermionic voltmeter was shunted across part of the megohm and the remainder acted as a grid leak which conveyed voltage signals to the grid of a PM26 pentode. The plate load of the pentode consisted of a 25:1 step-down transformer with a variable re-

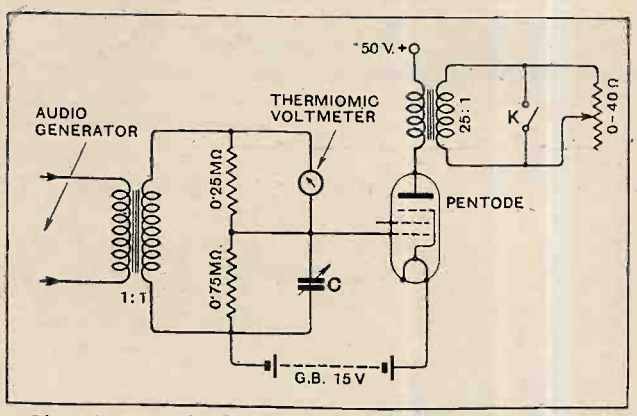


Fig. 31—Determination of the grid input impedance of a loaded pentode.

sistance across the secondary of 40 ohms maximum value. Thus the equivalent resistive plate load could be varied from 0 to $25^2 \times 40 = 25{,}000$ ohms. In the experiments the resistance load was first shorted by closing the key K, and the voltmeter reading was noted. On opening the key the grid leak of 0.75 megohm was shunted by the capacity which appeared across it due to feed-back and the voltmeter reading changed. By means of the variable condenser C capacity could be added to give the same change of voltmeter reading as was caused by introducing the plate load. With any fixed resistive load the required value of C was found to be independent of signal frequency, thus showing that the feed-back is actually capacitative.

The effective capacity increased as the resistive load was made larger, as shown in Fig. 32, curve 1. This is to be expected, since for a high-resistive load the working line lies more in the region where the valve amplification is large, as has frequently been pointed out in *The Wireless World*. It attains a value of 90 mmf. for a load of 17,000 ohms, which value is attained by the impedance of most reed-driven loud speakers (of 2,000 ohms nominal impedance) at 5,000 cycles.

As a check on the method, a similar experiment was carried out with a power triode, a DFA9. The results are shown in Fig. 32, curve 2, and the values agree well with those derived from the formula for triodes.

It is evident from Fig. 32 that the equivalent input capacity of a loaded pentode is much larger than that of a low magnification power triode, and must be taken into account when the coupling between detector and pentode is being designed, otherwise the high tones may be seriously attenuated.

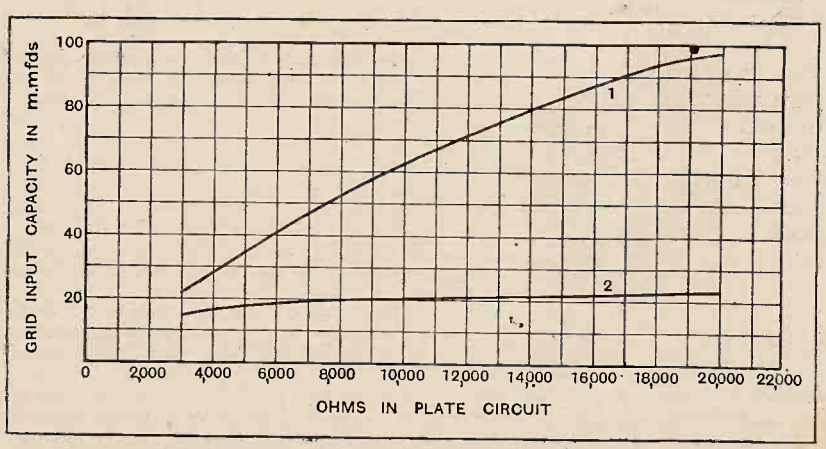


Fig. 32.—Variation of input grid-filament capacity with load in plate circuit (1) Pentode PM26. (2) Power triode DFA9.

Laboratory Tests on New Apparatus

L.T. CHOKE FOR "ALL D.C. THREE."

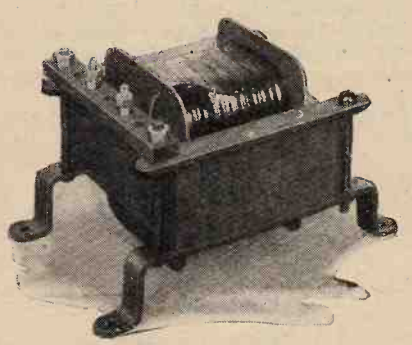
A special heavy-duty choke constructed according to specification, and for use in the above receiver, has been submitted for test by W. Bryan Savage, 146, Bishopsgate, London, E.C.2. The measured D.C. resistance of the winding is 59 ohms, which is the same as that of the choke used in the original set. No alteration is necessary, therefore, to the value of the various resistances.

Measured at 50 cycles and when carrying the total D.C. required to operate the receiver, the inductance was found to be 5.1 henrys; an entirely satisfactory value. As a guide for those who may require a heavy-duty choke of this type but for another purpose, the inductance with different values of D.C. flowing is given below.

INDUCTANCE WHEN CARRYING D.C.

D.C. in mA.	Superimposed A.C. in mA.	Inductance in henrys.
0	2.8	11.9
50	3.6	9.3
100	4.4	8.1
150	5.2	7.2
200	6.0	6.4
250	6.8	5.5
300	7.6	4.7

The physical dimensions of the choke are according to specification, the height



Heavy-duty choke for the "All D.C. Three," made by W. Bryan Savage.

over terminals not exceeding 3⅜in., this enables the choke to be accommodated comfortably in the space available under the plinth. The price is 21s.

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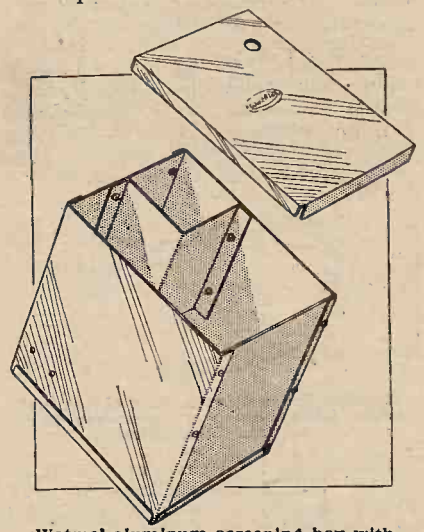
WATMEL SCREENING BOX.

There are some occasions where a screening box of slightly smaller dimensions than those generally employed is required, and to meet this need the Watmel Wireless Co., Ltd., Imperial Works, High Street, Edgware, Middlesex, have produced a box measuring 4in. × 6½in. × 6½in. high made from aluminium. In one corner of the box is a small hutch 2¼in. × 2¼in. × 3½in. deep with a 1⅝in. diameter hole cut in the base to accommodate a screen grid valve. A loose wooden base is fitted to the box, which has also a number of holes drilled in the sides to pass lead-in and lead-out wires. The valve hutch is built up from separate pieces of metal and can be easily removed if it is not required.

The price of the box is 5s.



Watmel aluminum screening box with built-in hutch for the valve.

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LOEWE QUARTZ OSCILLATORS.

One of the conditions imposed by the Postmaster-General in the issue of a licence for experimental transmission is that the wavelength of the transmitter should be checked, from time to time, by

Loewe quartz crystal oscillator for transmitter control, or calibration and occasional check of a wavemeter.

a wavemeter controlled by a quartz crystal. Those contemplating joining the ranks of amateur transmitters will be interested to learn that quartz oscillators, carefully adjusted and with a guaranteed percentage of accuracy, can be obtained from the Loewe Radio Co., Ltd., 4, Fountayne Road, Tottenham, London, N.15. These crystals are intended for the maintenance of a constant wavelength, and they can be incorporated in the transmitter. Where the power in use does not exceed 10 watts a suitable quartz crystal may be connected in the grid circuit of the oscillating valve, but in the case of higher power than this the use of a separate control valve becomes essential.

A further application of these quartz crystals is to be found in calibrating a wavemeter where a high order of accuracy is required. As supplied by the Loewe Radio Co., Ltd., the crystal is mounted in a dustproof case fitted with two contact-pins, and they are available ground to resonate at any wavelength between 40 and 1,000 metres. The prices vary according to the degree of accuracy required. Those guaranteed to within 10 per cent. of the marked wavelength cost 55s. each, and to within 1 per cent. the price is 70s. An accuracy of one part in 1,000 can be guaranteed at the price of 110s. per crystal.

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MILNES H.T. UNIT.

The Milnes H.T. unit consists of a battery of nickel-iron-type cells mounted in a crate and incorporating an ingenious

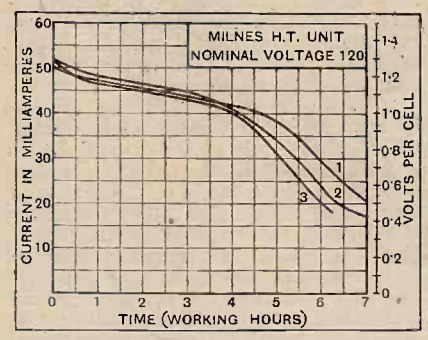
Milnes 120-volt H.T. unit which can be charged from a 6-volt accumulator.

series-parallel switch which connects groups of cells either in parallel or in series. Four cells constitute a group, which, when connected in parallel, can be charged from a 6-volt accumulator. The switch consists of an ebonite rod extending the full length of the crate and operated by a lever located outside the container. Fixed to this rod is a number of bent-wire contacts and steel studs, which bear against spring leaves connected to each group of four cells.

The electrolyte is an alkaline solution, so that sulphating and corroding are impossible. This fluid must not be exposed to the air unnecessarily, as it readily absorbs carbon dioxide, so that immediately after filling each cell a small quantity of the special oil supplied must be added. The presence of the oil precludes creeping of the electrolyte.

Laboratory Tests on New Apparatus.—

One advantage of the nickel-iron type of battery is that it cannot be damaged by a heavy discharge or an overcharge; even a short circuit has no harmful effect on the plates. These are very robust, as they consist of steel, will not buckle, and there is no possibility of loose paste falling out.



Discharge curves of the Milnes 120-volt H.T. unit.

For a battery of given voltage it is necessary to employ more cells than would be the case in a lead-type storage battery, since the E.M.F. of each cell, when fully charged, is of the order of 1.4 volts only. The bulk is not greatly increased, as can be seen by the size of the 120-volt unit, which, together with switch, measures 13⅜in. × 9⅝in. × 4¾in. high. For discharge purposes contact is made by attaching clips to the group-connecting leaves; these are rendered accessible by cutting a longitudinal slot in one of the side members of the crate. Intermediate tappings in steps of 10 volts up to the total of 120 volts are available.

The sample unit was given a prolonged test, the discharge being started at the rated maximum of 50 mA. Discharge was continuous and not intermittent, as is usually the case when testing dry-cell H.T. The initial charge was made from an 8-volt accumulator with a resistance in series.

The first discharge is shown by Curve 1 on the graph; from this the ampere-hour capacity of the unit can be computed. It will be seen that if the discharge is carried until the E.M.F. is down to 1 volt per cell—98 volts in all—a capacity of 205 milliampere-hours is available. The next charge was made from a 6-volt battery, the starting current being approximately 2 amps., but this fell rapidly to 1 amp., and then more gradually, until after an all-night charge only a few milliamps were flowing into the unit. Curve 2 on the graph shows the second discharge, which, on the same basis as the first test, shows a capacity of 190 milliampere hours. The test was repeated, and Curve 3 resulted.

It appears that the ampere-hour capacity slowly declined with this mode of charging; nevertheless, the over-night taper charge will be more than sufficient to keep the battery in good trim for ordinary use. Occasionally the battery should be given a heavier and longer charge at a higher rate to retrieve the capacity. No damage is caused by heavier currents, the limit being reached when the oil commences to froth. This should not be allowed to spill over the tops of the tubes.

The makers are Milnes Radio Co., Cottingley Bridge, Bingley, Yorks, and the price of a 120-volt unit is £4 5s. There is a 90-volt set costing £3 10s., and a 150-volt model at £5.

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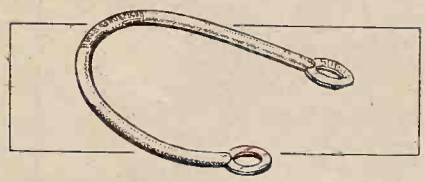
MAGNUM SPAGHETTI RESISTANCES.

Magnum Spaghetti resistances are so named as in appearance they resemble somewhat the succulent comestible of this name. The resistance is housed in a piece of yellow insulating sleeving terminating in circular washers provided with a hole large enough to pass a 2 B.A. screw. They are flexible, and will accommodate themselves comfortably between any two components used as anchorage points. Standard values range from 1,000 ohms to 50,000 ohms, and the price is 1s. 6d. in each case.



Magnum Spaghetti resistance of nominal value 5,000 ohms. It measures 5ins. between fixing poles.

Those from 1,000 ohms up to and including 40,000 ohms are rated to carry 10 mA., and the 50,000-ohm size is stated to carry 5 mA.

A 5,000-ohm sample was measured, the actual resistance being found to be 5,500 ohms.

The makers are Messrs. Burne-Jones and Co., Ltd., Magnum House, 296, Borough High Street, London, S.E.1.

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LISSEN VARIABLE MICA CONDENSER.

This condenser is of the semi-variable type, and intended for use where a continuously variable component is not required, although occasional change in the capacity may be required from time to time. It is housed in a bakelite moulding designed for either horizontal or vertical mounting, and the adjustment is provided with a locking device which enables the spindle to be fixed when the capacity desired has been determined.

Lissen variable mica condenser of the preset type.

A sample tested, nominally rated at 0.001 mfd. maximum, showed a minimum capacity of 0.000139 mfd. and a maximum of 0.000914 mfd. Change in capacity is obtained, as is usual with this type of component, by compressing a sandwich consisting of sheets of springy metal interleaved with sheets of mica.

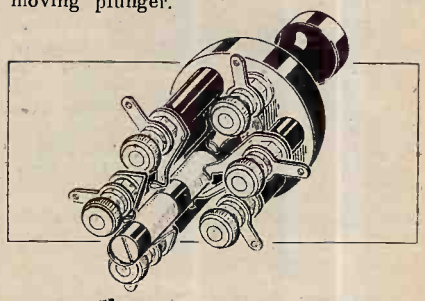
A condenser of this type requires to have a rigid back plate to withstand the pressure applied to the sandwich, and in this respect the Lissen version could be slightly improved, as the back plate is rather flexible, consisting of a piece of thin fibre sheet. A moulded cover plate would confer a real advantage and assure that the condenser would not change its capacity owing to bending of the back-plate under the continual strain of the pressure on the sandwich.

The makers are Messrs. Lissen, Ltd., Worple Road, Isleworth, Middlesex, and the price of the 0.001 mfd. size is 2s. A 0.002 mfd. size costs 3s.

o o o o

MELBOURNE SWITCHES.

These switches are made by the Melbourne Radio Supply, Norwood Buildings, Hatherley Road, Walthamstow, London, E.17, and function on the push-and-pull principle. The body consists of a circular disc of ebonite 1¼in. in diameter and $\frac{3}{16}$in. thick, in the centre of which is mounted a single-hole fixing bush. This acts also as a guide for the moving plunger.



Melbourne D.P.D.T. push-pull change-over switch.

The single-pole change-over pattern is fitted with three spring leaves, one of which is always in contact with the metal sleeve on the plunger. The remaining leaves contact alternately. An even pressure is maintained by adopting the same sized spring in every case, and this necessitates mounting some of the contacts on pillars. The pillar supporting the constant contact leaf is tinted red as a ready means of identification. In the S.P.D.T. model, which costs 1s. 6d., the fixing bush is not insulated from the contacts, but in the case of the D.P.D.T. type, which is sensibly the same as the S.P.D.T. but with a double set of contact springs raised above the first set, the bush is fully insulated. This model costs 2s. 6d. Indicating plates are supplied with every model.

Letters to the Editor.

The Editor does not hold himself responsible for the opinions of his correspondents.

Correspondence should be addressed to the Editor, "The Wireless World," Dorset House, Tudor Street, E.C.4, and must be accompanied by the writer's name and address.

CARRIER WAVE INTERFERENCE.

Sir,—Many important and far-reaching results have been born of the consideration of what have apparently been simple happenings (to wit, Stevenson and the kettle—Newton and the apple—Galileo and the metal balls dropped from Pisa's leaning tower—etc., etc.). I hope, therefore, I may be excused for putting forward a line of thought which a simple every-day happening has suggested to me.

I have, since its inception, taken a keen interest in the reception of broadcast programmes, and have spent altogether many thousands of hours searching for some improvement which shall lead to better reproduction, and I think I can safely lay claim to an "outfit" which, although perhaps untidy in appearance, does nevertheless give really fine reproduction.

Low-frequency amplification can, with fair ease, be made audibly (and very nearly scientifically) perfect, and the "diode" rectifier does not distort. Were there only one transmitter on the air, all would agree that practical perfection would be possible—but, alas, frequency separation, to use an Americanism, "has us beat."

The band-pass filter has its advantages, but it has two inherent disadvantages:—

(1) Frequencies over, say, 5,000 cycles are eliminated at the expense of brilliance.

(2) It varies from too sharp a cut-off at one end of the frequency scale to a deplorable double-hump with an intervening, and equally deplorable, dip at the other end.

There are other minor disadvantages, but these need not be touched on here.

To come to the point of this letter—supposing we are "tuned in" to the London Regional wavelength and have so flattened our response for the sake of realism that we receive a slight background from some foreign station or stations; then let us await the closing down of London Regional. For some moments we receive the unmodulated carrier, and with it the background just referred to. It has been our wont to picture such interference as shown in the diagram, Fig. 1, the base line depicting the audibility level, the dotted line the interfering station, and the dark line, London Regional. The shaded portion has seemed to represent the interference.

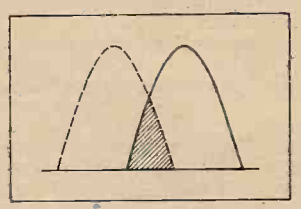


Fig. 1.

Now, were this so, we clearly should receive the unwanted station (weakly, of course) when the carrier wave from London Regional ceases.

But this is not the case, for as soon as the carrier ceases all is silent.

Carrying this to a logical conclusion, it becomes apparent that—

(a) The London Regional carrier has been responsible for the interference.

(b) Corollary—if we eliminate the fundamental frequency of a carrier we also eliminate the modulations thereof.

Now let us consider the position in practice. We have, say, three stations, A, B and C, working on frequencies of 991, 1,000 and 1,009 k.c. If the centre one were required, we should, using the best "band-pass" method of selection, accept all frequencies between 995½ and 1,004½ k.c.—but then, alas, the brilliance!

But, supposing we "go one better" and sharply reject at 991 k.c. and 1,009 k.c., at the same time tuning flatly to 1,000 k.c., as in the circuit, Fig. 2, the 1,000 k.c. acceptance, as indicated in Fig. 3 (*a*), is thereby cut on both sides and becomes as Fig. 3 (*b*).

By making our 991 k.c. and 1009 kc.. tuning circuits really sharp we approach very nearly to a curve 18 k.c. in width (and, therefore, retaining frequencies up to 9,000 cycles properly—a *very much* more desirable feature than retaining up to 4,500 cycles only), and of ideally perfect shape.

Interference from stations at 982 k.c. and 1,018 k.c. will be above audibility, and can, therefore, be ignored.

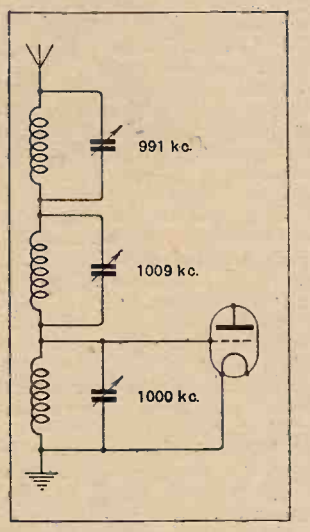


Fig. 2.

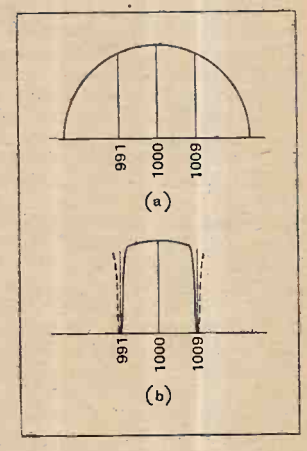


Fig. 3.

The 991 k.c. and 1,009 k.c. circuits, being extremely sharply tuned, offer very little impedance indeed to the 1,000 k.c. carrier and consequently there is really negligible loss in efficiency.

W. S.

RADIO SERVICING.

Sir,—I should be glad if you would allow me a little space to add my quota to the discussion on "Radio Servicing" which has recently received considerable attention in your journal.

I beg leave to state that at least the members of the W.R.A. must be absolved from any accusation of incompetence *as far as their own districts are concerned.* Every dealer has his own district and his own particular type of trade, which calls for specialised knowledge of the sets most generally in use therein. I commenced business in the better-class type of district, but soon found that the competition from the dabbler and the managing-director type of person who is delighted to get stuff for all his friends at trade price was too big to fight.

The course I adopted was to go to a working-class district, where the only people I had to contend with were "experts" who did not know a milliamp from a megohm, and inside a year I had built up a cast-iron connection and a reputation for almost Papal infallibility. Here is my point. After two years of 0-v-1 and 0-v-2 receivers, the only thing which keeps me ahead of my work is your excellent paper, and a lot of that is beyond me now, simply because I have not the opportunity of exercising a tenth of the knowledge I have. I can deal quickly, efficiently, and economically with any trouble brought to me by one of my customers, and I claim to be a super-efficient dealer *in my own district.* I should hesitate to set my wits against your recent correspondent, Mr. R. V. Jones, who could probably suggest improvements in the Science Museum Receiver, upon which I look with feelings akin to reverence. If he, however, were to come to Aston and make the round of my clients he would find that they

would take my word against anybody's on the subject of the simple sets which, for financial reasons, they have to use.

The examination question is at present engaging the attention of this Branch, and I hope to draw up the papers for the first examination during the next week. Mr. Jones will realise, however, that a tremendous latitude must be allowed. If one standard paper is set for all candidates and every entrant is expected to get a high percentage of marks, the papers must be easy to be fair. If they are too advanced the majority of dealers will fail, and the examination will defeat its own object.

What we propose to do, therefore, is to make a reasonably simple set of questions upon accumulator charging, Ohm's Law, fault finding on straight sets, knowledge of correct values for associated components, effects of varying anode resistance on performance of valves, etc., etc., and then to add to these certain "honours" sections on advanced theory dealing with multi-stage H.F. work, all-mains sets, P-A work and the like. Then a dealer will be able to pass the examination if he is capable of running a service depot at all, and to obtain honours standing in the subjects which he has made his particular study.

I trust that this will suffice to show that the Wireless Retailers' Association, at least, is conscientiously working to ensure that the man in the street shall have evidence, before entering a shop, that the owner has sufficient knowledge to give him the assistance or technical advice he needs.

One last point. Mr. Jones refers to "enormous profits." I have been about an hour on this letter, and for three-quarters of that time a customer has been in the shop. My head assistant has been with him all that time selling him a 14s. dry H.T. battery. He, the customer, came in for a four-and-sixpenny one, which would, of course, be all right for working a single-valve set, but not the slightest use for what the customer required. It is the first time he has been in the shop, and my man finds that he has a three-valve 0-v-2 set, which he runs off two 60-volt H.T. blocks. When his results go off he replaces the older of the two. It took forty-five minutes to convince him that it would be folly to spend 4s. 6d. on a 60 and very wise to spend 9s. 6d. more on a *good* 100. We have done the customer a service, and our overhead charges are 1s. in excess of the "enormous profit." This is not an isolated instance. We can say with truth that components are more often a loss on paper than a profit. Of course, it does not actually work out so in fact, because the customer is probably a regular one for battery-charging, and in spite of the rigorous supervision necessary to make this service efficient it is still possible to make a good profit. *But* (and it is a very big "but") the dealer's real profit bears no more relation to his re-sale discount than the average home constructor's set does to the designer's version of the same circuit.

J. WELLINGS.

(Chairman, Birmingham Branch, Wireless Retailers' Association.)

Sir,—The letters on "Radio Servicing" have been of interest, apart from a purely business and technical point of view.

Personally I have occasionally been bitten by a dealer, but that fact does not affect my testimony that the majority are hardworking and painstaking individuals whose services are intelligently and often generously given. There are one or two special aspects of their work which are often overlooked in discussions of their defects and virtues.

First, wireless is a new craze. Seldom has a new interest made at once so universal and scientific an appeal, and extended and developed at so rapid a rate. In addition to being new and scientific, it is more than averagely technical, and, from the viewpoint of the public, complex.

Such a specialised hobby has demanded a new army of dealer-mechanics. Some have proved failures, scientifically and temperamentally, and therefore also from a service point of view.

But many others have studied their subject, and have striven well, and have also failed—why? Simply because the practice of wireless, as of other scientific pursuits, requires not only knowledge and intelligence; it demands also time, patience and industry—art as well as skill.

Now these last are not very "financial" commodities in this cheap-jack generation. A public devoted to its hire-purchase commitments and its other economic troubles resorts inevitably to cut prices. There are none so blind as they who cannot afford to see; so the dealer who spends an hour or more hunting for a faulty connection may find his expenditure of time and patience unrewarded and unsung. In other words, the supply of brains may easily exceed the economic demand.

Of course the dealer suffers from these drawbacks no more than the inventor and other men of science.

As a professional man I have no intention of advising him that scientific wireless dealing, like other forms of virtue, should be its own reward. But there are two suggestions which may seem worthy of the average dealer's consideration.

The first is, scrap the hire-purchase credit system, since its economic effect has been to mortgage many persons' incomes to the limit.

Second, present every customer with a tariff or price list not only of things stocked but also of services available, and make it a tariff which will demonstrate clearly to the most unsophisticated person that time as well as skill is money, and that brains no less than goods are economic commodities to be sold and paid for at an economic price.

I write above of what I know, but there may be no harm in suggesting that the present defects of radio servicing arise mainly out of the present universal "hard-upness," and that the larger solution is for everyone, trade and public alike, to anticipate and recreate that revival of trade and prosperity which politicians continue cleverly to diagnose but fail to cure.

London, W.9. ALEXANDER BALDIE, M.B.

BEDLAM IN THE HOME.

Sir,—*A propos* the article under the pseudonym of "Free Grid." From his remarks I take it I am included in the section of radio enthusiasts toiling under the alleged false impression that true reproduction must go hand-in-hand with volume, and by still employing 120 volts grid bias (which is not free) it would appear that I am on the reckless road to (*a*) Bedlam in the home, (*b*) ditto in the police court, (*c*) the acquisition of a candidature to any of the recognised homes of rest. Nevertheless, I shall not dispense with a single volt of my grid bias, as I fail to understand how any sane person can enjoy a grand organ recital at the volume of a mouth organ, or a violin resembling the vocal efforts of a bronchial mouse.

I quite admit it would be ridiculous to invite the Queen's Hall orchestra to occupy a corner of a drawing-room, but "Free Grid" apparently lacks any sense of proportion, for any normal set giving an undistorted output of, say, 10 watts will not render anywhere near the volume to compare with the Queen's Hall orchestra at the Queen's Hall.

I certainly agree that there are a large number of establishments using very much out-of-date demonstration speakers and sets, and in some cases using first-class apparatus coupled with a cub's experience, and hence the lion's roar.

In my district I know of at least four loud speakers worthy of their name, and which have justly earned the admiration of the man in the street, and which have definitely created a demand for better radio.

About the "lack of interest" to which "Free Grid" refers, from experience I do not think the shopkeeper and his assistants are to blame, always assuming that the shopkeeper understands his trade and employs qualified assistants; the point of view of the salesman should also be considered, for, after all, he is only human. A short time behind the counter would, I am sure, convince "Free Grid" that the life of the salesman is not all roses.

To give an example. I know of a certain "customer" who asked at the local store for the circuit of a mains unit. On being told that this, together with advice, would be supplied free with the components, he boldly replied that he could get the parts wholesale from a friend in the game.

This kind of thing is a daily occurrence, yet in spite of this they still retain their good name.

My experience with watchmakers is almost as bad as "Free Grid's" experience with wireless retailers, but I consider this my misfortune, and do not condemn the rest of the trade. No doubt I shall sooner or later discover a watchmaker who understands the inner workings of a watch.

In conclusion, I regret that "Free Grid" has been rather unfortunate, but from his very biased remarks my sympathy goes to the wireless shopkeeper.

Holloway, N.7. VOLTAGE WHERE IT IS DUE.

READERS' PROBLEMS.

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

An Interesting Point.

I understand that by varying the value of the grid resistance in an R.C. stage it is possible to vary the frequency response. I fail to understand, however, why varying the value of the anode resistance does not have the same effect, since it is obvious that it is only in parallel with the grid resistance. T. D. R.

Your difficulty arises from the fact that you have supposed that the anode resistance is in parallel with the grid resistance, whereas actually this is not quite the case, as will be seen on reference to Fig. 1. In this diagram R_1 represents the anode resistance, C the coupling condenser, and R_2 the grid resistance. It will be obvious at a glance that C is in series with R_2 and R_1 is in parallel with both of them. It is because R_1 is thus in parallel with both of them and not with R_2 alone that no serious change in frequency response is brought about by varying it. C, of course, may be considered as an ordinary resistance at any given frequency, and the degree to which this given frequency is passed on to the grid of V_2 will depend upon the relationship between the reactance of C and the resistance of R_2 at that particular frequency. It will be obvious that the frequency response will be changed if either C or R_2 is altered. If, however, the reactance of C is raised or lowered by the same amount that the resistance of R_2 is raised or lowered, then no change in the frequency response can take place. For the purpose of argument we are ignoring such things as the grid-filament capacity of V_2, etc. The resistance or impedance of C at any given frequency is, of course, inversely proportional to its capacity. When R_1 is altered in value things are exactly the same as if both C and R_2 were simultaneously altered in value by the same amount. It will be obvious, therefore, that all that happens when R_1 is varied is that the amplification at all frequencies is altered. Here again we are ignoring such factors as the plate-filament capacity of V_1.

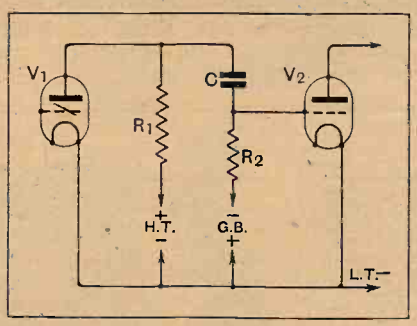


Fig. 1.—Showing that the anode resistance is in parallel with grid condenser and leak in an R.C.C. amplifier.

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An Acute Interference Problem.

As you will see from my address, I live less than twenty miles from Daventry; it is found that interference from the Midland Regional transmission renders it impossible to receive Langenberg—a station to which I especially wish to listen.

I have tried a two-circuit aerial tuner, but with only partial success. Do you think it likely that a capacity-coupled input filter would be any better? It seems to me that this kind of filter offers no great advantages (as far as selectivity is concerned) at the upper end of the broadcast band, because, according to published statements, tuning tends to become broader as wavelength is increased. J. S. W.

It is unlikely that a filter will give any greater selectivity than a properly operated two-circuit tuner of equally good design, although it has advantages in other directions.

We do not like to be discouraging, but your problem is an exceedingly difficult one, as there is only 9 kilocycles separation between the two transmissions; we see that the stations lie in different planes, so the best way out of the difficulty seems to lie in the use of a frame aerial, giving directional reception.

In any case, if you adopt band-pass filters—more than one will certainly be necessary unless a frame is used—you must be prepared to sacrifice some of the higher modulation frequencies. To allow the normal peak separation of 10 kilocycles will clearly be impracticable, and so you will find it necessary to use a coupling condenser in the order of 0.04 mfd., depending on the design of your coils.

Incidentally, we would point out that it is wrong to assume that the capacity-coupled filter is inherently unselective at the upper end of the tuning scale; this is only true when a fixed value of coupling condenser is used.

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Eliminator as Battery Charger.

I have an H.T. eliminator with a valve rectifier capable of giving 60 milliamps. at well over 200 volts. Would it be possible to use this instrument to charge a 120-volt H.T. accumulator battery, and if so, how should it be connected? R. T. E.

The output of the rectifying valve in your eliminator could certainly be used for recharging an H.T. accumulator, but the process will be slow.

There will be no need to make any internal disconnections in the eliminator. The procedure is to join a lead from the centre tapping of the H.T. winding of its power transformer to the negative terminal of the battery; another wire from the rectifier filament (or the centre tapping of its transformer secondary winding) must be taken to the positive accumulator terminal, via a milliammeter and a regulating resistance in series.

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.*

A selection of queries of general interest is dealt with below, in some cases at greater length than would be possible in a letter.

The Service is subject to the rules of the Department, which are printed below; these must be strictly enforced in the interest of readers themselves.

FOREIGN BROADCAST GUIDE.

BUCAREST

(Rumania).

Geographical Position: 44° 25′ N. 26° 6′ E.
Approximate air line from London: 1,302 miles.

Wavelength: 394 m. Frequency: 761 kc. Power: 12 kW.

Time: Eastern European Time (2 hours in advance of G.M.T.).

Standard Daily Transmissions.

16.00 B.S.T. (Sun.), 17.00 (week-days) concert and news; 18.30 gramophone records; 20.00 main evening programme; opera (Thurs.); 21.15 dance music (Sun.); 21.45 news and close-down (week-days).

Woman announcer. Opening and Interval Signal: Ticking of metronome (about 3 beats per second) Call (phonetic): *At-tent-see-oon-aye ah-ceetch rah-dee-owe-Book-ou-recht.*

Announcements are usually made in French, Italian and German as well as in Rumanian.

The studio terminates its nightly transmission with gramophone record of Royal Anthem sung by mixed choir and the good-night greeting: *Buna Seara tuturor.*

Grid Circuit Modifications.

My three-valve H.F.-det.-L.F. receiver, with indirectly heated valves, is fed entirely from A.C. mains, except that dry batteries are used for grid bias. I now propose to arrange for automatic bias, and, if possible, should like to use a 1,000-ohms potentiometer already in my possession. I believe that this will provide the necessary voltage drop for biasing my M.L.4 output valve, and that negative voltage for the H.F. valve can be taken through the slider. The detector works with a zero grid, so need not be considered. With maximum H.T. voltage applied, the M.L.4 is rated to consume 19 mA. when biased to 22 volts.

Will you please give me a circuit diagram showing the appropriate grid circuit connection? W. M. M.

Making a normal allowance for the H.F. and detector valves, and taking the figure you give for the L.F. valve, the total anode current of your receiver may be assumed to amount to 25 mA. at least, which will develop a bias voltage across your 1,000-ohm resister of 25 volts for the last valve. This is rather on the high side, but it should be easy to adjust matters by removing a few turns of wire from the resistance winding.

Apart from this minor difficulty, your proposal is quite sound; the potentiometer should be connected in the manner shown in Fig. 2. It may be pointed out that, under operating conditions, the slider should make contact with the resistance element at a point quite near to the end joined to the cathode bus bar.

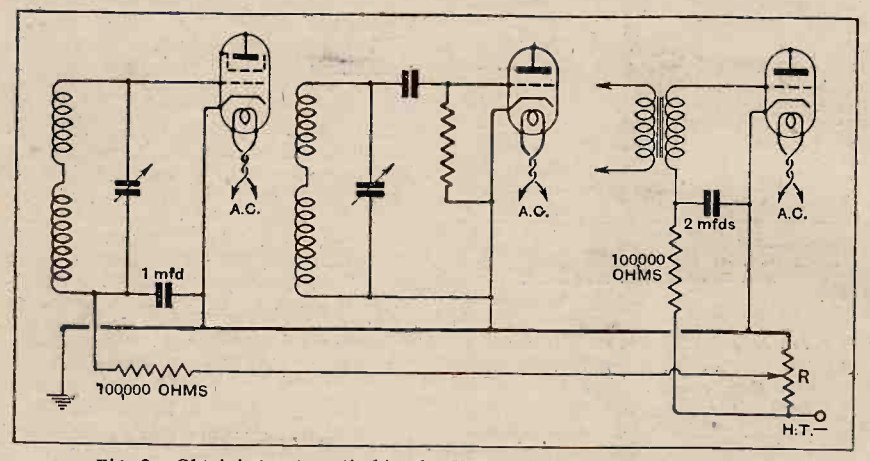

Fig. 2.—Obtaining automatic bias for H.F. and output valves by the use of a potentiometer.

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Matched Filter Circuits.

Would any advantage be gained by providing critical coupling adjustment (by means of a series variable condenser) between the aerial and the input circuit of a filter? If so, will you please give me some hints as to how this condenser should be set? R. H. H.

In order that satisfactory single-control tuning of the two component circuits of a filter may be achieved, it is desirable that the proportion of the total aerial capacity which is transferred to the first circuit should more or less balance the valve capacity which is in parallel with the second circuit. This can be done by choosing a suitable setting for the aerial series condenser.

Further, the height of the two tuning peaks of a filter circuit should be sensibly the same; any differences can readily be detected by noticing the relative deflections of a detector milliammeter while the circuit is being tuned through resonance. For this reason it is an advantage that damping due to the aerial should be adjusted (by alteration of coupling) to match that imposed by the valve.

It is seldom difficult to find an adjustment of coupling that allows a reasonably good compromise between the requirements of matched capacities and matched damping; we may add that the use of an aerial input coil with a number of tappings is a satisfactory alternative to the variable series condenser.

Increasing Transformer Output.

I have made the power transformer described in "The Wireless World" of January 22nd, and have modified it in the manner suggested in the constructional article by replacing the 6-volt winding by one capable of supplying 3 amps. at 4 volts. I now wish to draw 4 amps. from this L.T. secondary. Will you please tell me what modifications should be made?

A quantity of wire of each of the gauges specified for the original construction is available; and, as special instrument wires are not easily obtainable locally, I should prefer to make the alterations without using another size of wire, if it is possible to do so. R. C. L.

As you already have a supply of wire of the gauges as recommended, it is suggested that you should wind two extra turns of No. 18 D.C.C. wire on each L.T. secondary bobbin. But we would point out that the voltage regulation of this output, when modified in this way, will not be as good as before; if possible, we advise you to obtain some No. 16 wire, and to wind the same number of turns as originally specified for each coil.

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Failing Eliminator Output.

Although my H.T. battery eliminator (A.C. mains) is nearly two years old, its output, as far as the "power" terminal is concerned, seems to be undiminished, but I can detect a very considerable falling-off in voltage at the remaining two terminals. Even though the controlling variable resistances are set at minimum, output voltage seems to be insufficient, except for the last valve.

Do you think it likely that the rectifier valve has lost its emission, or can you suggest any other probable fault? B. P. T.

If the output of your rectifier had fallen off considerably, this would be reflected in a lowered voltage of the main H.T. supply, and so we do not think that this is responsible for your trouble.

It seems much more likely that the controlling resistances have developed a defect, and that their ohmic value, when set in the "minimum" position, is very much greater than it should be. Troubles of this sort are particularly likely to arise when variable resistances of the compression type are used.

o o o o

Differences in Coil Design.

Is there any basic difference between coils designed for use in conjunction with battery-heated and indirectly heated S.G. valves? I ask this because, although I have no mains supply, I am often tempted to try circuit arrangements described in connection with A.C.-operated receivers. F. S. F.

There is no essential difference, but it so happens that most indirectly heated valves have a higher impedance than their battery-heated counterparts, and so, to attain maximum magnification, the primary windings of intervalve H.F. transformers should have more turns. However, as A.C. valves are the more efficient, it is unusual for designers to strive after the utmost possible stage gain, which, even if attainable, may be embarrassingly high, and so we find in practice that coils may often be interchanged.

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Filter Circuit Adjustments.

It has been suggested in your pages that it is convenient, when making initial adjustments to a capacity-coupled filter, to loosen coupling between individual circuits by temporarily fitting an extra large mutual condenser. Is there any corresponding way of dealing with a filter coupled by mutual inductance? R. J. T.

In this case the equivalent course of procedure is to replace the coupling inductance normally used by one having only two or three turns. Alternatively, one can connect this coil in parallel with the coupling inductance included in the receiver. This latter method of loosening coupling is probably the most convenient, as the extra coil may easily be clipped in position without disturbing existing leads.

With a still lower impedance than type P.M.256, the Mullard P.M.256A definitely meets the demand for an output valve capable of handling large signal voltages without danger of overloading, and of delivering sufficient power for operating all forms of speaker including the moving coil type.

Its excellent performance is obtained at the very moderate anode voltage of 200, while the filament consumes only 0.25 amp. at 6 volts which may, if desired, be obtained by a step-down transformer from the A.C. electric light mains.

The amplification factor (3.6) indicates that the P.M.256A is particularly suitable for use in sets where large signal voltages are built up by the previous stages of low frequency amplification.

Mullard

THE·MASTER·VALVE

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

Arks.

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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.

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RECEIVERS FOR SALE.

SCOTT SESSIONS and Co., Great Britain; 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

OSRAM Music Magnet Four Kit; £9/12/6.—Hawksley, 62, Nith St., Reddrie, Glasgow. [1782

PHILIPS 3-valve Screen Grid and Pentode Battery Receiver, type 2502, complete with valves and makers' guarantee for 12 months; must be sold, no reasonable offer refused.—Box 7808, c/o *The Wireless World*. [1786

Receivers for Sale.—Contd.

Receivers for Sale.—Contd.

NATIONAL Portable Five, complete, just delivered from makers; bargain, £10.—Frankling, "Acacia," Temple Rd., Epsom. [1790

EVERYMAN Four, 6v., and H.T. accumulators, excellent condition; £12, or nearest; stamp particulars.—Frisby, 40, Coldcotes Av., Harehills, Leeds. [1788

MARCONI Superhet Model 82, complete, good condition numerous accessories. including mains unit, accumulators, 2 speakers; sacrifice, 20 guineas; —Full particulars from Captain X., c/o F. T. Harris and Co., Bude. [1808

RECEIVERS Constructed, corrected, modernised, installed, any type or make, components supplied cheaply..—Particulars, Radio, 75, Woodland Rise, N.10. [1800

OSRAM Music Magnet, 2S.6., det. and L.F., professionally built from specified parts and adapted for pick-up, complete with 2 volt valves, and never been used; £8.

ECKO 1 amp. L.T. Unit, in perfect order; £5.

PYE. 3-valve all A.C. Mains Set, S.G., det, and L.F., provision for pick-up, complete with valves, faultless; £11.

RADIELLE Heavy Duty Eliminator, in excellent order. 3 variable and 1 fixed tapping, and 5.25 volt output for L.S.5A or similar valves, total output 100 milliamps at about 350 volts but whole output can be controlled by master rheostat, for 220-240 A.C. mains; £9.

MULLARD Eliminator for A.C. 220-240 mains, 180 volts 30 milliamps; £2.

PHILIPS Eliminator, as above, with slightly bigger output; £2/10.

CAN be Seen Working by Appointment, or "W.W." deposit for approval.

H. B. WARE, The Beacon, Crowborough, Sussex. [1796

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

EVERYTHING Third Cost Price.—Burne-Jones special built receivers, 2 R.I.R.C.C. stages, R.I. push-pull output, P625A, P625, P.M.5X, valves, wired for gramophone pick-up, exceptional tone and range (£15), Ecko 100 m.a., 200-250 D.C. eliminator (£3), 9 Peto-Radford gravity float L.T. accumulators (10/- each), 6 Sifam meters, 200v., 6v. 3 amp., 100 m.a., 20 m.a. 2 m.a., (10/- each), Goldtone 3 amp. charger (15/-), Runbaken 2 amp. (lamp) charger (10/-), Celestion Woodroffe pick-up (30/-); cost over £75 new, accept £22/10 lot (genuine bargain).—Tetley, 9, Prince of Wales Terrace, London, W.8. [1836

IDEAL Home Receiver ("Wireless World," March 19th), constructed London experts, fine cabinet; cost £17; unnecessary new address; cash offers.—Blood, "Whitcot." Church St., Eye, Suffolk. [1835

A.C. Mains Radio Gramophone, 200-240 volts, £10; also 3-valve battery set with valves, batteries, cone speaker, £3/10.—89, Gipsy Hill, Upper Norwood, S.E.19. [1827

ACCUMULATORS—BATTERIES.

WET Battery Replacements, new process sacs, approximately 30,000 m.a.; 2/6 per dozen; particulars free.—Scottish Batterics, Braeside, Uphall Station. [1728

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

GUARANTEED H.T. Batteries Direct from Factory to You.—The Constant H.T. battery at factory prices, 40% less than other well known batteries: 66 volt battery, 4/9; 99 volt battery, 6/9; 108 volt battery, 7/6; 120 volt battery, 8/9; each battery has a guaranteed life of 250 hours at a discharge of 10 m.amp; postage 1/6.—The Constant Battery Co., 80, Marchmont St., W.C.1. [1820

120V. Exide Battery, with 220v. trickle charger; 35/-.—Bryant, 2, South Ridgway Place, Wimbledon. [1819

ACCUMULATOR HIRE.

DON'T Buy Dry Batteries, join our service; we keep you continuously supplied with fully charged C.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 B2, post free.—Radio Service (London), Ltd., 105, Torriano Av., Camden Rd., N.W.5. 'Phone: North 0623 (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 HT., 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

ELIMINATOR Kits, transformer, choke, condensers, valve, valve holder, resistance, terminals; 36/-, post free.—Fel-Ectric Radio, Garden St., Sheffield. [9963

ELIMINATORS.—Don't build an eliminator before seeing our lists; A.C. units, from 28/6, 25 M.A.; mains transformers, 220+220, 20 M.A., 2+2, 14/-; 270+270, 50 M.A., 2+2, 2 amp., 2+2, 4 amp., 25/-; power chokes battery chargers; lists.—Clearvolt Engineering Co., 148, New Cross Rd., S.E.15. [1781

CLIMAX, 34/-; D.C. eliminator, guaranteed, 20/-. —Bradshaw, 9, West St., Prittlewell, Southend-on-Sea. [1797

TRANSFORMERS, 100-250, input, 250-0-250, 4v. 1A, 4v. 4A, list price £1/1.—Apply The Radio Improvement Co., Ltd., 15, High St., Marylebone, W.1. [1811

VITREOUS Wire-wound Resistances, all values; prices on application to The Radio Improvement Co., Ltd., 15, High St., Marylebone, W.1. [1812

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 C32/0, 20/-.

SAVAGE'S "Wireless World" Four Equipment, mains teransformer, 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

LOTUS All-mains Unit for Osram Music Magnet, 200-250 volts, A.C., slightly soiled only; £5.—69, Great Hampton St., Birmingham. [1841

ECKO H.T. Eliminator, type IV60, new, 110 to 240, A.C., 3 tappings, 120, 120 variable, and power, 60 m.a. output, price £3/15; Ecko trickle charger, hardly used, voltage as above, £1.—Marden, 18, Dodbrooke Rd., West Norwood, S.E.27. [1839

RADIELLE Model D.C.100 (200-250v., D.C.), output 200 volts, 100 m.a., and 2 variable tappings; cost £9/10, sell £3; brand new.—Priestley, 8, Grosvenor Gardens, Muswell Hill, London, N.10. [1828

Chargers and Eliminators.—Contd.

TRICKLE Chargers, A.C. mains, for 2- and 4-volt accumulators, no upkeep; 18/6, carriage paid.—Benoit, 4, Manor Gardens, Gunnersbury Av., London, W.3. [1823

BRYCE'S Extra Special Offer.—25 only, mains transformer, input 200, 220, 240 volts, 40-60 cycles, output 0, 80, 110, 135, 210, 230, 250 volts, 150 m.a., to suit all Westinghouse rectifiers, 4v. 3a. C.T., 6v. 1a. C.T., price 25/11, post free, guaranteed; "Wireless World" Four mains transformers, price 26/6, post free.—Bryce's, 54, Dawson St., Bury, Lancs. [1815

CABINETS.

CABINETS to Your Own Requirements; quotations by return.—Hammonds, 1, Stratford St., Nuneaton. [1234

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 Customers' 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

BEAUTIFUL Portable Cabinets, fancy wood and plain, some inlaid, clearing under cost; also rexine portables (damaged), from 4/6.—Apply 12, Mornington Crescent, N.W.1. 'Phone: Museum 9247. [1441

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

METAL Cabinet for Record III, oak finish, with set of coils (Wearite) and variable condensers and escutcheons as specified; price £4/10, carriage paid.—R. Woodhouse, Norwood Booth Rd., Altrincham. [1837

COILS, TRANSFORMERS, ETC.

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

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. [1670

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 Four Coils, complete set; 25/-; c.o.d. or deposit.—Smith, 3, Park Parade, Harlesden, N.W.10. [1806

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

GRAMOPHONES, PICK-UPS, ETC.

B.T.H. Electric Gramophone Motors; 45/-.—Universal Radio Supplies, 77, East Rd., N.1. [1825

BANKRUPT Stock.—4 9-valve 3-stage push-pull amplifiers, in metal cabinets, size 33in. high, 19in. wide, 36in. long, containing Ferranti transformers, Pye chokes, etc., 2 Kolster Brandes electric turn-tables, 2 B.T.H. pick-up arms, Weston meters, M-L high and low tension smoothing equipment, all components as new; price £17/10 each.—Below.

THREE Ditto, resistance and choke coupled; £17/10 each.—Below.

TWO Samson 12-valve, 3-stage, push-pull amplifiers, Pam 16, in oak cases, £18 each; valves to suit same, 7/6 each.—Below.

EIGHT Metal Cabinets, size 36in. x 33in. x 19in.; £1 each.—H. Franks, 42, St. George's St., off Commercial Rd., London, E.1. 'Phone: Royal 8546. [1845

R.I. and Varley Pick-up, and special tone arm, both in new condition; 35/- the lot.—Jackson, 29, Birchwood Av., Sidcup. [1824

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

Loud-Speakers.—Contd.

BAKER'S SELHURST RADIO 36-page Booklet, "Sound Advice in Yours for the Asking"; write now for new edition; see displayed advertisement on page 23. [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

THE "Motor" Chassis and Unit.—True reproduction over the whole of the musical range guaranteed with this wonderful cone speaker, special compensating device adjusts for any input without loss of quality; price 47/6 cone and chassis, unit only 26/-; cash with order, which will be willingly refunded if not satisfied within 7 days; we ask you to compare this instrument with any moving coil.—Reproducer Distributing Co., 21, Station Buildings, Acton St., London, E.8. [1809

DEMONSTRATION Model 1930 Epoch, permanent magneto moving coil, 99 P.M. pentode coil, guaranteed perfect; £4/10.—S. G. L., 49, Clifton Rd., Liverpool. [1793

UNDY 8-pole Dynamic Unit and Chassis, as new; cost 50/-, bargain 35/-.—Clarke, 29, Tipton St., Sedgley, Staffs. [1792

IRISH Linen Loud-speakers, 20×20, 1/6; 22×22, 1/9; 24×24, 2/-; post free; or any size.—Irish Linen Warehouse, Hotel St., Bolton. [1831

AMPLION Lion L14 Chassis, 45/-; Ultra type P chassis speaker, 45/-.—Gilbert, 32, Sycamore Rd., Nottingham. [1822

BEL-CANTO Concert Grand Loud-speaker, condition as new; £3/10.—K. Wilson, Elm Cottage, Lamorbey, Sidcup. [1817

SAVAGE'S New Bathurst Speaker Gives Highest and Loudest Notes With Power and Quality, handsome cabinet, 3ft. 5in. high; £4.—Hear it at 18, Bathurst Rd., Wellesley Rd., Ilford, and judge whether you have heard its equal. [1757

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DIATRON and Gold Seal Tubes (American); send for prices.—Agents, Perry Co., 32, Dawes Rd., Fulham. [1804

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

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Wednesday, October 29th, 1930.

No. 583. Vol. XXVII. No. 18.

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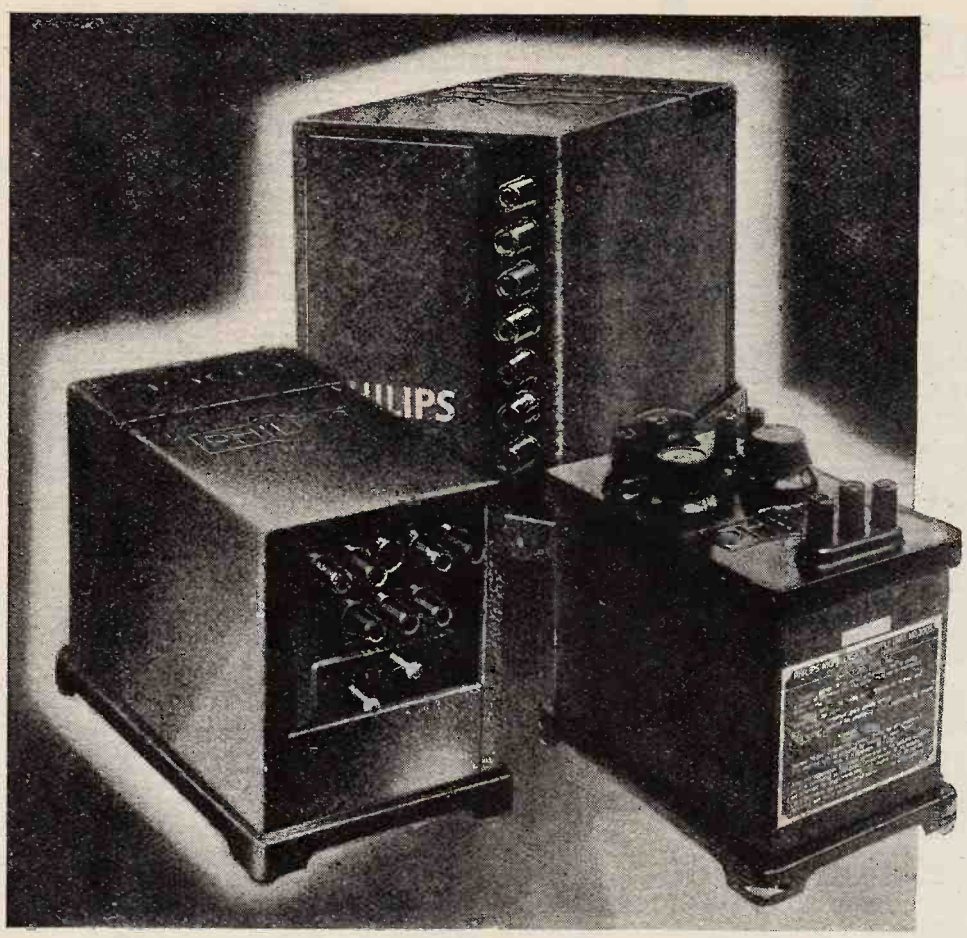

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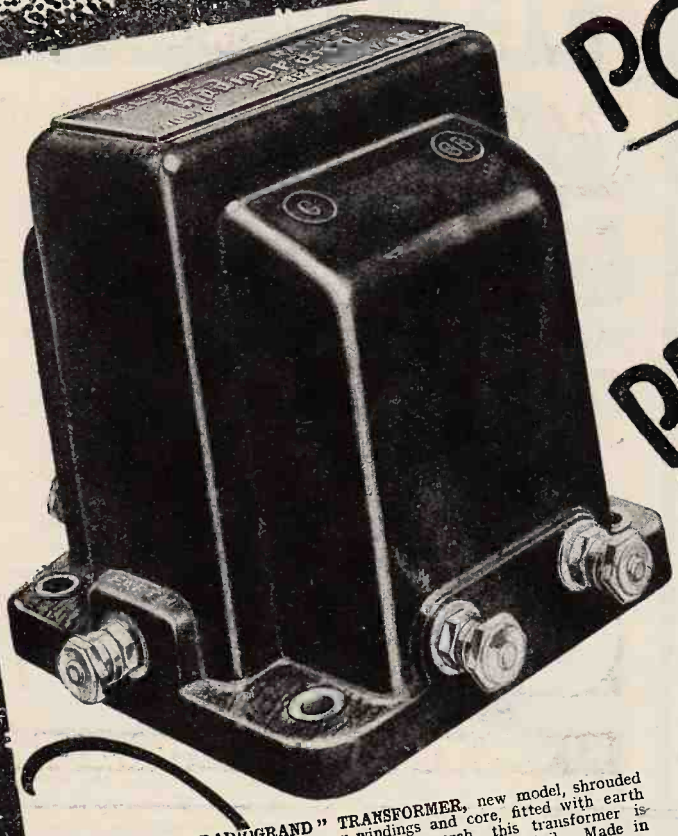

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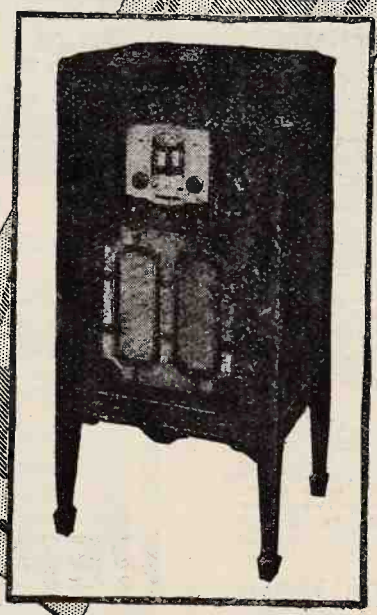

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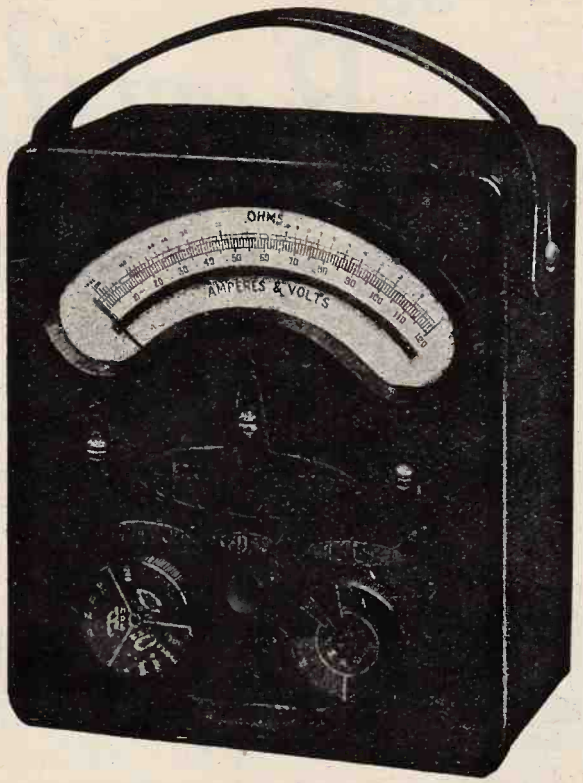

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The Wireless World AND RADIO REVIEW (18th Year of Publication)

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Olympia Competition Result

THE task of sorting out the entries for *The Wireless World* Olympia Show Competition has now been completed and the winning apparatus ascertained as well as the names of those entrants whose voting has gained for them the prizes which were offered.

It will be remembered that the apparatus at Olympia was, for the purpose of the Competition, divided into various classes and, in addition, entrants were asked to vote for what they considered to be the single outstanding exhibit of the Show. The vote has resulted in the Pye "Twin-triple" A.C. receiver being placed first as the outstanding single exhibit, and this receiver has also, as one would expect, gained first place in *Class* 1 as the best receiver. The award in *Class* 2, *Radio Gramophones,* goes to the R.G.D. Radio Gramophone de Luxe. In *Class* 3, which includes *batteries of all kinds,* the winner is the Exide "Gel-Cel." In *Class* 4, *Mains supply units,* Clarke's "Atlas" combined eliminator and trickle charger, model A.C.188, comes first. *Class* 5, *Loud speakers of all types,* Ferranti Magno-Dynamic Speaker. *Class* 6, *Valves,* Mazda A.C/Pen. In *Class* 7, which included apparatus not specified in other sections, the Jackson Bros. "Chassimount" condenser has been voted first place.

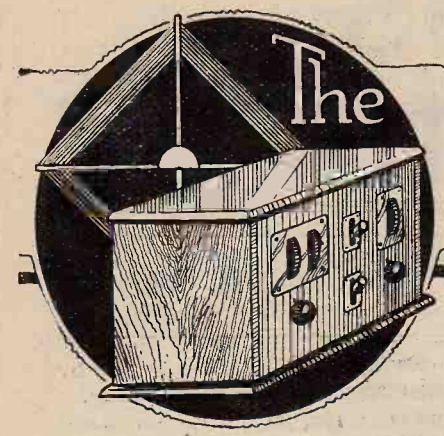
In awarding the cash and other prizes which were offered to the readers whose voting agreed most closely with the opinions of the majority, we have had to divide the prizes on account of ties. Two entrants—Mr. A. Sutherland, of Craigton, Rogart, Inverness, and Mr. R. Moir Cameron, of 4, Grange Loan Gardens, Edinburgh, tie for first place, and we have, therefore divided the cash prize of £50 between them, and also divided the second prize, which is a voucher to the value of £20, for the purchase of apparatus exhibited at the Olympia Show.

Thirteen entrants tie for second place and, consequently, the remainder of the prizes, vouchers for apparatus to the total value of £30, have been divided between the following successful entrants: E. J. B. Curtis, Bournemouth; A. B. Dilks, Bridgwater; P. F. Duncan, Hammersmith; A. J. Fairbairn, Glasgow; F. H. Grant, Leven, Fife; P. Halton, St. Albans; P. Lloyd Jones, Iver, Bucks; E. Lush, Manchester; F. Moss, Burton-on-Trent; E. Llewelyn Phillips, Chelmsford; B. C. R. Stevens, London, W.11; H. J. Whitehouse, Bromborough; H. A. Woodhouse, Woking.

The firms who are the manufacturers of the apparatus which has won first place in the various classes have already been notified by letter of their successes. Cheques have been sent to those readers who have gained cash prizes, and the remaining successful competitors have also been notified of the results.

As in previous years, we are arranging to illustrate and describe the winning apparatus in an early issue, when all readers will have the opportunity of learning more about the selected apparatus.

In This Issue



The FREQUENCY CHANGER of the SUPERHET.

The Use of Band Pass Filters and a Screen-grid Detector.

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

SINCE the operation of frequency changing is that which marks out the superheterodyne from all other types of receiver, a good deal of attention was devoted to this process in the preceding article of this series, in which the general principles of the receiver were discussed. We will therefore accept the conclusions already reached, and base the present discussion, which will largely be concerned with more practical points, on the knowledge that we have to add a local oscillation of suitable frequency to the incoming signal, rectify the resulting mixture, and collect the beat-frequency so formed from the output of the detector valve so that it can be passed on to the intermediate-frequency amplifier for further magnification. We will also presume it to be established that the oscillator-frequency must differ from that of the incoming signal by the frequency to which the intermediate-frequency amplifier is adjusted.

These remarks suggest that in considering the design of the frequency changer of a superheterodyne we shall have to work exclusively in terms of frequencies rather than in terms of wavelengths. A numerical example will, perhaps, serve to emphasise the point. If we wish to convert a 200-metre signal (1,500 kc.) to suit an intermediate amplifier working at 3,000 metres (100 kc.) we shall have to combine with it local oscillations of either 1,600 kc. (187.5 m.) or 1,400 kc. (214.3 m.) The frequency difference between signal and oscillator is in either case 100 kc.; the wavelength differences are 12.5 and 14.3 metres respectively. For an incoming signal on 2,000 metres (150 kc.) the oscillator has to be set at 50 kc. (6,000 m.) or 250 kc. (1,200 m.). Here we still have the same 100 kc. frequency difference between signal and oscillator that we had for the 200-metre example; the two wavelength differences, however, are now 4,000 metres and 800 metres. These last differences not only show no apparent connection with the wavelength differences for the 200-metre signal, but are even vastly different from one another. A survey of these figures makes it quite evident that any attempt to discuss the frequency-changer on the basis of wavelengths is going to land us in arithmetical complications of the most alarming description, whereas we need nothing much more than simple subtraction if we elect to work in terms of frequency.

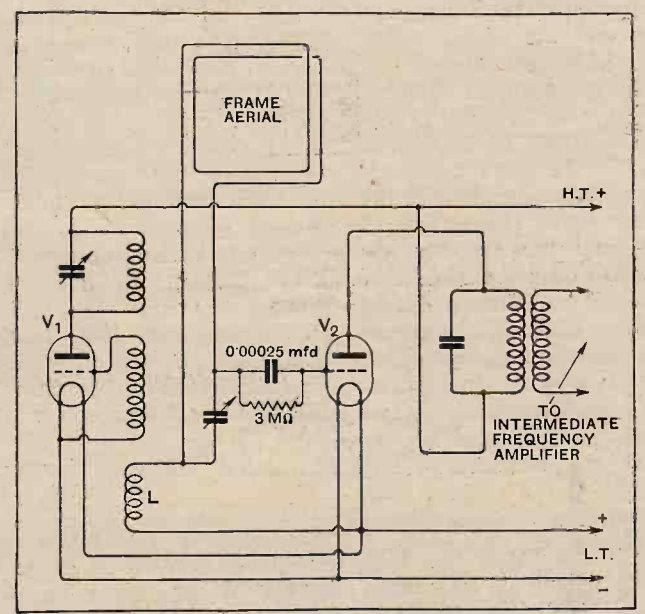


Fig. 1.—Circuit diagram of the frequency changer of an American superheterodyne (date about 1924), designed for use with UV.201a valves. L is coupled variably to the grid coil of the oscillator V_1. The valve V_2 is adjusted as grid leak rectifier.

The circuit of a typical frequency changer is given in Fig. 1, and an examination of this diagram will help to show the points which require more detailed attention. The oscillator, V_1, has to produce oscillations, as free from harmonics as possible, without consuming too heavy an anode current. These oscillations have to be fed, by a suitably designed coupling arrangement, to the grid of the detector valve V_2. It is usual to employ a coupling coil (L in the diagram) connected between the earth end of the frame and the filament of the valve. Both signal and oscillator frequencies are thus impressed simultaneously on the grid of V_2, which is adjusted for rectification. In the anode circuit of this valve there is a transformer, the primary of which is tuned by a condenser to the intermediate frequency. It is necessary to tune the primary in order that there may be a condenser of reasonably large capacity to by-pass to earth the high-frequency

The Frequency Changer of the Superhet.—

components of the anode circuit of the valve.

Although it is quite possible to combine the two functions of oscillation and detection in a single valve, fewer complications arise if we allot a separate valve to each job, for we are then able to choose and adjust each valve for the best possible results. Since the oscillations must be produced before they can be rectified, we will begin our more detailed survey with the oscillator.

Choosing the Oscillator Circuit.

The only essentials of an oscillator are that some provision should be made for feeding energy back from the plate circuit to the grid circuit, and that one or other of these circuits should be tuned. There are, therefore, many circuit arrangements that may be used; a few of them are given, each in its simplest form, in Fig. 2. Of these *a* is based on the old-fashioned single-valve set, with swinging reaction coil, and it is intended to typify also all the modern capacity-controlled variants as well. If the anode circuit is tuned instead of the grid circuit, as at *b*, more power is available, while for the greatest output a tapped anode circuit, as at *c*, may be used.

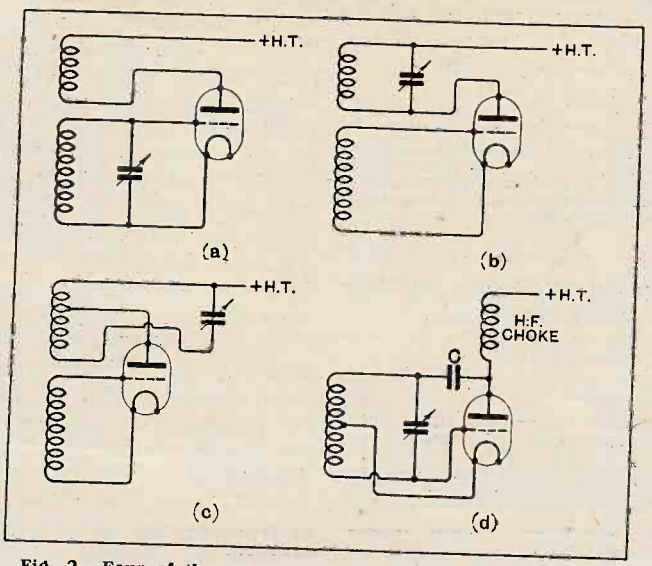


Fig. 2.—Four of the many possible oscillator circuits. Either (b) or (d) is likely to be the most convenient in practice. In (d) a variation of coupling can be obtained by adjusting the capacity of C, though at the cost of disturbing the tuning.

If it is intended to control the amplitude of the oscillation by varying the coupling between grid and plate circuits the design of the oscillator will probably be based on one of these three arrangements, but if other means of control (e.g., variations of filament or anode voltage) can be used the circuit at *d* is attractive on account of the fact that it only uses one centre-tapped coil. Range changing by replacing the coil is thus made very simple. The fact that neither side of the tuning condenser is earthed is, however, a point against this circuit, for unless some care is taken in screening hand-capacity effects may be troublesome. The Numans circuit,[1] using either an ordinary four-electrode valve or a screen-grid valve, may also be pressed into service.

On the whole, the writer would be inclined to choose circuit *b* if the mechanical arrangement of the set were such as to provide no safeguards against hand-capacity, but if a metal panel were to be used *d* would in most cases be more convenient.

The grid potential of an oscillator can be controlled in either of two ways: the simplest is to use a grid leak and condenser, the leak being taken to the negative end of the filament. If this is done, the anode current of the valve drops to a very low value as soon as it is made to oscillate, but "squegging" (intermittent stopping and starting of the oscillations at audio-frequency) is liable to occur if the amplitude of the oscillations becomes at all large. Since one is only in touch with the oscillator of a superheterodyne through a whole series of valves, it is not always easy to detect that the oscillator has started to "squeg," so that the grid condenser and leak which give rise to the effect are best avoided. When these are omitted, it is found that when the valve oscillates the plate current rises considerably above the normal or steady value; if the oscillator is not properly designed it may take plate currents up to 40 milliamps or more. The current can be brought down to 3 or 4 milliamps by loosening the coupling between anode and grid circuits, by decreasing the anode voltage, or by applying negative grid-bias. Too high a grid-bias, however, makes oscillation "ploppy," with the result that, as the coupling is slowly increased, the valve leaps suddenly from non-oscillation into oscillation so violently that a very heavy plate current is drawn. A small grid-bias, combined with smooth adjustment of either coupling or anode voltage, provides the most satisfactory compromise.

The tendency of the oscillator to produce harmonics is a point which has hardly received enough attention in the average superheterodyne receiver. If the oscillator is tuned to, say, 600 kc., it is very difficult to prevent it from producing oscillations of two, three, four . . . etc., times this frequency, so that it must be regarded as oscillating simultaneously at 600, 1,200, 1,800 . . . etc., kc. If the 600 kc. (fundamental) oscillation is beating with signals from a station on 700 kc., it will beat at the same time with signals from another station working on 500 kc., while the second harmonic beats with signals from other stations working on 1,100 and 1,300 kc., and the third harmonic with stations on 1,700 and 1,900 kc. If signals from any of these are present at the grid of the first detector, they will be passed on to the intermediate-frequency amplifier in the form of a 100 kc. beat-note, and will be heard as interference to the 700 kc. station to which the receiver is nominally tuned.

Preventing Harmonics.

It will be seen that three things are necessary before the harmonics can be troublesome. They have first to be produced by the oscillator, after which they have to reach the grid of the detector, and, finally, they have to mingle there with signals of the frequency necessary to give with them the 100 kc. beat-note to which the intermediate amplifier is assumed to be tuned. There are thus three ways in which interference from this cause can be combated, of which the first, and most

[1] See *Experimental Wireless*, December, 1924, and August, 1925.

The Frequency Changer of the Superhet.—important, is by so controlling the oscillator valve that the harmonics are minimised as far as possible. This, primarily, is a matter of operating voltages, and is most easily achieved if the oscillations are kept down to a low amplitude.

Next, we should like to arrange the feed from oscillator to detector in such a way that even such harmonics as are produced do not reach the grid of the detector. In cases where this precaution is thought necessary, an extra tuned circuit, as in the skeleton diagram of

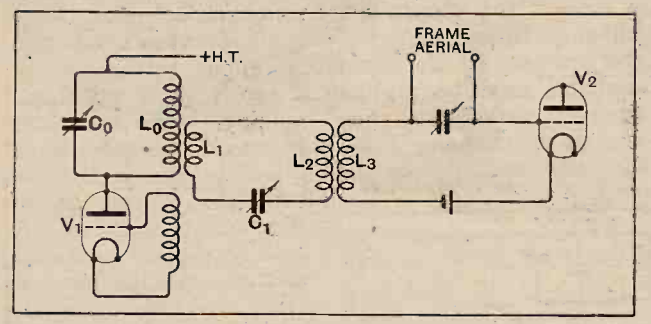


Fig. 3.—An intermediate tuned circuit $L_1C_1L_2$, interposed between the oscillator and the detector coupling coil L_3. This filters out harmonics generated by the oscillator if the coupling between L_1 and L_0 is not too tight. The condensers C_0 and C_1 may be ganged without much difficulty.

Fig. 3, may be used as coupling. Since this circuit need not be of very low resistance, it may quite well be ganged to the main oscillator tuning condenser.

Second Channel Interference.

Finally, we must take what steps we can to arrange that the signals whose frequencies are such that they can beat with the oscillator harmonics to give a 100 kc. beat-note are not permitted to arrive at the grid of the detector. Any reasonable tuning arrangement will ensure this in the case of all except the local station, which is more than strong enough at fairly short range to provide the few necessary microvolts across even a distuned frame. When the old 2LO was working, it was not uncommon for a carelessly designed superheterodyne to tune in that station in London at ten to fifteen entirely separate and sharply defined settings of the oscillator dial. Allowing for harmonics up to the fifth from both a transmitting station on 1,000 kc., and from the local oscillator, it can be shown that there are no fewer than twenty-eight possible settings within the normal tuning range of the oscillator at which the local station may be heard. Now that the Londoner has two local stations, the need for keeping a close watch on the harmonics of the oscillator has become even more insistent.

Apart from the possibility of oscillator harmonics, there is always "second channel interference." Owing to the fact that the oscillator frequency is near that of the signal, at any one setting of the oscillator there will be two signal-frequencies with which the oscillator can beat to provide the beat-note to which the intermediate amplifier is tuned. With a 100 kc. intermediate frequency, for example, an oscillator set to 700 kc. will "tune in" stations at either 600 or 800 kc. The frame aerial, however, will be tuned to only one of these, so that if the frame-tuning is sharp enough only the desired station will be heard. Usually, it is desirable to employ two tuned circuits (one in addition to the frame) in order to block the second channel more completely. The extra tuned circuit may either be coupled to the frame to make a band-pass filter, or may be incorporated in a stage of high-frequency amplification of normal design. It is an annoying fact that in neither case is it likely to be satisfactory to gang the two signal-frequency tuning condensers, because movement of the frame aerial in relation to various objects in its neighbourhood will upset its tuning.

The Detector Circuit.

Whatever input the detector may be given, its main duty is to produce as large a voltage as possible across its output circuit, which is tuned to the intermediate frequency. In an ordinary receiver the detector valve really operates both as detector and as the first audio-frequency amplifying valve, having a transformer or other audio-frequency coupling component in its plate circuit. For this reason it is necessary to choose a valve which is suitable for low-frequency amplification. In the superheterodyne the first detector may be regarded, in analogous manner, as the first intermediate-frequency amplifier. One would, therefore, select a screen-grid valve as the most reasonable one to precede the tuned intermediate-frequency coupling circuit, and the writer was not in the least surprised to find by experiment that the substitution of a screen-grid valve for a triode as first detector gave a very considerable increase in I.F. output. Apart from the fact that it requires a much smaller input from the oscillator, and that it offers the possibility of introducing the oscillations into the screen-grid circuit instead of the grid circuit, the valve is handled exactly like a triode.

In the past it has been usual to adjust the detector to work on the leaky-grid principle. In an ordinary receiver the function of the grid-condenser is to pass high-frequency currents to the grid of the valve while blocking the audio-frequency voltages that appear on

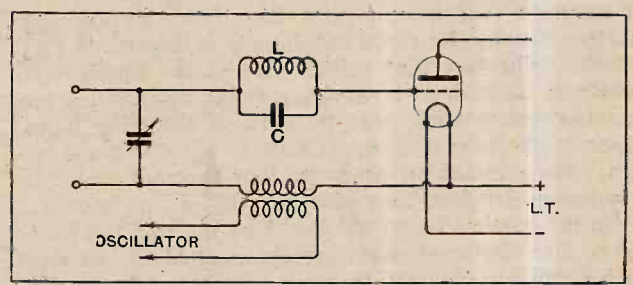


Fig. 4.—A circuit for the first detector of a superheterodyne. Here the rejector circuit LC, tuned to the intermediate frequency, replaces the usual grid condenser and leak. In this manner it becomes possible to obtain true grid circuit rectification, which does not occur when using the circuit of Fig. 1.

the grid through the rectifying action of the valve. A value of 100 to 300 micromicrofarads has generally been used to perform the necessary separation between the two frequencies. If we are going to use an intermediate frequency of 100 kc., which is twenty times the

The Frequency Changer of the Superhet.—

frequency (5,000 cycles) of the highest audio-frequency note that one usually tries to retain in an ordinary receiver, we shall need a grid condenser of about one-twentieth the usual capacity, i.e., from 5 to 15 micro-microfarads. Superheterodyne receivers, with a sublime disregard of the elementary mathematics of the situation, have generally employed 0.0002 microfarad condensers for this purpose.

It is probable that with a large input from the oscillator the grid was swung over so wide a voltage range that anode-bend rectification took place during part at least of the grid swing.[1] This suggestion is borne out by the fact that if the grid-condenser and leak are omitted, and the valve is adjusted for anode-bend rectification, the intermediate-frequency output is, at worst, unchanged, and is more usually increased. At all events it is clear that the grid condenser and leak do not earn their keep, and so are better left out. If true leaky-grid rectification is desired, the only practicable circuit is that suggested in Fig. 4, where a rejector circuit, tuned to the intermediate frequency, replaces the grid condenser.

It might, in fact, be worth while to try out this method of rectification in practice, so dimensioning the circuit that "power-grid" detection took place, for the process of rectification introduces us once again to the troublesome question of harmonics. Owing to the fact that rectification does not consist of a complete suppression of one half-wave of the applied voltage, combined with a perfectly undistorted amplification of the other half-wave, the output from a practical detector will contain not only all the components that a theoretically perfect rectifier would give, but, in addition, harmonics of all of them. An example will make clear the way in which this "distortion" can introduce signals from unwanted stations.

Suppose that we have set the oscillator to 1,000 kc. Our pre-detector tuning is supposed to select either a 900 kc. or a 1,100 kc. station, with either of which the oscillator would give the 100 kc. beat-note to which the intermediate amplifier is tuned. A station transmitting on 950 or 1,050 kc. would then give a beat-note of 50 kc., which should not be amplified by the intermediate amplifier. But the first detector will "distort" this 50 kc. beat-note, giving rise to harmonics of it—100 kc., 150 kc., and so on. The first of these (second harmonic) has the frequency to which the intermediate amplifier is tuned, and so this station is liable to be heard. If the pre-detector tuning is designed to provide against normal "second-channel" interference, it will be sharp enough to cut out 900 kc. completely when set to 1,100 kc., but it by no means follows that 1,050 kc. signals will not be able to reach the grid of the detector. So far as the writer can see, there is no satisfactory means of combating this particular source of interference so long as one adheres to normal superheterodyne design.

Bringing together all the suggestions that have been made in the course of this rather discursive article, the writer would suggest that the circuit of Fig. 5 represents a frequency changer that would be both highly efficient and as free as possible from the various interference troubles that have been mentioned. It is simply a refinement of Fig. 1, brought up to date and overhauled generally. Whether all the refinements shown are really necessary is another matter.

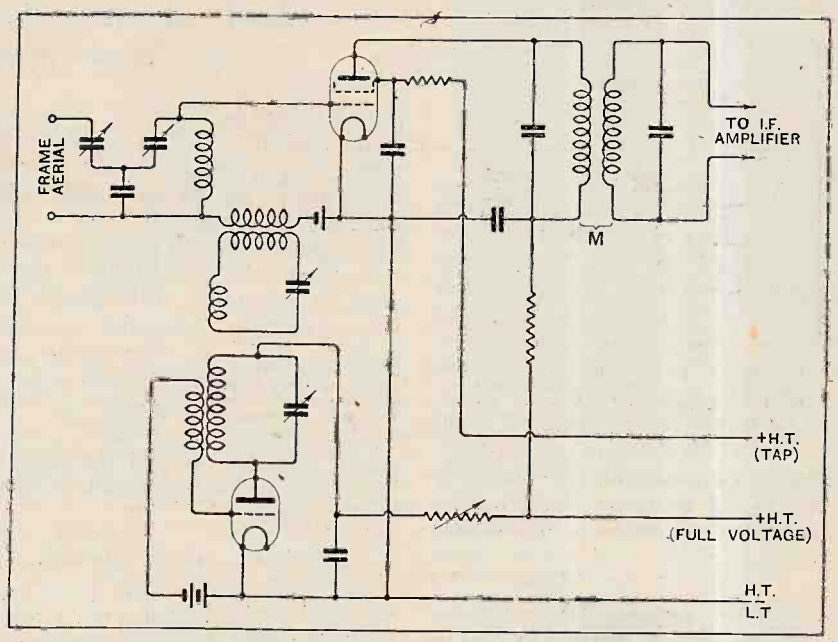


Fig. 5.—An elaborate frequency changer including precautions against most of the possible difficulties discussed in the text. There is a band-pass filter for the signal frequency, an intermediate tuned circuit between oscillator and detector, while the I.F.A. coupling takes the form of a band-pass filter. A screen-grid valve is used as anode bend detector, and the whole is fully decoupled.

[1] P. David, "Onde Electrique," Vol. VII, p. 313, 1928.

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SCREENING HINTS.

A SIMPLE partition screen dividing the grid and plate inductance of the H.F. valve is usually all that is necessary in the case of sets employing only one H.F. stage. If two H.F. stages are employed, however, the problem becomes vastly more complicated, and it is desirable to screen each stage in a completely enclosed metal box. The H.F. valves, however, should not be placed inside the boxes with the inductances, as trouble is likely to be caused by the fact that the valve electrodes are within the field produced by the coils. It must be remembered also that if a band pass arrangement is used it is necessary to separate the two halves of the filter by means of a screen, because if interaction takes place the device will no longer fulfil the function for which it is intended.

The NEW YORK SHOW

Automatic Volume Control. Tone Control. Two-Electrode Detectors. Whisper Tuning.

By OUR NEW YORK CORRESPONDENT.

THE Seventh Annual Radio World's Fair in New York has just closed its doors. One hundred and seventy-six radio manufacturers have displayed their wares. Just how many people went to see them is a deep secret. At no time did I find Madison Square Garden overcrowded, and I can remember past years when you could not move in the crush. In fact, rumours and mutterings hint that the R.M.A. feel so upset about it that they express doubt as to whether New York will see a similar show

Crosley 26 H. receiver. A battery-operated set with three screen-grid H.F. valves and push-pull output.

next year. But, then, we have heard rumours of that sort before.

However, it can certainly be said that this year's show, more than any other, demonstrated beyond question that the modern radio set has become as much of a household necessity as the very furnishings. And it is difficult to enthuse over mere furniture, so perhaps the New York public should be forgiven. That the radio industry itself is mature and stable was evidenced by the general perfection of design and finish, both external and internal. New features were, with one possible exception, sound and conservative. There were no sensational stunt departures from generally accepted practice such as have, in years gone by, been offered to the public regardless of their real efficiency so long as they appeared to present a sufficiently plausible reason for attracting the not-so-technically-minded buying public.

Automatic Volume Control.

The possible exception is the new feature, widely adopted this year, called the automatic volume control. Arguments in favour of this device are that the volume level remains the same at all times, unless manually adjusted, thus preventing overloading of the loud speaker on local stations, and fading when distant stations are being received. This feature, although new in broadcast receivers, has been in use for some years in commercial point-to-point short-wave telegraph receivers, where it functions admirably. But in broadcast reception we do not want a receiver which will automatically level out all signals to the same degree of intensity. Perfect reproduction involves not only perfection of tone. It involves also the perfect reproduction of light and shade in music. In other words, the original balance between the pianissimo and fortissimo passages of a musical rendering must be preserved, else the "colour" of the performance is entirely lost. Controversy raged round this point some time ago, when it was the practice of the control room engineers at the broadcasting stations to reduce the volume of fortissimo passages and increase that of pianissimo passages. Having now got the transmitting end right there is no sense in ironing out the volume level at the receiver.

Other features of this year's sets included straight-line tuning scales with automatic lighting when the desired station is reached, one-knob tuning, local-distance switch, pre-selector tuning, "whisper tuning," two-electrode detector valves, increased use of shielding, which in some cases amounted almost to armouring, hum-less operation, noise filters, tone control, and gramophone connections.

New Buddy All-mains receiver by Crosley. Three screen-grid valves are used, one of which is a detector.

With automatic dial lighting, as the tuning control is moved over the scale a light flashes up and remains on as soon as the adjustment for the desired station is reached, and in some cases the name of the station appears also. This, of course, is achieved by the prior adjustment of contacts behind the panel, according to condenser settings. Pre-selector tuning involves the inclusion of highly selective circuits

The New York Show.—

ahead of the detector, with, in some cases, complicated circuit arrangements ahead of the first H.F. stage, thus enabling razor-sharp tuning to be achieved, while at the same time admitting the full 10 kc. frequency band width. By means of the local-

A receiver with four screen-grid valves and a power detector—the Victor R.35.

distance switch, the resonance curve of the receiver is widened to about 14 kc. when receiving from the local station, and narrowed to 10 kc. or less for distant reception, so that side-band fringe interference from the local is eliminated.

"Whisper tuning" is not so awesome as it sounds. It is simply a refinement whereby, by pressing in the volume control knob, the volume is reduced to a whisper while tuning from one station to another is being carried out, so that unwanted stations do not blare out at fifty horse-power strength at every degree on the dial; you simply swing across the dial in silence till the desired station adjustment is reached, pull out the volume control knob again, and the station you want comes in at full strength. A very desirable refinement—around New York.

Two-electrode detector valves are used in some sets, three-electrode valves of the small power variety in others, for the so-called "power detection," and occasionally even screen-grid valves are used in the detector stage. If you live in New York, within a few miles of two or three 50 kW. stations, and use a modern receiver with three or four screen-grid H.F. stages ahead of the detector, you want "power detection." Another object of power detection is to eliminate the first L.F. stage, sufficient power being delivered by the power detector to operate the output power valve.

The objectionable hum of A.C. sets has at last been eliminated, and this year's sets can be operated at low volume levels without that irritating hum impinging on the programme. Incidental noises of the click and grate order are greatly minimised, if not eliminated, by the noise filters, without in any way impairing quality.

Are Superhets Returning?

Most sets this year are fitted with tone controls, whereby the listener may accentuate either the treble or the bass, according either to his individual tastes or the acoustics of his home. This is quite a good idea, and should go far towards eliminating these acrimonious discussions as to the relative tonal qualities of Smith's and Brown's receivers. But what of the family disputes as to the setting of it?

Crosley Pal set, selling at a popular price.

The development and introduction of quick-heater valves has eliminated that annoying wait for the receiver to become operative after it is switched on.

Gramophone pick-ups have undergone still further improvement, and were displayed in large numbers. Numerous receivers this year are equipped with a jack into which the pick-up can be plugged, thus instantly transforming the radio set into a gramophone reproducer. At the same time, pick-up manufac-

Amrad Rondeau receiver. There are four screen-grid valves, and a local-distance switch is included. Automatic volume control is used to prevent overloading.

turers still sell an adaptor which can be plugged into the detector socket in cases where a jack is not fitted.

Screen-grid valves are practically universal this season, either three or four of them being incorporated in the H.F. stages. One or two improved superheterodynes employing screen-grid valves were also on display. It is claimed that these are more than four times as sensitive as the older models, and that many of the old faults of the superhet. have been eliminated. Certainly they seem to be becoming popular again. The fact that they use as many as twelve or fourteen valves is purely incidental in this land of cheap valves and universal A.C. operation. I have, perhaps, not made it clear that radio sets are sold here in beautiful cabinets which invariably include valves, dynamic loud speaker, power rectifier and transformer—everything, in fact, for electric light socket operation. All one has to do is to take the set home (or preferably have the carrier deliver it'),

The New York Show.—

connect aerial and earth, and plug the power lead into the nearest electric light socket. There isn't a single battery in the whole set.

New D.C. Sets.

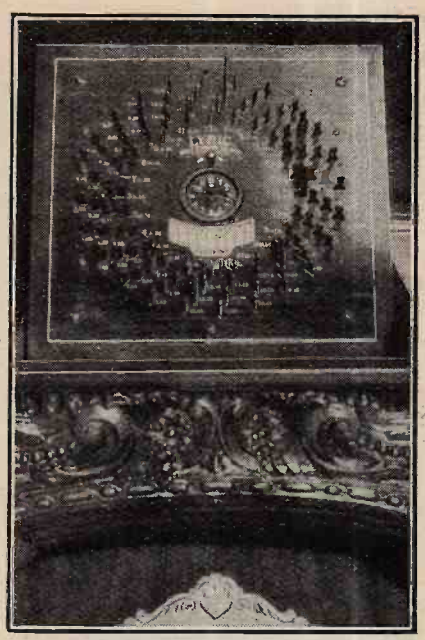
Home recording is a new feature of an R.C.A.-Victor eight-valve combination superhet. and electric gramophone. A small microphone is provided into which members of the family or friends can speak or sing. The records, of the unbreakable variety, are six inches in diameter and play for one minute and twenty seconds. Several of the new radio-gramophones incorporate automatic record-changing devices. The console of one instrument can accommodate assorted ten- and twelve-inch discs. Either side of ten- to twelve-inch records can be played without any rearrangement of the records, and with no interruption of the concert.

Atwater Kent All-mains receiver, with three screen-grid H.F. stages. Note the comprehensive screening.

Midget sets are very popular this season. These little sets are entirely self-contained, and were displayed by over fifty manufacturers. They measure approximately fifteen inches square and eight inches deep, and are designed for use on the mantleshelf or other similar position. Small console sets, measuring only twenty-four inches high, were also much in evidence. The flat tops of these sets come in very handy as small occasional tables.

The development of 2-volt valves, a recent event here, has made possible a range of D.C. receivers whose performance compares favourably with that of the A.C. receivers. In the past the undistorted output of D.C. receivers has been far below that of A.C. receivers, due to the necessarily low voltage operating the power valves. In the new 12-valve Fada sets, to quote an example, adequate power is assured by the use of six small power valves in two banks of three each, operating in push-pull. The other valves are three screen-grid H.F. amplifiers, and three heater type valves in a two-electrode detector circuit and first L.F. stage. These receivers operate on 90 to 130 volts D.C., and should be welcomed by those whose supply is of this character. A few battery-operated sets were in evidence, for the benefit of those who live in rural areas where there is no power supply.

One of the outstanding novelties of the Fair was a new 24-hour self-tuning device incorporated in the



The Lyric 24-hour self-tuning device. The selection of a large number of programmes can be pre-arranged.

sets displayed by Lyric Radio. In the centre of this device, which is mounted under the top lid of the set, is a watch, and around it are arranged 96 little levers which pull vertically out in ten graduated movements. Each lever corresponds to one fifteen-minute period of the day. As explained in a previous article, all programmes here are now arranged in 15-, 30- or 60-minute periods. Also mounted in the centre of the device is a tablet graduated in nine divisions, each one of which can be lettered by the user to correspond to one of his nine favourite stations. Contacts under the tuning dial are then pre-set accordingly for the dial readings of these nine stations.

No Portable Sets.

In operation all the user has to do is to study the radio programme, pick out the items he wishes to hear from any of the nine stations. If, for example, London Regional is No. 5 on the tablet, and it is desired to hear that station's programme between 6.15 and 7 p.m., the levers marked 6.15, 6.30 and 6.45 are pulled out to the graduation marked 5, but the set is not switched on. There is no need to worry further, or to keep an eye on the clock. Promptly at 6.15 the wireless set will

The New York Show.—

be automatically switched on, and will remain on, tuned to London Regional, till 7 o'clock. During the course of that programme, further levers may be set for future programmes, and as soon as London Regional terminates at 7 p.m. the set will be automatically retuned to the next station it is desired to listen to, and so on, according to the settings.

Before going to bed, levers may be set to return to London Regional for the dance music, and if you want the set switched off at midnight without the bother of getting up to do it, you just pull the midnight lever out as far as it will go, to graduation 10, and off the set will go at midnight. Or, if you are in New York, you may read in bed till two or three o'clock listening to stations farther west which, owing to difference of time, have not yet closed down. And if you want to be called in the morning, you set the levers accordingly to, say, 7 a.m., and to one of the local stations which starts up at that time with chimes or a bugle, and follows with physical jerks, daily dozen, setting-up exercises, or whatever you like to call that particular form of torture. This is quite the best device of its kind that I have ever seen.

As regards prices, these range anywhere from £9 for a battery-operated set (Crosley 26-H) employing three screen-grid H.F., det., and two L.F., with two valves in push-pull in the last stage, to marvellous all-electric radio-gramophones costing as much as £120. A fairly average price to pay for a handsome console set, including all the features already described (less gramophone, of course), is £20 to £30, delivered to your home ready to connect up.

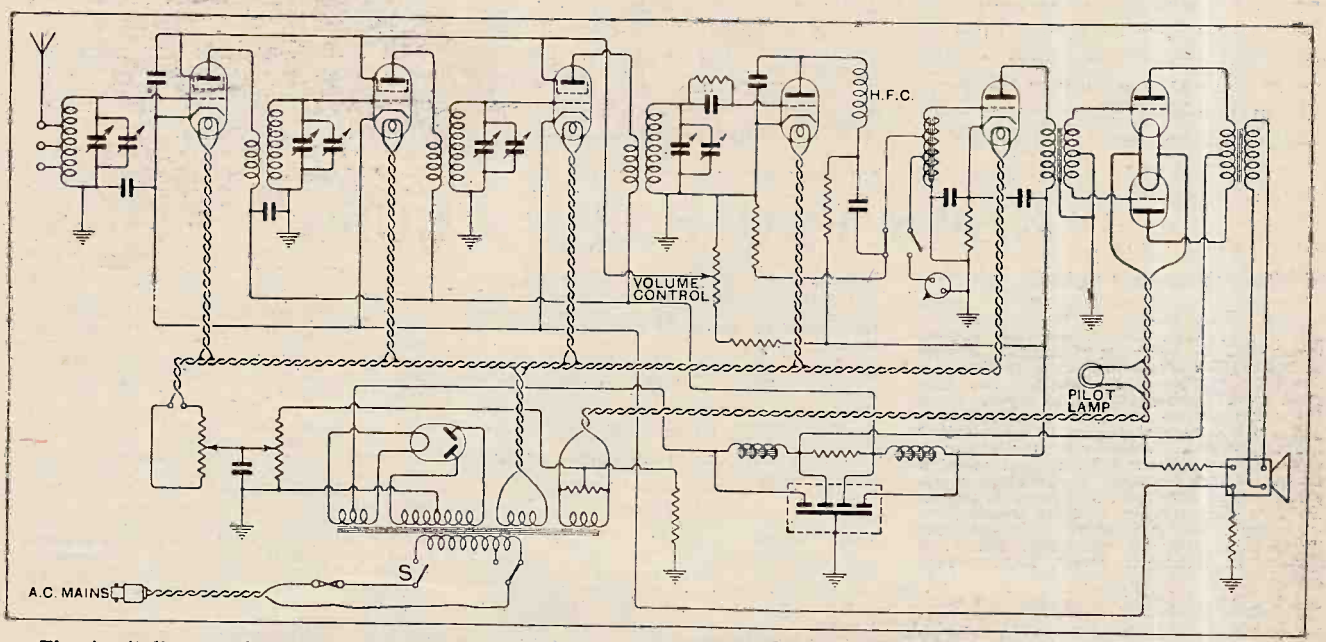
Portable sets were conspicuous by their entire absence, but several sets were on display for use in automobiles and aboard motor boats. The latter are simply battery-operated sets, designed to occupy a minimum amount of space, and encased for marine use. The former fit under and behind the dashboard, and are controlled by a single knob on the dash. The modern automobile receiver will function perfectly without signs of interference even when the car is running.

A most interesting exhibit was the Perryman valve-tester. This apparatus, which reminded one of a small telephone switchboard, tests 20,000 valves per day (when fed automatically) for correctness of filament, and plate current, gas pressure, etc., registering red or green lights when readings were incorrect or correct and stopping the cycle at a faulty valve.

The gallery was given over to a number of exhibits and demonstrations sponsored by the Science Forum and the New York Electrical Society. Here were numerous examples of "electronics," or more familiarly "telearchics." The photo-electric cell activated a small motor car whilst an invisible beam actuated an automatic counter as each visitor crossed its path. A suit of armour saluted visitors with a "Thank you" on leaving the stand, and judging by the lapse of time between each vocal effort, selenium was probably the cause. Practically no accessories were shown, and very few loud speakers apart from complete outfits. Only two or three firms showed short-wave receivers, among which the De Forest appeared as an extremely compact and well-made 4-valve battery receiver, and the Pilot Super Wasp, a 4-valve A.C. set of larger dimensions.

Speaking generally, prices were not low, but in view of the magnificence and æsthetic appearance of the cabinet sets, one was compelled to the opinion that they were excellent value for money.

An innovation this year was the inclusion in the Radio World's Fair of a number of non-radio exhibits of



The circuit diagram of the Amrad No. 81 receiver. There are three screen-grid valves, a leaky grid detector, and an impedance-coupled low-frequency stage, into which a pick-up can be connected. The output stage is transformer push-pull coupled.

The New York Show.—

domestic electric machinery, such as vacuum cleaners, washing machines, etc.

Several robots were included in the booths of some of the exhibitors, and the two crystal studios of the National Broadcasting Company proved as great an attraction as ever. At the opposite end of the basement were to be found the Tone-o-Graph talking film studios, where members of the public had an opportunity of not only seeing how talking films are made, but of actually taking part in the casts themselves to see if they could qualify as "talkie" artists.

Also in the basement was the 75-watt 40-metre band transmitter of the magazine *Radio News*, which excited a great deal of interest. Not only was the transmitter in the basement of this steel-frame building, but the aerial was too, and yet two-way communication was established with points as far distant as England and Mexico. It was through the medium of this station, operated by enthusiastic members of the A.R.R.L., that I was able to send, direct to the editor of *The Wireless World*, a few first impressions of the Fair.

One feature of the Show remains unchanged—the radio sets are still silent. They have not yet learned our little trick of supplying all sets with a common programme from a central gramophone record broadcasting studio. Instead, if you want to hear all the sets you have seen, you have to walk miles from one hotel to another in the Times Square section, which is about half a mile from Madison Square Garden. The manufacturers take suites in the different hotels and demonstrate their sets there. Not only is a tour round these hotels very fatiguing and inconvenient, but the hospitality of many of the manufacturers is highly devastating, in spite—or because—of prohibition!

Of television there was none this year, with the exception of an inoperative exhibit by the Jenkins Television Corporation.

NEWS FROM THE CLUBS.

Short-wave Lectures and Demonstrations.

Short-wave phenomena are arousing special interest among members of the Kentish Town and District Radio Society, and every effort is being made to assist experimenters. A series of lectures and demonstrations of particular interest to short-wave enthusiasts is now being given every Tuesday evening at 8 p.m., at the headquarters, Carlton Road School, Kentish Town, N.W.5. Amongst other things, the problem of the peaked amplifier for facilitating the separation of amateur C.W. stations operating in the narrow frequency bands at their disposal, will be dealt with in a practical manner. All keen members are cordially welcomed.

For any further particulars, application should be made to the Hon. Secretary, Mr. A. H. Sartain, 40, Harrington Street, Regent's Park, N.W.

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For Balham Readers.

Neon lamps and their application to radio and television were effectively described by Mr. Charles Roddis in a recent lecture before the Bec Radio Society.

An important feature of this year's programme is a series of non-technical talks for beginners on most meeting nights. These talks are given at 7.45 p.m. Members' problems are dealt with at 8.30, and, after an interval for refreshments, a lecture or demonstration is given at 9.10 p.m. until 9.45 p.m.

Vacancies exist for new members, and interested readers in the Balham district are requested to get in touch with the Hon. Secretary, Mr. Arthur L. Odell, 9, Westway, Grand Drive, Raynes Park, S.W.20. The meetings are held at the Bec Institute, Beechcroft Road, Balham, S.W.17.

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New Session at Wembley.

The Wembley Wireless Society recommenced their weekly meetings on Friday, the 17th October, in the Large Hall, Park Lane School.

A large number of old friends attended, and quite an interesting evening was spent discussing the new receivers shown at Olympia.

On Friday last an up-to-date lecture was given by Mr. Wallace on the conversion of existing battery sets to A.C. mains.

Members and friends are again reminded that the meetings this year will commence at 7.30 prompt.

Syllabus of the forthcoming meetings may be had on application to the Hon. Treasurer, Mr. H. Pottle, 90, High Road, Wembley.

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The Set of the Future.

A lecture on screened-grid valve amplification, illustrated with slides, was given by Mr. Youlé, of The Marconiphone Co., Ltd., at the meeting of the Bristol and District Radio and Television Society, held at the University on October 17th. The lecturer dealt with the characteristics peculiar to this valve; and demonstrated how advantage could be taken of these phenomena in circuit designing.

A most interesting discussion followed, in which the members envisaged the receiver of the future.

The meeting concluded with a demonstration of Marconiphone receivers embodying screened-grid amplification.

Hon. Secretary, Mr. S. T. Jordan, 1, Myrtle Road, Cotham, Bristol.

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Valve Vintage.

An amusing discussion on "Valve Vintage" took place at a recent meeting of the South Croydon and District Radio Society.

Mr. F. Nightingale, opening the discussion, said that to-day one's choice of valves for a receiving set might well be very complicated, and it amused him to compare this with the situation only five years ago. Then one simply walked into a shop, asked for a general-purpose valve, and used it in either the H.F., detector, or L.F. stages!

One member put forceful views on the vintages of valves. Modern valves, he said, were not nearly so good as the older ones. He still had a dull-emitter valve, bottled in 1924, and he would not part with it for any newly bottled product. Admittedly its original two-volt filament now required ten volts before the valve would give forth its precious emission! Another member asked him what voltage this filament would require after maturing in the wood for another ten years! The majority of members disagreed with the "maturing in the wood" principle as applied to valves.

Hon. Secretary, Mr. E. L. Cumbers, 14, Campden Road, South Croydon.

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Fundamental Principles Explained.

The Muswell Hill and District Radio Society have this session introduced an innovation into their syllabus in the form of a series of four lectures by Mr. L. Hartley, B.Sc., A.I.C., on the elementary principles of wireless. The first of these was given on October 8th, and brought home to members the many uses to which A.C. and D.C. current can be put quite apart from radio purposes. The action of many of those components that we regard as so commonplace—the choke, transformer and condenser—were explained, as were the functions of batteries. This talk concluded with a brief discussion upon the all-important subject of atoms and molecules.

Mr. Hartley's second lecture on October 15th dealt with the theory and uses of the thermionic valve, which, though looked upon in such a matter-of-fact way, is really one of the most ingenious electrical devices of the present day. Its discovery—or rather, its development—was shown, and its diverse applications nowadays were pointed out.

Hon. Secretary, Mr. C. J. Witt, 39, Coniston Road, London, N.10.

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The Best in Five Years.

The best year of work for five years was reported at the ninth annual meeting of the Ilford and District Radio Society just held. Mr. F. E. Collinson has been elected president. An excellent syllabus has been arranged for the winter session, which opened with visits to the Barking Power Station and Ongar Wireless Station, and a lecture by Mr. A. Serner, B.Sc., A.M.I.E.E., on "Metal Rectification."

Hon. Secretary, Mr. C. E. Largen, 16, Clements Road, Ilford.

FORTHCOMING EVENTS.

WEDNESDAY, OCTOBER 29th.

Muswell Hill and District Radio Society.—At 8 p.m. At Tollington School, Tetherdown, N.10. Concluding lecture of series: "Elementary Principles of Radio," by Mr. Leonard Hartley, B.Sc., A.I.C.

THURSDAY, OCTOBER 30th.

Slade Radio (Birmingham).—At 8 p.m. At the Parochial Hall, Broomfield Road, Erdington. Lecture and demonstration by Mr. A. F. Poynton.

FRIDAY, OCTOBER 31st.

Bristol and District Radio Society.—At 7.15 p.m. In the Geographical Lecture Theatre, University of Bristol. Demonstration by Messrs. Graham Amplion, Ltd.

TUESDAY, NOVEMBER 4th.

Bec Radio Society.—At 7.30 p.m. At Bec School, Beechcroft Road, S.W.17. Lecture: "Condensers for Eliminators," by Mr. B. Haywood, of the Dubilier Condenser Co. (1925), Ltd.

South Croydon and District Radio Society.—At 8 p.m. At the Surrey Drovers' Hotel, Selsdon Road. Joint meeting with Thornton Heath Society. Lecture and demonstration by Mr. H. R. Rivers-Moore, B.Sc. (president).

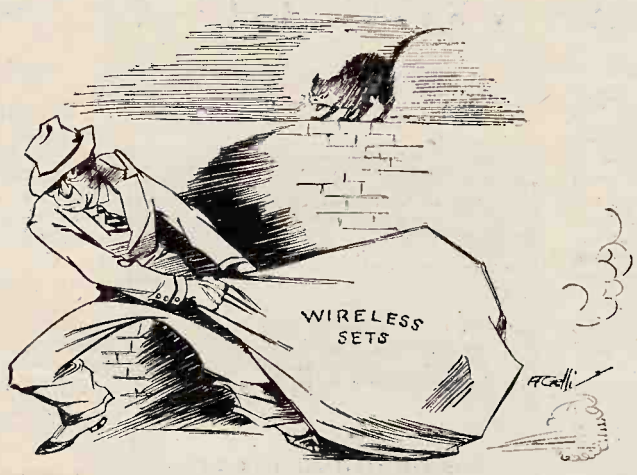
WEDNESDAY, NOVEMBER 5th.

Institution of Electrical Engineers, Wireless Section.—At 6 p.m. Inaugural address by the chairman, Mr. C. E. Rickard, O.B.E.

Unbiased.

By FREE GRID.

I HAD intended crossing the Channel the other week in order to put in an appearance at the Paris Radio Show, as in previous years, but unfortunately fate, in the form of a wretched cold, kept me "confined to barracks" for several days, and as it happened I was only just fit again in time to get in at the tail end of the Manchester show. It is, I think, always interesting not only to make a comparison between the designs of the complete sets and components of our friends across the water, but also to exchange points of view with the French exhibitors, and for this purpose I generally dig out an old acquaintance of mine who is more or less permanently exiled in the gay city and is well versed both in the technicalities of radio and also in the intricacies of the French language. By doing this I save much time and trouble, as previous bitter experience has taught me that my ability to discuss the idiosyncrasies of the gardener's boy and his passion for pens is apt not to be appreciated at its true value by French exhibitors. I shall therefore have to make amends for my disappointment by exchanging points of view up in the North, where the language barrier is perhaps not quite so insuperable.



A number of sets "on appro."

During my enforced idleness I have, naturally enough, beguiled away the time with the aid of my wireless set, or perhaps I should say with several sets, as a friend who is fairly well blessed with this world's goods is contemplating the purchase of an all-electric receiver, and has dragged a number of sets which he has "on appro." to my place in order that I might advise him. In this I must confess I have found no little difficulty, as there is not much to choose between the half-dozen or so which he turned over to me. All are fairly sensitive and selective, and the quality in all cases rises to a level which but a few years ago was simply not attainable by any means. I think, however, that my final choice will fall on one which employs a power grid detector, and in this I am not swayed merely by theoretical considerations, as the quality is definitely better than from the others, which employ the older forms of rectification.

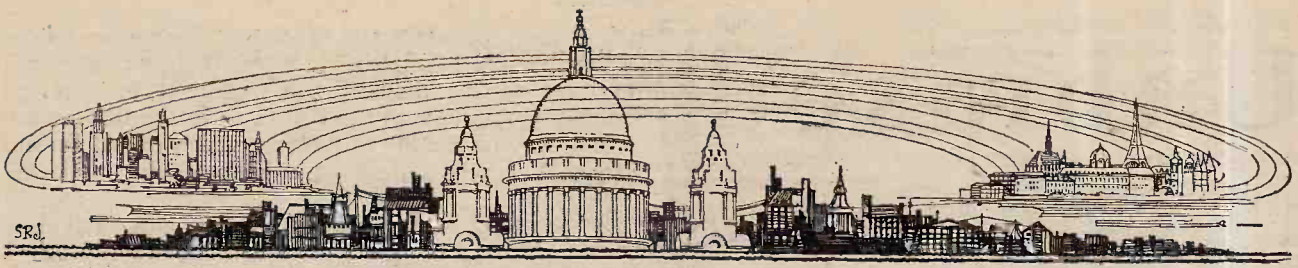
During my wanderings around the various stations of Europe with these sets I had ample leisure to observe things which under ordinary circumstances are not particularly noticed, and one thing which was brought very forcibly to me was the fact that the so-called gaiety of the Sunday transmissions of certain European stations is very greatly overrated. It is true that you have only to listen to the dullness and gloom of the average Sunday programme of the B.B.C. to realise that we are a long way off the life of pleasure which ruined ancient Rome, but very little solid enjoyment was to be extracted from the medley of negroid noises which filled the Continental ether on the particular Sunday of which I speak. Possibly, however, I struck a particularly bad patch, or my indisposition gave me a jaundiced view of things, and I will leave it at that.

Wanted: Another 5XX.

I suppose there are very few parts of the country in which I have not had experience of broadcasting, with the exception of Scotland and the wilder parts of North Wales. It has been my experience that the two parts of the country which are worst served by broadcasting are the extreme south-west of the country and East Anglia. In the first mentioned district I have very definitely found that 5XX was the only British station of any real entertainment value whatever, the medium-wave stations being subject to fading, and Morse interference. In East Anglia things were somewhat better, in the matter of fading, and ships' Morse is the chief cause of trouble. I must say, however, that in the coastal districts of East Anglia I have always been compelled to rely on 5XX. This all goes to show, in my opinion, how much an alternative long-wave programme is needed, a fact which I have noticed has been rubbed in by *The Wireless World*. My experience has been confined, I will admit, to makeshift aerials, and I should be interested to hear what conditions are like on a pukka aerial and earth system in the districts I have mentioned. In Cornwall I found, by the way, that the average popular portable is almost useless.

Watch Your Watch.

I wonder how many people have had their watches ruined by experimenting with moving-coil loud speakers? Mine came to disaster recently when examining the magnet system of one of the "permanent" type of moving-coil loud speakers. Being on my wrist it came well within the influence of the magnetic field, and is now hopelessly magnetised, so much so, in fact, that it not only loses, which is the customary symptom of a magnetised watch, but refuses to go altogether, so strong was the magnetising force. The remedy, of course, is to place it for a time in a strong alternating current field, this having a demagnetising effect, and this I intend doing.



CURRENT TOPICS

Events of the Week in Brief Review.

FINED FOR ILLICIT TRANSMISSION.

For transmitting by wireless telephony without a licence, D. E. Waddington, of Redland, Bristol, has been fined £3. Waddington's "talks" with a friend were overheard by a Post Office official.

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BIRR?

Whether the new Irish high-power broadcasting station will be situated at Athlone or Birr was recently discussed by Mr. P. W. Shaw, member of the Dail, in a newspaper interview. With a 120 kilowatts launched on the ether, British listeners will not be over-meticulous. Athlone by any other name will sound as loud.

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100 kW. STATION FOR LUXEMBOURG.

The latest budget of the Société Luxembourgeoised'Etudes Radiophoniques, which holds the broadcasting monopoly in the Grand Duchy, provides for the establishment of a 100 kW. broadcasting station within eighteen months. According to *Radio Science* (Brussels), a provisional station of between 6 and 8 kW. will operate before the end of the year.

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MYSTERY VAN STIMULATES HONESTY.

How the appearance of the Post Office "mystery van" speeds up the issue of new wireless licences was shown at the Potteries Stipendiary Court at Hanley last week during the hearing of a "wireless pirate" case.

A Post Office representative stated that since the mystery van had visited the district 1,065 new licences had been taken out. The normal rate of increase during the same period would have been about two hundred and fifty.

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THE WIRELESS OPERATOR.

Even veteran wireless operators might blush on reading the description of their character as noted by a student in the Radio Corporation of America training institute:

". . . He (the R.C.A. operator) stands ever ready to do what is right without fear or equivocation," says the writer. "Constantly on his toes, he accepts and executes orders with sunny eagerness. . . . He is steadily advancing the frontier of his knowledge by study and application plus a sincere impulse to do his job just a little better than the next man."

RADIO CALL TO PRAYER?

A broadcasting station is to be installed at Mecca, forming one of a chain of such stations which Ibn Saud proposes to erect throughout Arabia.

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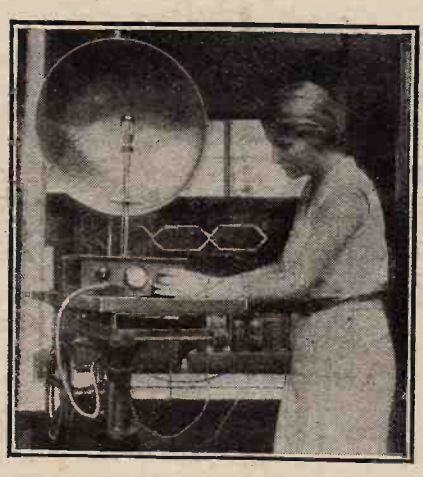
TWO SHILLINGS A MONTH.

Austria, having experimented with a system of licence fees graduated according to the cost of the receiving set, has now decided to adopt a uniform scale, viz., two shillings per head per month.



MIDGET WAVE SET. A new German receiver constructed for sensitivity on wavelengths of 14 centimetres.

U.S. SPONSORED PROGRAMMES FOR EUROPE?

A scheme to broadcast American "sponsored" programmes throughout the world is being considered by the Federal Radio Commission, according to our Washington correspondent. Applications have been received from the General Electric and Westinghouse Companies for the removal of the experimental status of the short-wave auxiliaries of WGY (Schenectady) and KDKA (Pittsburgh) to enable these stations to transmit the ordinary commercial programmes for world consumption.

If the claims are allowed, arrangements will be set on foot whereby these trade propaganda transmissions are picked up in foreign countries and relayed by local stations.

SHORT-DISTANCE BEAM SERVICE.

A miniature beam wireless system for communication between Sicily and the surrounding islands has been authorised by the Italian Government. Six transmitters, each with a power of 10 kW., are to be constructed, and they will work on wavelengths between 1,200 and 1,500 metres.

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WIRELESS TO FIGHT AMERICAN GANGSTERS.

That America is waking up to the value of police radio is shown by the decision of the U.S. Federal Radio Commission to permit twenty-four cities and two States to operate police wireless stations. Twenty other cities have been granted permission to build such stations.

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POLICEMEN AS WIRELESS OPERATORS.

Wireless classes for policemen are the latest innovation in Prague. The classes have been formed to enable every officer to work the police radio apparatus which is to be adopted throughout Czecho-Slovakia for the suppression of crime. The students are given practical lessons with an up-to-date transmitter and receiver.

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AMATEUR RADIO HOAX.

The famous "Paris Experimental" station, which for a long time secured publication of its programmes in leading French radio journals, has been dragged from the domain of mystery by the Paris police.

According to the *Antenne*, the practical joker is a youth of eighteen, who announced the establishment a year ago of a short-wave "poste" with a power of 1 kilowatt and a wavelength of 31.65 metres. The announcement received a "good press," whereupon the youth, feeling under an obligation not to disappoint the world, collaborated with some amateurs of his own age in the construction of a transmitter which eventually came on the ether with a power of 25 watts, and broadcast a few gramophone records and newspaper extracts. It then closed down, but the "programmes" appeared as usual in the Press to the mystification of a number of genuine experimenters, who marvelled at the insensitiveness of their receivers.

It was only after an imaginary description published by one paper of the

"super station" in Suresnes and its "auditorium in Paris" that the police became interested. According to the *Antenne*, the station owner is to be prosecuted for transmission without a permit.

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DR. LEE DE FOREST.

Dr. Lee de Forest may shortly remarry. According to the Los Angeles *Examiner*, quoted by the *New York Times*, the inventor of the three-electrode valve intends to marry Miss Maria Mosquini, a film comedienne.

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AMPLION "TWO SCREEN-GRID CABINET."

We are asked to state that the Amplion "Two Screen-grid Cabinet," referred to in our Olympia Show Report of September 24th, is obtainable for A.C. mains operation only, and not in D.C. and battery models as stated.

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THE LATE MR. R. B. WEAVER.

News of the death last week of Mr. Robert Beresford Weaver, manager of the Wireless Department of the General Electric Co., Ltd., came as a real shock to his many friends and associates in the radio trade. Mr. Weaver suffered a serious illness a few months back, but seemed to have recovered. He took an active part in the Olympia Radio Exhibition. He was in his 55th year.

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"*THE WIRELESS WORLD* FOUR."

We regret the occurrence of two typographical errors in the List of Parts relating to "*The Wireless World* Four," on page 431 of our issue of October 15th. The grid leak value appearing as 0.1 megohm should have been given as 0.01 megohm, i.e., 10,000 ohms. Also, a resistance value of 10,000 ohms should have read 15,000 ohms.

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R.S.G.B. AND L.R.S.

One of the most interesting examples in recent years of collaboration between important radio societies is the arrangement arrived at between the Radio Society of Great Britain and the Lensbury Radio Society. During the present session joint meetings are taking place at frequent intervals. Through the courtesy of the Anglo-Mexican Petroleum Co., Ltd., these meetings are held in the Lecture Theatre of their building at 16, Finsbury Circus, E.C.2. The proceedings, which are strictly informal, open at 6.15 p.m. sharp and continue for about an hour. Refreshments are then served, and those who wish can resume discussions until 9.15.

Members of the R.S.G.B. are requested to note that this programme in no way affects conventions or other meetings such as are usually held at the Institution of Electrical Engineers. Full particulars of meetings, etc., can be obtained from the Hon. Secretaries, Mr. D. Wilkes (L.R.S.), Shell Corner, Kingsway, W.C.2, or Mr. J. Clarricoats (R.S.G.B.), 53, Victoria Street, London, S.W.1.

On November 7th the discussion will deal with radio rectifiers, and the lecturer will be Mr. A. Gay (G 6NF.)

RISING FIGURES.

At the beginning of September the number of wireless licences held in Czecho-Slovakia was 287,604—increase of 2,124 during the month of August.

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"RADIO NATIONALISATION" DEMAND IN FRANCE.

The French Railways Radio Club—the largest club of its kind in France—now possesses 10,000 members, many of whom were present at the annual festival just celebrated in the Salle Wagram, Paris, under the auspices of the French Postmaster-General.

A striking appeal for speedy State action in broadcasting affairs was made by M. Abeloos, the President, in the course of his address. He declared (writes our Paris correspondent) that French listeners were crying for "a body representing not merely commercial concerns, but the general interests of the nation," i.e., a policy of radio nationalisation.

Post office workers support this view, but the majority of commercial interests in France oppose the nationalisation policy on the grounds that it would put a brake on subsequent radio progress.

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TWO USEFUL DIARIES.

The Autocar Motorist's Diary for 1931 contains a mass of information useful to the owner-driver, including particulars of hills with single-figure gradients, Motor Racing History, List of Speed Records and winners of racing events, Conversion tables and formulæ, and the distances between the principal towns in Great Britain. In the Diary portion provision is made for recording the mileage week by week, and pages are provided for monthly summaries of running expenses.

The Motor Cycle Diary for 1931 contains similar information and memoranda but adapted for the use of motor cyclists. Both Diaries are strongly bound in leather cloth with pencil, size $4\frac{5}{8} \times 3\frac{5}{8}$, to fit the pocket, and are obtainable, post free 1s. 7d. from the publishers, Messrs. Iliffe and Sons Ltd., or from booksellers and stationers, price 1s. 6d.

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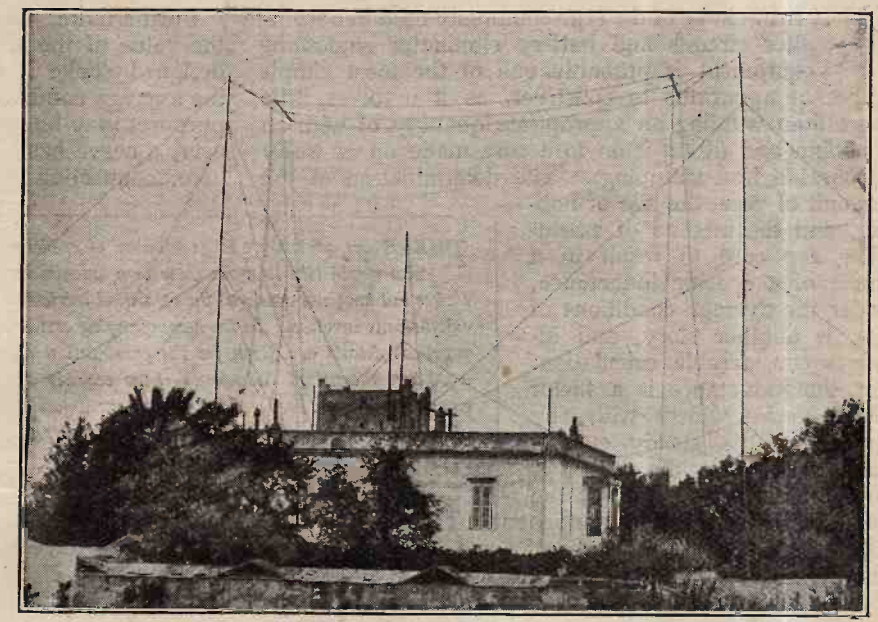
WIRELESS PICTURES AT SEA.

Has wireless facsimile transmission and reception reached a stage of development which would justify its general introduction for marine purposes? A considered statement on the question is issued by the Marconi International Marine Communication Co., Ltd., in reply to certain suggestions made in American marine circles that the introduction of such apparatus is imminent.

Having regard to its possible value for shipping, the subject was one of those which came under discussion at the meeting of the Executive of the Comité Internationale Radio-Maritime in Brussels last month (says the Marconi Company). The technical and commercial experts gathered there, representing some forty countries, were satisfied that on the data so far amassed, and submitted to them for consideration, it would be premature at present to undertake the inauguration of a service of facsimile transmission to ships at sea.

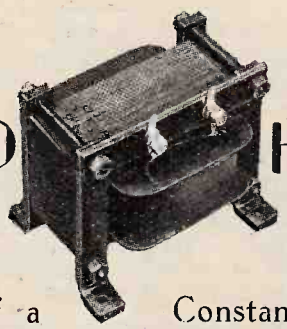
The difficulties are both tehnical and commercial. Sets to give reliable results such as would be required to inspire full confidence must be fairly elaborate, and the probability is that a weather chart service could not be conducted at a charge of less than one guinea a day per ship.

The technical difficulties still to be overcome include interference from other signals and from atmospherics and fading.



CASABLANCA CALLING. In addition to the broadcasting station at Rabat, Morocco possesses a lively disseminator of news and music at the villa of Dr. Veyre, member of the Radio Club de Maroc. The station, seen in the picture, can easily be heard in Europe on wavelengths of 28 and 48 metres.

MAKING A 20 HENRY CHOKE



Constructional Details of a Constant Inductance Choke to Carry 100 mA. of D.C.

By H. B. DENT.

THERE are probably a large number of readers who would like to make their own smoothing chokes but have not mastered the somewhat intricate calculations involved. In the accompanying article practical details are given for the construction of a 20-henry constant inductance choke capable of carrying 100 mA. D.C. Such a component has a multiplicity of uses in sets deriving their current from lighting mains.

AN L.F. choke of the type commonly used in output-filter circuits and battery eliminator smoothing equipment is probably one of the most simple pieces of apparatus to construct, as it involves little more than winding an appropriate quantity of wire on a bobbin and fitting it on to a core made up of easily procurable iron stampings. The determination of the amount of wire, the size of bobbin, and the method of assembling the core to result in a choke of a specific inductance, under the average conditions of use, is another story, and involves considerable calculation. For the inductance is a factor which varies widely with any change in the steady current passing through the winding, and, to a large extent, upon the value of the alternating component. Thus a choke designed to give an inductance of some 20 henrys when no direct current is flowing, but with an alternating component of, say, 10 volts, may quite likely show only half this inductance value when a steady current of a few milliamps is passed through the coil.

Furthermore, the inductance is not independent of the value of the alternating component, but in a well-designed choke it may be of small magnitude under the average conditions of working, and for all practical purposes may be ignored. As a matter of interest, however, a curve has been prepared of the choke described here, connecting inductance with the alternating voltage across its ends. This is shown in Fig. 1. As will be seen, the inductance maintains practically a constant value for all values of A.C. over 30 volts.

In an output filter stage embodying a good super-power valve the working condition will be well on the horizontal part of this curve, but in the case of battery eliminators the A.C. component will be, in general, less than 20 volts, with the result that the effective inductance of the choke will be somewhat less.

The steady direct current passing through the choke is the principal factor governing its inductance, and this may suffer considerable change with quite small variations in the value of the D.C. The aim in the presen

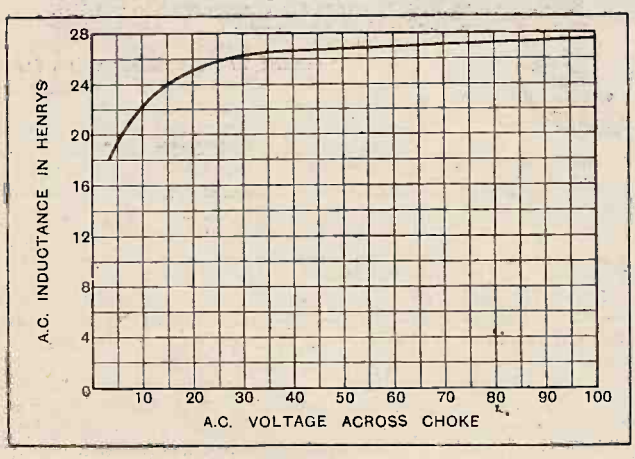


Fig. 1.

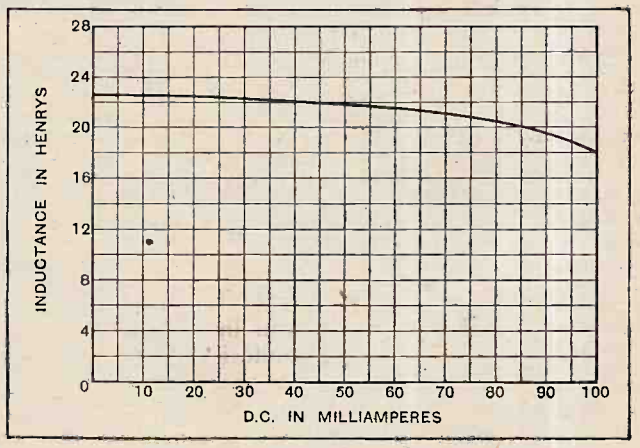


Fig. 2.

The curve in Fig 1. shows the change in inductance with A.C. voltage across choke. The core section is 1.5 ins., the air gap 0.018in. In Fig. 2. is shown the curve giving change in inductance with passage of D.C. through choke. The core area is 1.4 sq. ins. and is made up of Savage No. 34 stampings. The bobbin is No. 4H and the winding contains 4,000 turns of No. 32 enamelled wire. Air gap 0.018in., D.C. resistance 220 ohms. Measurements taken at 50 cycles with 12 volts across choke, the A.C. varying from 1.7 mA. to 2.075 mA.

Making a 20-henry Choke.—

case has been to design a choke whose inductance remains sensibly constant over a wide range of D.C. values. That this state can be attained with reasonably simple construction is exemplified by the curve connecting inductance with the D.C. given in Fig. 2.

With no D.C. flowing the measured inductance is 22.5 henrys, and with 50 mA. of D.C. flowing, this falls to 21.8 henrys. On passing 100 mA. of D.C. through the coil the inductance falls to 18 henrys. Only in exceptional cases will a small choke of this type be required to

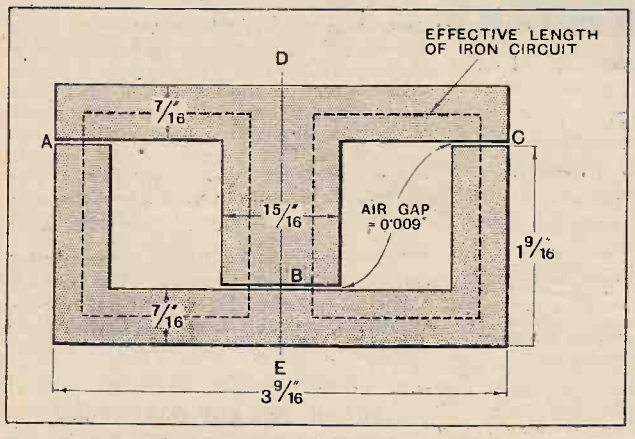


Fig. 3.—Showing the essential dimensions.

carry more than some 50 mA. of D.C., and up to this point the inductance curve is sensibly horizontal, so that one would be justified in designating this component a "constant inductance" L.F. choke.

Its constancy is achieved by introducing an air gap, suitably proportioned, in the iron core, and any alteration to the length of this gap will very seriously modify the slope of the curve, also the maximum inductance attainable. Therefore, during the assembly process particular care must be taken to assure that the air gap is the correct size. The length of the air gap in the iron circuit is 0.018in. in the present case.

The stampings used for the core are the familiar "T" and "U" pieces, as shown in Fig. 3. This assembly gives two iron paths in parallel, so that if we visualise the core folded back along the line DE, so that the left-hand half is brought over to coincide with the right-hand portion, we shall have two gaps in the core, namely, at B and C. The gap at A will be in line with that at C. Therefore, the total air gap of 0.018in. is divided equally between the joints B and C, and each is 0.009in. long. In the assembly we must insert distance pieces at the three points, A, B and C. These can consist of any insulating material, such as paxolin, shellaced cardboard, empire cloth, etc.

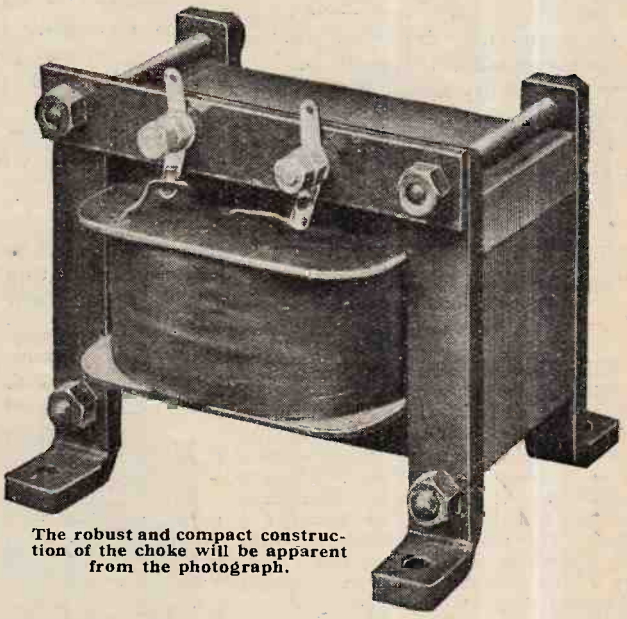
For the benefit of those not in the possession of a micrometer a satisfactory substitute is a standard wire gauge. No. 34 S.W.G. is equivalent to 0.0092in., which is sufficiently accurate for our purpose.

The material required comprises 100 pairs of transformer stampings of the size given in Fig. 3, a bobbin suitable for assembling this quantity of iron and to fit into the winding space on the core, and 1lb. of No. 32 S.W.G. enamel-covered wire. A suitable bobbin can be obtained from W. Bryan Savage, 292, Bishopsgate, London, E.C.2, and is styled size No. 4H, the stampings being listed as size No. 34. The thickness of the core will be 1.5in., and the cross-sectional area 1.4 sq. in.

The bobbin should be wound with 4,000 turns of the No. 32 enamel wire, the turns to be run on evenly, but not necessarily in layer form with consecutive turns touching. Looseness and bunching in such a manner as to lead to waste of space must be avoided, as it is only by exercising reasonable care in this process that the requisite number of turns can be accommodated.

When the stage has been reached for assembling the core the "T" pieces can be inserted into the bobbin, as many as possible being packed in, and the final two or three tapped home if necessary. If any looseness exists in the core when finally clamped up, the laminations will tend to respond to fluctuations in the coil current and emit the characteristic hum of the rectified supply if used as a smoothing choke, or act as a miniature loud speaker when employed as an output choke. These spurious effects should most certainly be avoided.

The spacing pieces can then be placed in position, and the "U" shaped laminations assembled, using the same number of these as there are "T" pieces. During the assembly of the stampings all paper-covered sides must point in the same direction. If a little Seccotine, or other suitable adhesive, is smeared on both faces of the air gap spacers, it will assist in keeping them in position, and act, also, as a binding agent when the core is clamped together.



The robust and compact construction of the choke will be apparent from the photograph.

The clamps are made from mild steel strip $\frac{3}{16}$in. thick and $\frac{1}{2}$in. wide, with the lower ends turned up to provide a means of fixing to the baseboard.

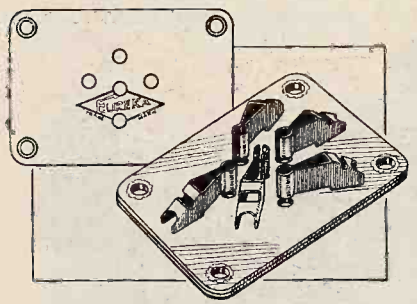
Before the steel clamps are placed in position a strip of insulating material, such as shellaced paper, or empire cloth, should be inserted between each clamp and the core to prevent partial short-circuit of the air-gap. The D.C. resistance of the coil is quite low, the actual value being 220 ohms. Thus, when passing 50 mA. of D.C. only 11 volts will be absorbed in the choke.

Wireless World Laboratory Tests on New Apparatus

"EUREKA" VALVE HOLDERS.

Messrs. L. Person and Sons, 63, Shaftesbury Street, London, N.1, have recently produced a new-type skeleton valve holder intended for assembling on sub-bases, raised above the level of the baseboard, so that all wiring can be laid out of sight. Although produced to meet the needs of set manufacturers in the first case they are now available to the home constructor, the prices being 6d. for the four-pin type, and 7d. each for the five-pin model. If required these can be supplied mounted on metal strips in gangs of two, three, four or more.

Each holder measures $2\frac{1}{4}$in. $\times 1\frac{3}{4}$in. $\times \frac{7}{16}$in. deep. Suitable hard copper is used for the contact springs, which are mounted on thin paxolin with a top cover of the same material; this serves to hold the springs in position. Slots are provided in the springs in which the connecting wires are placed and remain secure when soldered.



"Eureka" skeleton 5-pin valve holder for sub-panel mounting.

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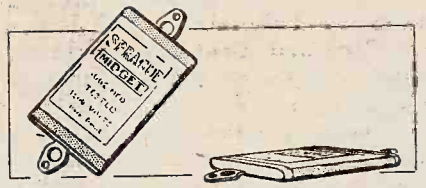
SPRAGUE MIDGET CONDENSERS.

Although tested to withstand a working voltage of 1,500, these condensers are extraordinarily compact, the space required being no larger than that occupied by an ordinary postage stamp. The condensers are of American manufacture, and are marketed in this country by Messrs. Howard Thomas and Co., Ltd., 320, Regent Street, London, W.1. They are available in all recognised standard capacities ranging from 0.00005 mfd. to 0.02 mfd.; the smaller sizes, up to and including 0.0005 mfd., cost 1s., and the largest size 2s., prices of other capacities falling within these two limits.

The condensers are so small and light in weight that they may be anchored by the wiring, and it has not been deemed necessary to provide any particular means for fixing.

The soldering lugs are of generous size, and each has a hole large enough to clear a 4B.A. screw, so that the condensers can be positioned by clamping them under the terminal heads of some of the components in the set, should this mode of fixing be preferred or prove the more convenient.



Sprague midget condensers, which are about the size of a postage stamp.

The capacity of some samples was measured, the nominal values and the actual capacities being tabulated below.

Specimen.	Nominal Capacity.	Measured Capacity.	Deviations from Nominal.
	Mfd.	Mfd.	Per cent.
1	0.00025	0.000275	+10.0
2	0.00025	0.000257	+ 2.8
3	0.00025	0.000260	+ 4.0
4	0.002	0.00207	+ 3.5
5	0.002	0.00225	+12.5
6	0.002	0.00199	− 0.5

The majority of the samples tested came within 10 per cent. of the rated capacity; this tolerance is quite permissible in fixed condensers for general use.

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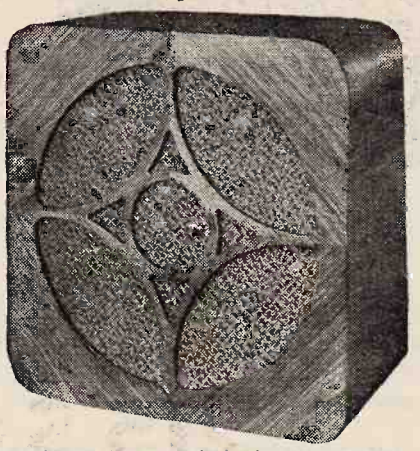
BLUE SPOT TYPE 41K LOUD SPEAKER.

The movement of this loud speaker is the well-known type 66K, and the quality of reproduction is well up to the high standard set by this unit. The high frequency response, particularly between 5,000 and 6,000 cycles, is above the average for loud speakers of this class, while the middle register is uniform, with the exception of a slight increase—not sharp enough to be regarded as a resonance—between 2,500 and 3,000 cycles. In the bottom register the response is good down to 100 cycles, but in the particular model submitted slight frequency doubling was evident at this frequency, and the 50-cycle response was negligible. The general effect, however, is excellent, and at 50s. the instrument represents good value for money.



Blue Spot 41K loud speaker in polished walnut cabinet. The movement is a 66K unit.

The cabinet is light, and is constructed of walnut-faced three-ply, the overall dimensions being $12\frac{1}{2} \times 12\frac{1}{2} \times 6\frac{1}{4}$in. Supplies are available from the British Blue Spot Co., Ltd., 94-96, Rosoman Street, E.C.1.

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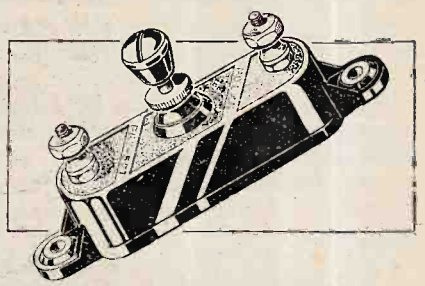
POLAR PRE-SET CONDENSER.

This is a semi-variable condenser of the type now generally used where a capacity of the order not available in the standard range of fixed condensers is required. It is eminently suitable for inclusion in circuits which, once tuned, need no further adjustment, such as a rejector, to mention one of the many rôles it will fill.



Polar Pre-set semi-variable condenser enclosed in a neat bakelite case.

The plates are cut from phosphor-bronze, interleaved with thin sheets of mica, and the capacity is varied by altering the pressure applied to the sandwich; a small bakelite-shrouded screw with a saw-cut for insertion of a screw-driver serving as the adjustment. A locking-nut enables the spindle to be fixed when the required capacity has been obtained.

These condensers are available with a maximum capacity of 0.001 mfd. or 0.0003 mfd., the price in each case being 2s. A sample 0.0003 mfd. size was measured, and the maximum capacity found to be 0.000338 mfd., while the minimum value was 0.00006 mfd. only. This provides a very useful range of capacity.

The makers are Messrs. Wingrove and Rogers, Ltd., Arundel Chambers, 188-189, Strand, London, W.C.2.

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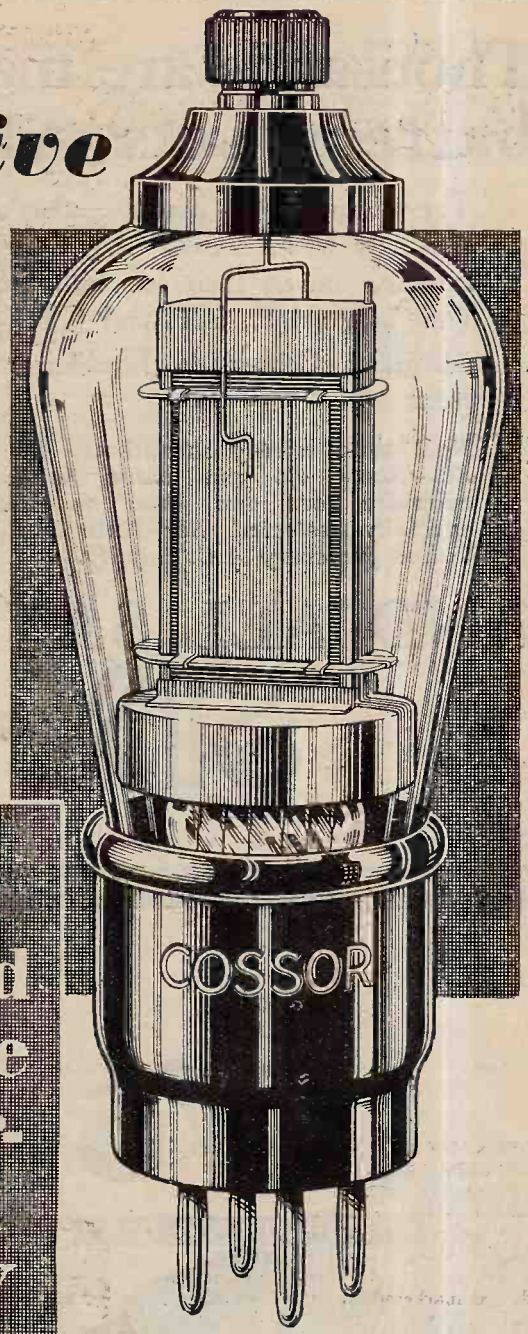

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VELOCITY of SOUND in LOUD-SPEAKER DIAPHRAGMS

A Method of Measurement Using Simple Apparatus.

By N. W. McLACHLAN, D.Sc., M.I.E.E., F.Inst.P.

NOTHING happens instantaneously, there is always a time lag between cause and effect. If a gun is fired a mile away, the sound or report is heard several seconds after the flash is seen at the muzzle. This point was brought out very forcibly at the last Schneider Trophy Race in the Solent. The seaplanes travelled so fast that the noise emitted from the exhaust appeared to come from a point well behind the plane. This showed clearly that the velocity of the plane was comparable with the velocity of sound in air. In loud speaker problems a similar effect occurs. Suppose we have a simple arrangement consisting of a flat steel or aluminium disc mounted on a reed type of movement as shown in Fig. 1. When the reed moves up and down, due to an alternating current in the windings, the disc emits a sound of the same frequency as the current. Now the force on the disc is exerted at the centre where it is attached to the reed. If the force acts upwards, say, its effect it not felt instantaneously throughout the disc. A certain small time elapses between the application of the force and its being felt at, say, the outer edge of the disc. This is due to the velocity of sound energy (in the disc) from the centre to the edge of the disc being relatively small.

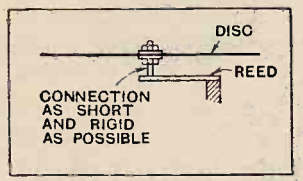


Fig. 1.—The force exerted by a reed at the centre of the disc is not felt instantaneously throughout the disc.

We know that sound can be heard when the disc vibrates, so that energy is communicated to the surrounding air. If we concentrate our minds on the centre of the disc, we see that it sends sound waves out to the air in every direction. Some of these (X) travel at 90° to the disc, others (YY) at a smaller angle, whilst one bunch (ZZ) travels *over* the surface of the disc (see Fig. 2.) Meanwhile sound travels *in* the disc itself (WW), but it travels at a different rate from that of the sound *over* the disc. It is this velocity *in* the disc itself which is important in the design of loud speaker diaphragms, and it is the one which we desire to discuss in this article.

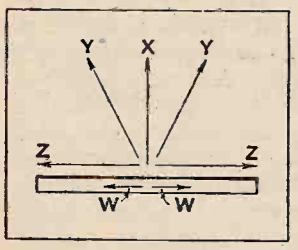


Fig. 2.—The velocity of the waves ZZ over the disc is much higher than those WW in the disc.

In measurements of the velocity of sound in the open air, an approximate method used many years ago was to fire a gun some miles away and take the time which elapsed between seeing the flash and hearing the report. Where discs or diaphragms are concerned this method is obviously not at our disposal. Consequently we have to devise something more subtle which fits in with our particular case.

The following method of measuring the velocity of sound in a flat circular disc can be used by anyone having certain simple apparatus. Take a piece of sheet metal about $\frac{1}{32}$in. thick and cut out a circle 8 inches diameter (about 20 centimetres). Drill a small hole at the centre so that the disc fits over the screwed stem of a reed-type loud speaker movement (see Fig. 1). Screw a nut on the stem, then put the disc between two small washers, and screw another nut firmly on the top. Mount the movement in such a way that the disc is quite horizontal and the movement itself rests on felt or padding to insulate it mechanically from the table—to avoid resonance of the latter. Connect the movement to the power valve of a receiving set in the usual way. Obtain a beat note —by causing the receiver to oscillate or otherwise—and vary it by altering the tuning of the set. At one or more frequencies of the beat note the sound from the disc will be very loud. These points correspond to resonances.

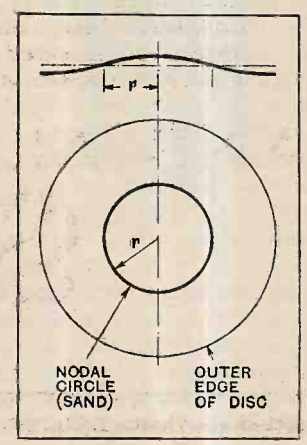


Fig. 3.—Diagram showing shape of disc when there is one nodal circle (exaggerated).

Having found one of these resonances, sprinkle fine sand on the disc and vary the beat note. The sand will collect in one or more circles, of which the attachment to the movement is the centre. At these circles the disc is substantially motionless. Hence they are known to the physicist as "nodes" or points of zero motion. Suppose Fig. 4 represents the condition at a resonance frequency where there is one circle only. When the portion within the circle is moving upwards, that outside is moving downwards, and vice versa. Thus the sound radiated from these two portions will at any instant be of opposite

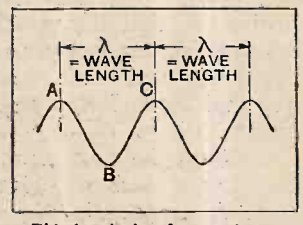


Fig. 4.—A simple waveform. With a frequency of 1,500 cycles per second the wave travels 1,500 times the distance AC every sound.

Velocity of Sound in Loud Speaker Diaphgrams.—sign, so that they neutralise each other to an extent. At higher frequencies there will be two, three, etc., circles. Considering the case of two or more circles, we are in a position to ascertain the average velocity of sound waves *in* the disc by simple measurement. Before indicating how this is done we shall digress to explain a simple point which it is essential to understand before calculating the velocity.

Fig. 4 shows a simple waveform. A and C are crests, whilst B is a trough. If we imagine the wave to travel to the right, it repeats its motion at intervals equal to the distance AC. This is known as the wavelength, and is designated by the Greek letter λ (lambda). Now the wave repeats itself every *cycle*, i.e., if there are 1,500 cycles per second, the wave repeats itself 1,500 times every second. Thus it travels 1,500 times the distance AC every second, so that its velocity (distance covered per second) is 1,500 AC. But 1,500 is the frequency (f) of the wave and AC is λ the wavelength, so that the velocity $v = \lambda f$.

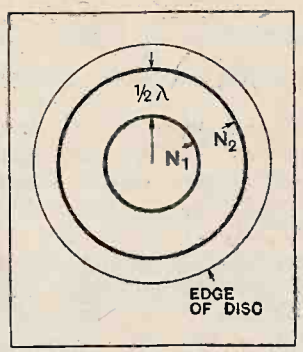


Fig. 5.—The inner two circles represent the nodal circles of the disc. The distance between them can be considered as half a wavelength. N_1 is a nodal circle 1.75 inches radius and N_2 3.25 inches radius.

Returning to the case of the disc, the nodal circles at a certain instant are shown roughly in Fig. 5. The distance between the two circles can be regarded as *half* a wavelength. Here, we assume, the velocity between the two circles is constant, which is not strictly accurate, so that we shall obtain the mean velocity between the circles.

We have now to ascertain the frequency at which the two circles occur. To those who have the necessary calibrating apparatus it is easy, but the reader may not be in this happy position. It is suggested, therefore, that the note should be matched against the pianoforte or violin. Care must be exercised not to mistake it for a harmonic. Having found the frequency, the velocity can be calculated from the formula $v = \lambda f$.

Take the following example for a disc 7 inches diameter 0.023 inch thick: Radii of circular nodes 1.75 and 3.25 inches respectively at a frequency of 900 cycles per second. The wavelength is twice $(3.25-1.75) = 3$ inches, so that the velocity is $900 \times 3 = 2{,}700$ inches per second or 225 feet per second. This is about $\frac{1}{5}$ the velocity of sound in air, which latter is actually between 1,100 and 1,200 feet per second according to the temperature.

To obtain the best results the disc should be fairly thin. Large discs will give circles at low frequencies. At certain frequencies the disc will execute vibrations about one or more of its diameters, i.e., the sand will lie on one or more diameters. Sometimes the sand figures will be a mixture of diameters and circles. In one mode which appears at a lower frequency than the first circle the centre will be almost stationary, whilst the outer edge moves violently, the sand being nowhere at rest except near the centre.

As a matter of interest aluminium, cardboard, wood and other materials can be tested and the velocity of sound in them obtained. Cardboard is not always successful, and difficulty may be experienced with wood due to the grain. However, this is for the experimenter to discover for himself. The velocity will be found to increase with the frequency and with the thickness of discs of the same radius and material.

Following on this the reader can try his luck with paper cones. In this case the experiments are not so easy. The well known "Kone" loud speaker is useful in this respect. Although sand will serve the purpose, better results are obtained with lycopodium powder. I should mention that a good deal of energy is required to make the sand or lycopodium jump on the diaphragm, especially at the higher audible frequencies. The surface of the paper should be fairly rough, and the sides of the cone not too steep or the powder will merely roll off.

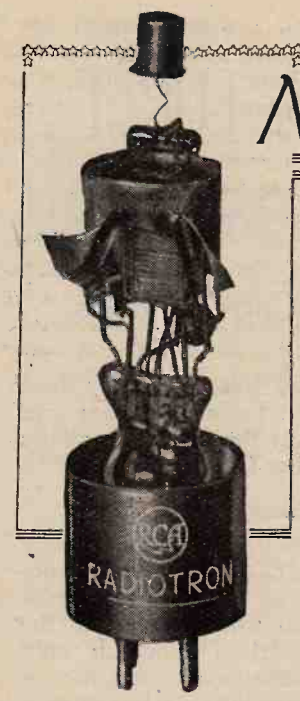
At 2,000 cycles the velocity near the outer edge of a "Kone" diaphragm is about 250 feet per second, i.e., about the same as in the steel disc discussed earlier in this article.

° ° ° °

GRAMOPHONE PICK-UPS AND LONG EXTENSION LEADS.

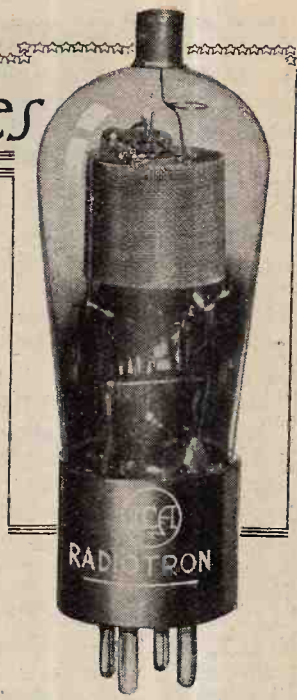
ONE of the greatest difficulties in the use of a gramophone pick-up is experienced by those who possess a large cabinet gramophone which is, more often than not, situated in a different part of the house to the wireless receiver. This is due to the fact that, in the interests of efficiency, the wireless set is placed in a position near to the aerial lead-in—which sometimes means that it is in an upstairs room—there being extension leads to various rooms for the use of the loud speaker. Long leads attached to the pick-up usually mean that high notes suffer, since the effect is the same as if a condenser had been deliberately placed across the pick-up. Sometimes the position is so desperate that the possibility of an entirely separate amplifier placed near the gramophone has to be considered.

This method of overcoming the trouble, however, is unnecessarily expensive, and it can be averted by the use of a low-impedance pick-up. Although this does not eliminate the self-capacity of the extension wires, it removes the evil effect of it, which is just as good, from our point of view. The inevitable fly in the ointment is that the voltage output from these devices is very much less than from the more conventional high-impedance pick-up. Even this disadvantage can be overcome, however, by using a properly designed step-up transformer at the point of entry to the receiver. The transformer core should be earthed and experiments should be made with the earthing of one of the terminals of its primary, in order to improve results, more especially if electrc light mains are in the vicinity of the extension wires. If the length of the extension wires is not too long, lead-covered wire is an advantage.



New American Valves

Notes on Three R.C.A. Radiotron Models.



ALTHOUGH they are not readily available in this country, it is thought that a description of certain of the latest American valves will be of interest to readers if only for the fact that they furnish a standard of comparison with the leading British types. The valves forming the subject of these notes are three new R.C.A. Radiotron models designed especially for districts where lack of accumulator charging facilities demands low filament consumption. In each case there is a 2-volt filament having a sufficiently small consumption to be supplied either from a small storage battery or a dry cell.

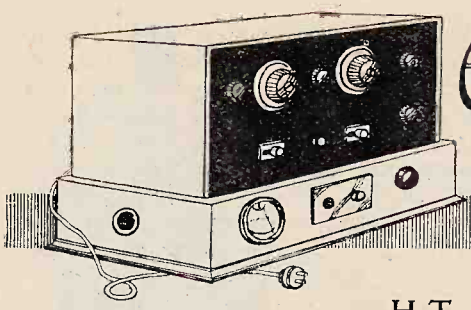
The general purpose member of this service consumes 0.06 amp. at 2.0 volts, and passes but 2.0 milliamperes of anode current when biased to $4\frac{1}{2}$ volts negative. The price paid for such extremely low current consumption is a reduced mutual conductance of the order of 0.7 m.a. per volt. The amplification factor is 8.8. Specifications as given by the makers for the other two valves are published in the Table.

Type.	Fil. Volts.	Fil. Amps.	Max. Plate Volts.	Grid Voltage.	Plate Current (mA.).	A.C. Resistance (Ohms).	Amplification Factor.	Mutual Conductance (Micromhos).	Undistorted Power Output (Milliwatts).	Approximate Interelectrode Capacities.		
										Grid to Plate.	Grid to Filament.	Plate to Filament.
Power Output....	2.0	0.15	135	22.5	8.0	4,000	3.5	875	170	6$\mu\mu$F.	3.5$\mu\mu$F.	2$\mu\mu$F.
Screen-grid	2.0	0.06	135	3.0	1.5	800,000	440	550	—	0.02$\mu\mu$F.	—	—

It will be seen that the mutual conductance is given in micromhos, which is undoubtedly the correct unit since conductance which is the reciprocal of resistance is expressed in mhos; 1,000 micromhos are equivalent to what is familiarly called in this country one m.a. per volt or a slope of one. It is refreshing to see the publication of valve capacities in the case of an output valve. We are inclined to forget the important influence they have on the functioning of each intervalve coupling. Every valve in a receiver (a screen-grid valve offends only in a minor degree) throws a load back into its grid circuit irrespective of any grid current which may be flowing such as in a leaky grid detector. The load is of two kinds, capacitative and resistive—the latter being positive (reverse reaction) if the anode load is chiefly capacitative and negative (normal reaction) if the anode load is inductive. These loads, both types of which are always present, are all produced by anode-grid capacity within the valve, and operate as a function of the effective amplification of the valve. With a pentode, for instance, the input load (capacity component) may profoundly modify the performance of a preceding L.F. transformer. When the same valve is used as a power grid detector the input load (resistive component) may seriously damp the tuned grid circuit to an extent that is far greater than the grid current loading. In band-pass filter circuits which are ganged, the replacement of a valve by another with a slightly different amplification factor will cause the grid-filament capacity to be changed and the ganging to be upset. Knowing the value of the static capacities the working loads can be estimated with reasonable accuracy, and it is hoped to see greater appreciation of this by our own valve manufacturers.

The general level of efficiency of these new American valves as shown by mutual conductance and residual capacity in the case of the S.G. valve, does not seem to be high.

British valve manufacturers have reason to be proud of their achievements when it is reflected that there has been available for over a year a battery-heated screen-grid valve with an anode-to-grid capacity four times less than that of one of the latest products of the States. We have just seen another battery-heated S.G. valve at the Olympia Exhibition whose residual capacity is some ten times less than 0.02 $\mu\mu$F. In the matter of 2-volt output valves of modest filament consumption, we can also hold our own as will be evident from an examination of *The Wireless World* "Valve Data Sheet."

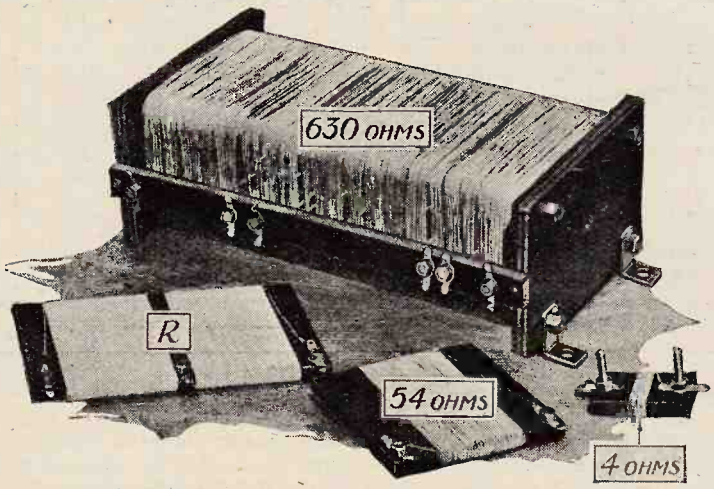


A D.C. BAND-PASS THREE

H.T., L.T., and Grid Bias from Direct-Current Mains.

IT cannot be denied that many multi-valve receiver circuits do not lend themselves particularly readily to D.C. mains operation. But the three-valve H.F.-det.-L.F. type of set is generally an exception, and so it can be taken that the "Band-Pass Three,"[1] which is, apart from its input filter, an inherently simple and straightforward example of this circuit arrangement, may be adapted for a direct-current supply without much difficulty.

As a basis for conversion it is suggested that the L.T. and H.T. feed system of the "All-D.C. Three"[2] should be adopted, as it is suitable for voltages between 200 and 250, and is intended for use on supplies with either positive or negative "earths." The accompanying diagram shows how the tuning system of the one receiver may be superimposed on the filament circuit of the other, and, to simplify matters, the main L.T. connections are drawn in heavy lines. It is inevitable that a circuit of this nature should appear to be involved; even without the extra wiring of the filter, apparent complications are introduced by the peculiar connections of valve filaments and bias resistances which are necessary when the valves are to be fed in the most economical possible manner, and when grid bias cells are to be entirely eliminated. It will probably be easier to appreciate the essential features of the present circuit if it is considered in conjunction with a simplified diagram of the "All-D.C. Three," which was published in the "Readers' Problems" section of *The Wireless World* of September 24th.



Specially constructed resistances for voltage regulation.

By making a suitable choice of valves, the total consumption of the set need not exceed some 60 watts, which is no more than that of a single electric lamp. The H.F. amplifier filament may be rated at 2 volts 0.15 amp., and the detector at 2 volts 0.1 amp.; these valves are connected in parallel, but are in series with the output valve, which, to suit the resistance values given, should be of the Marconi or Osram P.625 type.

A Combined Smoothing System.

It is unnecessary to repeat such information already given with regard to the "All-D.C. Three," which obviously applies equally to any set with the same feed circuit. Attention should be drawn, however, to the L.F. choke (L.F.C.) which assists in smoothing both H.T. and L.T. circuits. This component must have a low D.C. resistance and a reasonably high inductance, even when carrying the normal current of from 270 to 280 milliamperes. It must be inserted in the negative lead when the positive main is earthed, and not in the position shown. Chokes made to the published specification are now available commercially.

There is considerable latitude with regard to the actual construction of the various resistances, provided that one uses the gauge of wire recommended, which is capable of carrying the necessary current without excessive rise of temperature. It is wise, however, to make reasonable provision for free radiation of heat, and so the coils should be wound in such a way that a large part of their surface is exposed. No. 28 double-silk-covered Eureka wire, as specified, has a resistance of slightly over 3.9 ohms per yard, and, if the wire is wound on formers of irregular shape, some care should be taken to measure off the required lengths of wire for each resistor with fair accuracy, although minor discrepancies can be made good by adjustment of the 50-ohm rheostat provided for fine regulation.

No value has been allotted to the resistance R, as it may be omitted entirely if the mains voltage does not exceed 200. Its purpose is to absorb any surplus above that figure without disturbing the distribution of poten-

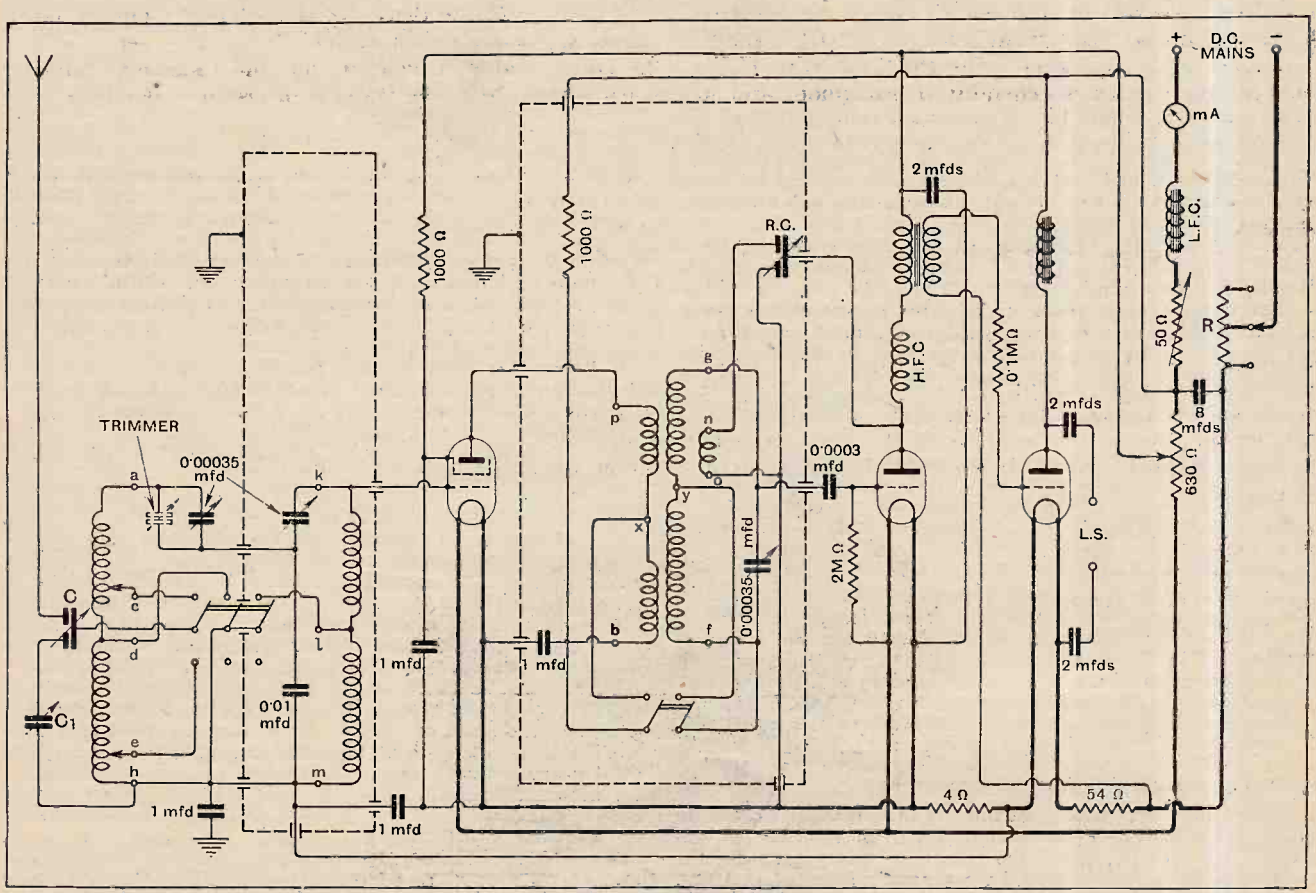
[1] *The Wireless World*, September 17th and 24th, 1930.
[2] *The Wireless World*, August 20th and 27th, 1930.

tials throughout the circuit. It should have a value of 160 ohms, with a centre tapping to which the negative input lead is joined when the mains voltage is between 220-230 volts; the whole resistance element is connected in circuit for supplies of between 240 and 250 volts.

It will be observed that the screening boxes are not in metallic connection with the mains, and that they are directly earthed. Alternatively, each box may be joined through a 1-mfd. condenser to the negative filament terminal of its associated valve; this is better from the point of view of safety, as no harm would be done by an accidental short-circuit between the mains and

control device, with a semi-variable balancing condenser, as described at length in *The Wireless World* of September 24th; this is certainly worth its slight extra cost, as provision for the best possible regulation of input H.F. voltage, without appreciable change of tuning, is highly desirable in any set with band-pass tuning.

Although unwilling to suggest further complications that are not strictly necessary, the writer may point out that it is always as well to provide complete isolation between D.C. mains and the aerial-earth system; to do this, primary windings must be added to the input filter coils. These primaries should have the same number of turns as were originally included between the medium-



Complete circuit diagram, with values of components. The coil terminal points are marked with reference lettering corresponding to that in the original diagrams of the "Band-Pass Three."

the metal work. In any case, the rotors of all three tuning condensers should be insulated from the screens, unless a special arrangement of fixed series isolating condensers (as in the original "All-D.C. Three") is adopted.

With regard to construction of the composite set under discussion, the builder is not restricted to any particular style, but it will probably be convenient in most cases to combine the features of its two prototypes—the layout of the "Band-Pass Three" for the receiver circuit components, and a plinth base for the mains equipment, which, as already stated, requires a certain amount of ventilation.

The circuit diagram shows the more elaborate volume

and long-wave tapped aerial connections and the earthed ends of the coils.

Anode and screening grid voltages can be arranged either as shown in the present circuit diagram, or exactly as in the "All-D.C. Three." Any desired pressure, up to a maximum of about 170 volts, can be obtained by making connection to an appropriate tapping point on the main 630-ohm resistance, which acts as an H.T. potentiometer, in addition to limiting the voltages applied to the valve filaments.

As a safety measure, it is almost essential that a pair of fuses and a double-pole switch should be fitted in the main feed leads; the switch should always be "opened" when making internal adjustments.

CORRESPONDENCE

The Editor does not hold himself responsible for the opinions of his correspondents.

Correspondence should be addressed to the Editor, "The Wireless World," Dorset House, Tudor Street, E.C.4, and must be accompanied by the writer's name and address.

POWER DETECTION.

Sir,—Mr. P. K. Turner, contending in your issue of October 8th that he was the first in this country to find that grid rectification, properly arranged, is superior to anode bend, alludes to our meeting in 1929, when Mr. Brereton and I had decided that the anode-bend detector was too imperfect for our needs, and were investigating the possible alternatives.

Mr. Turner arrived at an opportune moment. We had lately read, in the now defunct *Radio Broadcast*, the articles by Professor Terman on Grid Leak and Power Detection, and had ourselves begun to try them out in combination. I mention this because of a mild hint of accusation running through Mr. Turner's letter. He says, "if he remembers rightly," it was at that time my intention to use Kirke detection for the South Kensington set, and that a discussion arose because he stated his view that it was unnecessary. In proof that we had actually started our experiments in grid detection, I may remind Mr. Turner of a trifling discussion we had upon grid-leak values, when I mentioned that I had been using 100,000 ohms, and he replied that for commercial reasons he could not go below 250,000.

But if Mr. Turner found us in active pursuit of the power-grid detector, and not yet resigned to the diode, as he seems to have thought, we undoubtedly profited by his experience, and were quick to try some of the values he was kind enough to suggest. (Some of his "conditions for good-quality grid rectification" need not obtain for push-pull rectification, by the way.)

It is due to Mr. Turner to acknowledge his own claim to priority. It is due to ourselves, on the other hand, to point out that we never claimed anything at all!

London, S.W.3. R. P. G. DENMAN.

WIRELESS EXHIBITION, MANCHESTER.

Sir,—Having won the premier prize in the open competition for home-constructed radio sets, I cannot let the opportunity pass without acknowledging the help I have received from the pages of *The Wireless World*.

In making up the set, I endeavoured to embody the very latest ideas as expressed by several writers, which, together with a few of my own, won me a total of 97 points out of 100.

Liverpool. E. B. JONES.

SHIELDING AND H.F. RESISTANCE OF COILS.

Sir,—I have read with great interest the papers of Dr. Smith-Rose on the matter of "screening," or, as we term it, "shielding," and wish to correct the fallacy in this paper which is so general as to have almost been generally accepted as truth.

The error I refer to is his assumption that the shielding or screening of radio frequency inductance coils necessarily results in an increase in the coil resistance. That this is not fact can be determined very easily by the measurement of the resistance of a given coil in both the screened and the unscreened condition, and it will invariably be found that where a rational distribution of the space within the screen has been employed, the coil will show a lower resistance when screened than when unscreened.

In this assertion I assume, of course, that material of low conductivity, such as copper or aluminium, is used, and assume also that ratio of the coil diameter if cylindrical, or equivalent diameter if of any other cross section, bears a relation to the diameter, actual or equivalent, of the shielding can of the order of 1 over the square root of 3. I assume also that coil and the can are co-axial and that the coil ends are removed from the can ends by reasonable distance of the order of one-half the diameter of the coil.

Striking as it may seem under these conditions, coil resistance is reduced by the application of shielding.

One might assume from this fact that the actual operational characteristics of such coils as are used in radio circuits in the broadcast band might be improved by this process. That is not the fact, however, since the very condition which brings about the reduced resistance invariably brings about a more than proportional reduction in inductance so that the coil when shielded is not capable of as high a voltage step-up through resonance, nor is it capable of as high a degree of selectivity as when unshielded.

The phenomena, referred to above, which accounts for these changes lies in the distribution of the magnetic flux without the coil and within the shielding can, which, because of its closer approach to complete uniformity of distribution, markedly reduces the irregularities of the current distribution across its conductor. This is particularly true at the ends of the coil, and results in a more effective working of the conductor of the coil in that the current distribution is more nearly uniform, with a resultant reduction in resistance. On the other hand, this great uniformity in flux distribution is brought about through the constraining influence of the shielding can, which, however, increases the reluctance of the magnetic flux path about the coil through the mere limitation of the flux to the space within the can and thereby reduces the inductance.

I believe that this peculiar condition is probably no more definitely realised in England than it is here, and that the publication of these comments may be of some assistance to designing engineers in your country, as it has been in this.

New York City, LAWRENCE C. F. HORLE.
September 11th, 1930

ACCUMULATOR CAPACITY.

Sir,—I noticed at Olympia that the 1,000-hour rate of discharge has been adopted as the standard for calculating the capacity of slow-discharge accumulators, a rate which is almost always much slower than the average user's. I consider that 200 hours would be a much more suitable period of discharge; the "2,500 milliamp. hour" H.T. accumulator would then be discharged at about 8 to 10 milliamps., and the "25 amp. hour" L.T. accumulator at 80 to 100 milliamps. Both of these discharge currents are close to the loads applied in ordinary use, and from the point of view of round numbers a 200-hour rate has the advantage of being ten times as long as the 20-hour rate of ordinary accumulators. D. A. BELL.

Berkhamsted, Herts.

A GERMAN EXPERIMENT.

Sir,—Your Editorial under the above heading is very interesting, as are your views addressed to the B.B.C. that a gramophone performance by first-class musicians would be better appreciated by listeners than a flesh-and-blood performance by poorly qualified amateurs.

There is, however, no reason to restrict such performances to musicians, for gramophone records cover the whole field of entertainment.

In your issue dated September 3rd, p. 235, you printed a letter of mine on this self-same subject which would appear to have anticipated and may even have inspired both the Stuttgart experiment and your present Editorial, although I notice that you have omitted to refer to my views.

Your remarks concerning methods of transmission might at first glance appear to smack of sarcasm, although in fact quite to the point, elementary though they be, but the B.B.C. "mandarins" are analogous to present-day schoolboys, *i.e.*, ignorant of such elementary subjects as reading, writing and arithmetic, but possessed of a smattering of biology, psychology and the other "ologies" such as tends to make modern life so stupidly complicated and slipshod. HERBERT S. COPPOCK.

Didsbury.

Broadcast Brevities

By Our Special Correspondent.

A "Star" Programme—and Why.

Harry Lauder, Gracie Fields, Gertrude Lawrence, and Henry Ainley—all in one broadcast programme! The date: November 8th.

And now the explanation of this seeming prodigality with the programme money.

oooo

Gramophonic Announcements.

"Mechanical" vaudeville programmes are to be given on November 3rd and 8th, the complete performances—artistes and incidental music—being provided by gramophone records. Further, all the announcements will be made by the same means.

The mechanised artistes on November 3rd will include Maurice Chevalier, Sacha Guitry, and Yvonne Printemps.

oooo

Questions of "Radiofusion."

The Continentals seem much more enthusiastic over land-line relays than the majority of listeners in this country. At the Budapest Conference of the Union Internationale de Radiofusion, concluded last week, plans were discussed for developing the present sporadic policy into a vast scheme of international programme exchanges.

oooo

Fighting Electrical Interference.

That the Conference carries weight no one can doubt. Eighteen countries were represented, and fourteen postal administrations actually sent delegates. Some useful talk was bestowed on the menace of electrical interference with broadcast reception. So serious has this become that the Conference has appointed "competent committees to follow up the question."

oooo

The Tourist's Portable.

For the first time, I believe, in the history of these conferences, the delegates discussed the question of tourists' portables. It was high time.

Criminal tendencies are still imputed to the miserable creature who dares to tour Europe with a portable set. He passes furtively from one country to another, filling up a form here, dropping a *pourboire* there, until he begins to wonder whether it would have been less trouble to take the grand piano!

oooo

Wireless Passports?

The aim of the Radio Union is to bring about a standardisation of Customs charges for portables, or, better still, to institute a system of wireless passports whereby a single document would enable the tourist to take his set from country to country without further trouble.

Flaws in the plan may be discovered when the various countries begin to consider the portable as a possible weapon for espionage.

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Future Meetings.

The next meetings of the Union are to be held at Semmering (Austria) in February, and at Stresa (Italy) in June.

Armistice Day.

The Prince of Wales will broadcast the "Poppy Day" appeal on November 10th.

Armistice Day, in addition to the service from the Cenotaph, will include a special evening broadcast entitled "In Memoriam." The music of Elgar will form the background to a programme built up on the works of the War poets: Rupert Brooke, Julian Grenfell, Edward Shanks, and others.

At 10 o'clock British listeners will hear the "Last Post" and Reveillé played by the Belgian trumpeters at Menin Gate.

"EIAR, RADIO TORINO!"—Signora Maria Corsius, the new lady announcer at Turin, who was chosen from 180 candidates. The necessary qualifications included not only the possession of a pleasing voice, but the ability to read market reports in a clever and original manner!

Mr. Baldwin to Broadcast.

Mr. Stanley Baldwin's speech at Ashridge, the Bonar Law College, will be relayed to London Regional on November 8th. The ex-Prime Minister's speech follows the first dinner of the Ashridge Fellowship, and is entitled "Education in Citizenship."

oooo

Something for Everybody.

"The best 'Diversions' hour yet" is the description which a B.B.C. official applied in advance to next Friday's effort (October 31st). Although, of course, the exact details are not divulged, I can state that the ingredients include the full National Chorus, directed by Stanford Robinson; a glimpse in a broadcasting news room, showing how news is collected and prepared for the microphone; a relay of "Eldorado" from Daly's Theatre; and the début of a new quartette.

Friday's "Diversions" will be staged at the unusual hour of 8 p.m.

oooo

National Lectures Demand Alternatives.

I hope that the B.B.C. will provide a suitable alternative programme on November 28th, when Mr. Reginald McKenna delivers a National Lecture on "The Economics of Finance."

When the Lord Chief Justice gave the last National Lecture, on March 24th, there was no alternative, and the address, fascinating as it was to most intelligent people, lasted fifty minutes.

Please, B.B.C., provide an alternative to "The Economics of Finance," if only to spare the feelings of the financially embarrassed.

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"Michael Faraday."

Future National Lectures will be "Biology and Statecraft," on January 12th, 1931, by Sir Walter Morley Fletcher, and "Michael Faraday," on March 4th, by Sir William Bragg.

oooo

A Good Idea?

Presumably to put us in a receptive mood for what is to follow, the B.B.C. is experimenting with a quarter-hour interval of silence before the opening of the Wednesday evening symphony concerts. I confess that the innovation leaves me frigidly calculating that it will rob listeners of $5\frac{3}{4}$ hours of programme time between now and next May.

oooo

No.

Admittedly many musicians would be distressed if their evening with Bach or Beethoven were prefaced with fifteen minutes of comedy patter, but if such an item is on the bill between 7.45 and 7.55 they need not listen. Five minutes should be the maximum period of silence; this would give the music-lovers an ample chance to tune-in in good time without being outraged by the preceding items.

oooo

Big Receipts: Few Free Seats.

By the way, the rush for season tickets for these concerts has been mighty enough to suggest that financial success is already assured. The more optimistic prophets at Savoy Hill foretell a 200 per cent. increase on the total takings this winter as compared with last year.

The "free list" has been cut down by half.

oooo

To-day and To-morrow.

But the time is coming (as we saw at Olympia) when broadcast receivers will give so perfect a rendering of the original that no one will give two brass terminals for a seat at the Queen's Hall. Meanwhile the B.B.C. is wise to make hay while the cone rattles.

READERS' PROBLEMS.

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

An American Idea Elaborated

I understand that the latest American sets are often fitted with a so-called "Local-Distance" switch, which is connected in such a way that the H.F. input to the first valve may be reduced to a very considerable extent when receiving near-by transmissions, thus preventing overloading in the earlier stages. Although my own "local station" is more than 40 miles away, a device of this kind would be useful in my new 2-v-1 set, particularly when it is operated by unskilled members of the household, who do not appreciate the niceties of predetection volume control (which is already fitted, together with provision for regulating L.F. magnification).

Can you tell me how to arrange matters so that operation of the switch will not introduce any change of tuning? C. M. C.

Several American receivers include this device, but it seems that no particular precautions are taken against the introduction of some slight variation in input circuit tuning by operation of the "Local-Distance" switch. However, this undesirable change in tuning can be prevented by adopting the arrangement shown in Fig. 1, for which a double-pole, double-throw switch will be required.

When the switch blades are in the "up" position, the normal aerial connection is obtained. By throwing over the switch, aerial coupling is reduced; the actual degree of reduction will depend on the position of the tapping indicated by an arrow-head. This tapping point is best determined by trial and error, and, if your set is highly sensitive, it may be found best to include no more than one turn—or perhaps even a fraction of a turn—in the aerial-earth circuit.

The purpose of the condenser C (which may be of the semi-variable compression type, with a maximum capacity of about 0.0003 mfd.) is to prevent any change in tuning due to removal of a large proportion of the transferred aerial capacity. Adjustment of this condenser need only be made once, and should present no difficulty: with the switch in the "local" position, its setting should be varied until signals are at maximum strength, indicating that the input circuit is again accurately tuned.

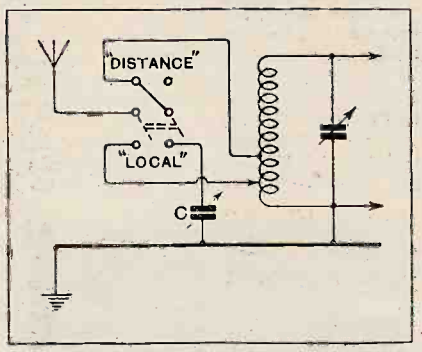

Fig. 1.—Reducing aerial input without variation of tuning: an especially useful arrangement where a band-pass filter is employed.

o o o o

Adding an Aerial.

My H.F.-det.-2L.F. four-valve transportable set has no provision for the connection of an external aerial, but, as I am now living in a locality where reception conditions are poor, I should like to make this addition, if it can be done easily.

My technical knowledge is extremely limited, so I should be grateful if you would describe the necessary alterations in the simplest possible way. T. L. G.

You should find no difficulty in connecting an aerial; it should be joined, through a fixed condenser of 0.0001 mfd., to the grid terminal of the first valve. This valve is easily identified, as it will almost certainly be of the screen-grid type, with an anode terminal mounted on its glass bulb. An earth lead must be connected to the negative accumulator terminal, or, if more convenient, to the metal screening.

If selectivity is found to be poor when the aerial is added, it would be worth while to substitute an aerial series condenser of 0.00005 mfd. for the value suggested above.

Filter Preceding Neutralised Triode.

My present receiver, which employs a neutralised three-electrode H.F. valve followed by an anode-bend detector and two L.F. stages, although rather out of date, is working so satisfactorily that I do not propose to change it until a mains electric supply becomes available next year. I should, however, like to improve its selectivity by adding an input band-pass filter, but cannot remember ever having seen this arrangement mentioned in connection with this system of H.F. amplification; do you think that the combination would be satisfactory? T. W. C.

There is no reason at all why an input filter should not be used before a neutralised triode valve, and, provided that reasonable precautions are taken to ensure satisfactory screening both between the coils of the filter and between these coils and the H.F. coupling, no trouble is to be anticipated. Where neutralised H.F. stages are used, it is even possible to use a double-tuned filter, with primary and balancing windings added to the first coil, as an intervalve coupling.

o o o o

"Constant Impedance" Volume Control.

In the "Readers' Problems" section of "The Wireless World" for October 1st, you publish a circuit diagram showing how a double potentiometer may be connected to a loud speaker as a volume control in such a way that the output circuit impedance is not greatly changed. Will you please tell me where a potentiometer of this special type may be obtained. S. P. D.

These "differential" potentiometers, with two resistance elements and a double slider, are obtainable from Claude Lyons, Ltd., 79, Old Hall Street, Liverpool.

o o o o

Voltage Regulation.

I understand that an anode bend detector, when supplied with anode current by an eliminator, should be fed through a potentiometer rather than through a series voltage-absorbing resistance. If this is correct, what should be the value of the potentiometer? J. B. F.

No great harm is done by using a series resistance of a comparatively low value, but when it becomes necessary to absorb a large surplus voltage, potentiometer control is infinitely better, as it helps to maintain good anode voltage regulation.

Without knowing the voltage to be applied across the potentiometer, we cannot definitely assign a value to it, but, in general, its resistance should be such that it passes about four or five times as much current as is likely to be consumed by the valve. Assuming an eliminator output of 200 volts, a 50,000-ohm potentiometer should be suitable.

A selection of queries of general interest is dealt with below.

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.

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(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.

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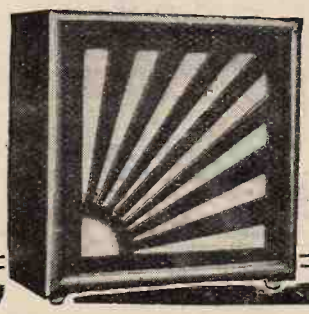

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RECEIVERS FOR SALE.

SCOTT SESSIONS and Co., Great Britain; 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

MARCONIPHONE 4-valve, with H.T. unit, trickle charger, moving coil speaker, all suitable 100 volts A.C., also accumulator; original price £54, what offers?—Box 7883, c/o *The Wireless World*. [1867

EVERYMAN Three, including valves, eliminator, trickle charger, accumulator, speaker; £10.—47, Meadowside Rd., Cheam, Surrey. [1865

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

NEW All-Wave Four Receiver, in mahogany cabinet, including gramophone pick-up, C.A.V. 140v. H.T. accumulators, Exide L.T. Magnavox speaker, extra 4 valves, everything as new, professionally built; cost over £26, bargain at £16/10.—Wine Stores, 43, High St., Penge, S.E. [1873

MUSIC Magnet Four, complete unopened carton, bought mains set, c.o.d. willingly; £8/10.—Box 7889, c/o *The Wireless World*. [1871

5-VALVE Lissen De Luxe Portable, perfect condition and selectivity; £8 for 20 guineas value.—Hughes, 99, Broomfield Av., Palmers Green, N.13. [1868

CLIMAX A.C. All Mains Receiver, as new, guaranteed; £7/10.—Barrington, 186, St. James' Rd., Croydon. [1855

McMICHAEL Super Range Portable Four, perfect condition; £15.—Morrey, 20, Howard Rd., Coulsdon, Surrey. [1854

ALL Guaranteed Condition, 7-day trial.—Brownie crystal set, 5/-; 3 crystal sets, mahogany cabinets, 4/-; 2 pairs Fellows phones, as new, 7/6; Browns A, 10/6; General Radio 3-valve set, splendid working order, complete with valves and speaker, £3; another, mahogany cabinet, complete, £3; H.M.V. cabinet gramophone, splendid condition, £2; send 1½d. stamp full list.—Electrocet Radio Co., Solihull, Birmingham. [1852

1931 Music Magnet Four Kit, valves, cabinet, as new, unassembled, 24in. double linen diaphragm speaker with 66K Blue Spot unit, 10-guinea Amplion A.R.19 speaker, in real lacquer, all perfect; offers.—Pomfret, Belle Vue, Ebbw Vale, Mon. [1882

MEGAVOX, the perfect and most powerful "Wireless World" Three (S.G. Det. Pen), exactly to specification, in handsome oak pedestal cabinet, complete with long- and medium-wave coils, valves, L.T. and H.T. accumulators or D.C. eliminator; £12/10; Amplion "Lion" cabinet speaker, all as new; demonstration with pleasure.—Singleton, Summerlands, Yeovil. [1876

3-VALVE All-wave Receivers, £3/17/6 complete; cabinet speakers, 20/-; all worth double, guaranteed.—Simmons Radio, 9, Ilfracombe Avenue, Southend-on-Sea. [1874

EVERYMAN Four, built by leading manufacturers, solid oak cabinet, in perfect condition, Varley anode resistance, Rich Bundy choke, filter, output, circuit, complete; £7.—10, Audley Gardens, Seven Kings. [1934

AMPLION 4-valve 2S.G. Portable, in use 3 weeks, perfect condition; £17/10.—Box 7898, c/o *The Wireless World*. [1936

ORMOND Portable, 5-valve, new; £10, or offer.—Ward, 9, Jellicoe Av., Lincoln. [1941

KILOMAG Four, all-mains, 5-compartment metal cabinet, including eliminator, 2 A.C.S.G., A.C.H.L., P.650 valves, J.B. condensers, Varley transformer, best components throughout, splendid range, supply voltage 210-220-230 A.C., new, £16, components alone worth more; new Brown Vee unit speaker, with ornamental baffle, 25/-.—Shephard, Highclere, Highfield Rd., Blackheath, Birmingham. [1932

PHILLIPS 2515, 2 valves, all electric, 230v., A.C., 50 cycles, 6 weeks' use, seal intact, guaranteed; £9.—Gore, 79, Foley St., Hereford. [1931

McMICHAEL Super-range Portable Four, very little used, perfect condition; £17, or near offer.—Addey, "Ramzon," Cuckoo Hill Rd., Pinner. [1929

FAMOUS American Grebe Syncrophase 5, complete with valves, accumulator, and 200v. 60ma. H.T. eliminator; a real bargain, £18.—'Phone : Streatham 2454, Mack, 58, Thornton Av., Streatham Hill. [1928

OSRAM Magnet 3, loud-speaker and D.C. H.T. Ekco unit; £8.—Ford, 122, Chancery Lane. [1927

EVERYMAN Four, complete with Standard wet battery (140v.), in cabinet and Marconi cone speaker; lot £12.—Marks. 'Phone : Padd. 9712 (after 7 p.m.). [1926

Receivers for Sale.—Contd.

£3/10.—5-valve Transportable, complete, less valves, fitted turntable; snip, £3/10!—Frost, 132, St. John St., E.C.1. [1925

EVERYMAN Four; £8, bargain; demonstration evenings.—Olds, 102, Gaisford St., Kentish Town. [1909

5-VALVE Portable, receives Continentals, complete; £5.-2, Dollis Hill Av., Cricklewood. [1908

EVERYMAN Four, powerful and high quality, perfect, valves, coils; £6; or nearest.—27, Sneath Av., Golders Green, N.W.11. [1906

NEW 3-valve Receiver, good components and cabinet; £3; "W.W." deposit system.—R. Phillips, 48, Somerset Rd., Teddington, Middlesex. [1905

3-VALVE S.G. Cossor Melody Maker, H.T. eliminator, large Brown horn loud-speaker, complete; £7.—Battersby, 45, Stanley Park Rd., Carshalton, Surrey. [1893

AT Third Cost Price.—Burne-Jones special built Receiver, 2 R.I.R.C.C. stages, R.I. push-pull output, P625A, P625, P.M.5X valves, wired for gramophone pick-up, exceptional tone and range (£12/10), with Ecko 100m.a. 200-250v. D.C. Eliminator; £15.—Tetley, 9, Prince Wales Terr., London, W.8. [1836

PHILLIPS' 2-valve Amplifier, cost 45/-, 16/6; Celestion balanced armature unit, 12/6; Marconi H.T. unit, D.C., 18/6; c.o.d.—4, Brecon Rd., Handsworth, Birmingham. [1943

ACCUMULATORS—BATTERIES.

WET Battery Replacements, new process sacs, approximately 30,000 m.a.; 2/6 per dozen; particulars free.—Scottish Batteries, Braeside, Uphall Station. [1728

GUARANTEED H.T. Batteries Direct from Factory to You.—The Constant H.T. battery at factory prices, 40% less than other well known batteries: 66 volt battery, 4/9; 99 volt battery, 6/9; 108 volt battery, 7/6; 120 volt battery, 8/9; each battery has a guaranteed life of 250 hours at a discharge of 10 m.amp; postage 1/6.—The Constant Battery Co., 80, Marchmont St., W.C.1. [1820

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DON'T Buy Dry Batteries, join our service; we keep you continuously supplied with fully charged C.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 B2, post free.—Radio Service (London), Ltd., 105, Torriano Av., Camden Rd., N.W.5. 'Phone: North 0623 (3 lines). [1466

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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 HT., 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

Chargers and Eliminators.—Contd.

CROMPTON Rotary Convertor, 200-220v. D.C. input to give 50 cycles R.C. output, with starter, frequency meter 50 cycles, voltmeter 0-250, and Zenith D.W. transformer; £12 all; loco.—"Rhapsody-Twin," 22, Bunhill Row, E.C.1. [1886

GILJAY 200-50 D.C. Charger, output 15 volts, 5 amps.; £3; guaranteed.—Harris, 67, Redlands Rd., Penarth. [1858

SALE or Exchange.—210v. Davenset station charger; £18; would entertain part exchange for garage type or 6a Tungar.—Norton and Shapley, Lucius St., Torquay. [1858

EKCO 1930 A.C. Eliminator, type 3F20, 200-250v. input, output 150v. 60v. and S.G. tapping; £3/3.—Bickerton, 21, Russell Gardens, Golders Green. [1856

ELIMINATOR Godwinex, D.C., 4 tappings, condition and performance as new; 25/-.—Thomas, 75 St. Mary's Terrace, Bradford. [1857

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 C32/0, 20/-.

SAVAGE'S "Wireless World" Four Equipment, mains teransformer, 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

RADIELLE Model R.K. (200-250v. A.C.), output 400 volt 80 m.a., 2 variable and 1 S. grid tappings; cost £15, sell £5; brand new.—Priestley, 8, Grosvenor Gardens, Muswell Hill, London, N.10. [1922

BRYCE'S.—"Wireless World" Four Mains transformers, A.B.4; 26/6; guaranteed; write for transformer lists.—Bryce's, 54, Dawson St., Bury, Lancs. [1899

REGENTONE W5 H.T. Eliminator, L.T. trickle charger, 230-250 A.C. mains; £4/15, listed £5/17/6.—"Redcot," Arthur's Hill, Shanklin, I.O.W. [1920

MAINS Transformers and Chokes Made to Specification in 24 hours.—Challis, 22, Park Rd., Rugby. [1919

CABINETS.

CABINETS to Your Own Requirements; quotations by return.—Hammonds, 1, Stratford St., Nuneaton. [1234

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

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

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

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DIGBY'S Cabinets.—Write for new 16-page art catalogue.—F. Digby, 9, The Oval, Hackney Rd., E.2. 'Phone: Bishopsgate 6458. [0126

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

Cabinets.—Contd.

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. [1970

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 Four Coils, 25/- per set; Band Pass Three coils, 37/6 per set as specified; c.o.d. or deposit.—Smith, 3, Park Parade, Harlesden, N.W.10. [1877

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.—All 'W.W." coils; D.C. Three choke, resistances; write for list; see under Miscellaneous. [1913

FERRANTI A.F.5C., £1/4; A.F.5C.C., 25/-; O.P.M.3C, 20/-.—Gilbert, 54, Hazelbourne Rd., S.W.12. [1924

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

DYNAMOS, ETC.

M-L Motor Generator, 200v. A.C. output, 450v. 120 mA., and 6v. 8 amps., complete with H.T. and L.T. smoothing, practically new; cost £32, accept £10. —11, Lythalls Lane, Coventry. [1889

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

LISSEN 30/- Pick-up, 16/-, perfect; volume control, 2/6; megostat I.M., 3/6.—Briggs, Carlton Rd., Shipley. [1900

PICTURE RECEIVER APPARATUS.

TELEVISION Scanning Discs, special apparatus used by P. D. Walters, Esq., for receiving American transmissions.—Supplied by John Salter, Featherstone Buildings, High Holborn, W.C. [1706

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

TWO Osram S.G.610, one H.L.610, one H.L.210, all absolutely unused; one P.625, one H.210, used test only; 45/- the lot; three H.612, one H.610, one B.4, all useful, thrown in.—10, Audley Gardens, Seven Kings. [1933

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 23. [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

Loud-Speakers.—Contd.

GENUINE Blue Spot 66a Units; 8/6 each.—Dismore, 80, Whitegate Rd., Southend. [1940

AMPLION Lion Speaker L18, power chassis; £3.—Glover, "Elmdene," East End Rd., East Finchley, N.2. [1916

SPEAKERS, 18×18×6 polished oak, 17in. floating cone, sunset fret, gauze, Tritron unit, splendid tone; 22/6; other units fitted.—Parke Radiograms, 79g, Turnpike Lane, N.8. [1907

AMPLION Cabinet Loud-speaker, 32/6; Hegra chassis, 40/-; latest types, nearly new.—22, Porchester Sq., W 2. [1903

EPOCH Moving Coil 6 volt Pot., complete in heavy oak cabinet; £4/10.—Pinchbeck Brendon, Sandy Lane, Cheam. [1898

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

MET-VICK 200-240 Rectifying Transformer, 10/6; Hydra 2 mfd., 500v. D.C., 1/-; Igranic 3138 soldering irons, 10/-; 4in. grindstone, 2/6; Millers Falls braces, 3/6; hacksaws, 9d.; steel squares, 2/-; Ferranti trickle chargers, 17/6; record vices, 2/6; Isenthal Mercury switch, T.B., 2 amps., 1/-; Varley H.F. chokes, 3/-; Ferranti No. 21 meter, 15/-; carpenters braces, 3/-, etc.; callers only.—"Rhapsody-Twin," 22, Bunhill Row, E.C.1. Also Converter, see separate heading. [1887

BARGAIN.—Brown's horn speaker, perfect condition, 12/9, cost 30/-; Exide hydrometer, 2/-, cost 4/6; 13½ yards stout flexible electric wire, 2/4, post free.—E. Hawthorn, "Woodville," Llandrindod. [1850

AIR Force 2-valve Transmitters, Mark II, contains transformer, choke, high voltage condensers, ammeter, multi cables, and many other useful parts, made by G.E.C., new and unused, complete in carrying case, 10/-; carriage extra.—Modern Radio Supplies, 37, Lisle St., W.C.2. [1851

BROWN'S A Phones, 10/6; 2 pairs Fellows, 7/6; Climax L.F. choke, 2/6; Titian coil, 5/-; Lotus L.F. and H.T. eliminator, relay, 10/-; R.I. S.L. super transformer, 10/-; 2 Westinghouse G.B. rectifiers, not used, 10/-; send 1½d. stamp for full list; all guaranteed.—Electrocet Radio Co., Solihull, Birmingham. [1853

G.E.C. Universal A.C. D.C. Gramophone Motor, £2; Silver Marshall 440 3-stage intermediate frequency amplifier and detector unit, 30/-; 2 Silver Marshall 0.0003 condensers, 2/6 each; P625A, 5/-.—Box 7864, c/o *The Wireless World*. [1863

MILLIAMMETERS, 0-5, panel mounting moving coil, shunt to extend range supplied if required; 10/6.—Sherwin, 62, High St. North, East Ham, E.6. [1864

AMATEUR'S Surplus.—Burndept Screened 4, £6; Senior 5-watt R.K. equipment, £10; 3-valve shortwave, £3/10; M-L convertor, 6v.-120v., £6; convertor, 6v.-240v., £8, all in perfect condition.—Box 7884, c/o *The Wireless World*. [1866

POWER Transformers.—Igranic B208A.T.A., 25/-; Radielle W.W.S., 20/-; Ferranti O.P.1, 10/-; Ferranti P7, 10/-; Westinghouse rectified, R4-2-2, 10/-; Radielle L.F. choke, 5/-; Ormond ditto, 6/-; 3 R.I.-Varley H.F. chokes, 2/6 each; Igranic potential divider, 4/-; Sifam mA. meter (2 mA.), 12/6; Lewcos B.A.C.5, B.A.C.20, 3/6 each; 2 T.C.C. 8 mfd. condensers, 800v, 7/6 each; P625, 6/-; P625A, 5/-; D.U.2, 5/-; 2 A.C./S (Cosmos cap), 7/6 each; A.C./H.L. (ditto), 5/6; 2 Utility D.P.D.T. switches, 2/- each.—Box 7890, c/o *The Wireless World*. [1872

EPOCH 66 6-volt ½ Amp., Ferranti O.P.M.I (C); £4, f.o.r.—65, Killinghall Rd., Bradford. [1875

Components, Etc., for Sale.—Contd.

DUBILIER Toroids, with bases, medium- and long-wave, Pye 6-pole switch, 5/- each; wanted, 66P. unit.—195, Castle Rd., Bedford. [1878

AMATEUR'S Surplus, slightly used, guaranteed perfect; stamped envelope for list.—Johns, Angmering, Rye, Sussex. [1879

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

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

GREAT Radio Sale.—2 valve transmitting sets, new and perfect, 15/-; Morse transmitting sets, new and perfect, 12/6; 1in. spark coils, complete, 6/9; super sensitive microphones, 2/6; microphone transformers, 2/6; television motors, electric, any voltage, D.C., 10/- each; ¼h.p. motors, 110v. D.C., 25/-; 50-75V-4A charging dynamos, 35/-; 20v. 6a., 40/-; 100v. 10a., slow speed, compound, £7; portable telephones, 17/6; earphones, 1/3; telephone H.T. generators, 6/6; Morse tapping keys, 4/-; heavy brass buzzer, 3/-; 1M.F. Mansbridge condensers, 1/3; hand telephones, 5/-; shunt regulators to carry 10 amps., 10/-; other sizes cheaper; 1,000 ohm chokes, 1/-; Ford ignition coils, 4/-; ¼h.p. 220v. motors, 35/-; Mark III Star crystal sets, slightly incomplete, 12/6; D III buzzers, platinum contacts, 5/-; Dewar switches, 1/-; 12v. car dynamos, 25/-; 6v. or 12v. car starter motors, 10/-; new L.F. transformers, 5/6; cash with order or c.o.d.; all goods guaranteed; all letters answered; immediate delivery; full descriptive list now ready. —Galpin, 1, Queen's Rd., Peckham, London, S.E.15. [1942

ULTRA Type F, 35/-: 100v. Exide, 22/6; Oldham H.T. charger, 37/6; Philips A.V.5A transformer, 18/6.—Box 7899, c/o *The Wireless World*. [1937

PYE 926 Differential Condenser, 3/-; pair Ferranti push-pull transformers, 30/-; set 3 Ideal condensers, 0.0005, 21/-.—"Whyncroft," Market Av., Chichester. [1911

EKCO to T60 D.E. Eliminator, £3/15; Epoch 99 M.C. speaker, D.C., £3/10; parts for Orgola Senior kit, J.B. condensers, £2/10; kit of Colvern coils, C.T.T.A.D., £2/5; screens, panel, 2 Climax H.F. chokes, Mullard R.C.C. unit, Varley anti-mobo, £2 to £5/10 the lot.—J. W. Caygill, 23, Alwinton Ter., Gosforth, Newcastle-on-Tyne. [1917

DAVENSET Transformer, output 4v. 5 amp., 6/-; Epoch trickle charger, 200-220v. 50 cycles, output 1 amp. at 2, 4 or 6 volts, 36/-; Dubilier grid leaks, 1/- each; P.X.4, as new, 13/-; smoothing condensers; stamp reply.—27, Miles Hill Av., Leeds. [1918

WESTINGHOUSE Rectifier, H.T.1; Ferranti mains transformer for same, E.M.1; 240v., A.C.; Philips transformer, 4v., output 240v., A.C. mains; 1 Hydra power pack condenser; 3 Hydra condensers, 8 mfd., 1,000v., D.C.; 2 Hydra condensers, 4 mfd., 1,000 v., D.C.; 7 Hydra condensers, 2 mfd., 500v., A.C.; 1 Hydra condenser, 4 mfd., 500v., A.C.; 1 Hydra condenser, 2 mfd., 500v., D.C.; 4 Sensitite condensers, 4 mfd., 750v., D.C.; 3 Sensitite condensers, 2 mfd., 500v., D.C.; 2 Pye L.F. chokes, 32H; 2 Pye L.F. chokes, 20H; 2 Webson L.F. chokes; 4 Croix L.F. chokes, M5; 4 Croix mains transformers, W.W.2; 2 Croix mains transformers, T.P.2 and T.P.6; 1 Heayberd mains transformer, 400 and 7.5v. output, 200-240 A.C.; Ferranti A.F.5C, O.P.1C, O.P.C.; Ferranti m.a. 0-50; 1 Farrand inductor chassis; 1 Webson M.C. speaker, 6v. field coil; 1 A.C. Pen., 1 M.H.L4, 1 M.H.4, 1 M.S.4, 2 L.S.6A.s; all parts for "Wireless World" A.C. kit set; best offers secure any of the above.—Write 349, Hasland Rd., Hasland, Chesterfield. [1930

AMATEUR'S Wireless Stock for Sale, Brookmans, Clarion Three; write list components, valves.—C. Beard, 85, Thackeray Av., Tottenham. [1897

MAZDA A.C. S.G., 12/6; Met-Vick A.C. P1, 5/6; Ormond speaker unit, 6/-; Ormond 0.00025 friction drive, 7/6; Met-Vick combined eliminator transformer, 95-115v., 17/6.—4, Warren Rd., Purley. [1895

LOOK! Astounding offer!—Complete set super-het. parts, comprising 2 frame aerials, oscillator coil, 3 Burndept high-frequency transformers, 4 P.M.3, etc.; £3.—A. Barham, The Cottage, Stoke Heath, Bromsgrove. [1896

SEVERAL Smoothing Chokes for Sale, 20 henries, 25 m.a.s, 8/-; also a few in larger sizes; all guaranteed and as new.—State requirements to Radio, 47, Bath Rd., Kettering. [1901

SALE.—Pair of 1930 Binowave coils, 35/-; 3 Dubilier Toroids, long, medium and short waves, 6/6 each; 1 long and 1 medium wave Megavox aerial coils, 17/6 for both; 1 500,000 ohm potentiometer, 6/6; sets of parts for 1930 Kilo-Mag Four, including valves and A.F.6 transformer, £15.—White, Gilstead, Calveley, Cheshire. [1892

Components, Etc., For Sale.—Contd.

REGENTONE Eliminator, 200-250 A.C., model W2A, three H.T. tappings, output 180 volts, 4 volts for heating A.C. valves, £5, cost £7/15; pair Polar 0.00035 condensers, drum dials, 8/6 each; Ferranti A.F.6, 20/-; all new condition.—115, Southwood Rd., S.E.9. [1891

SECOND-HAND Goods, guaranteed; any c.o.d. or "Wireless World" deposit system.—L.S.5, 10/6; Mazda P.P.3 425, 12/6; Cossor 610 R.C., 4/-; 610 H.F., 4/-; P.M.256, 6/-; P.M.5b, 3/6.

VARLEY Pick-up, with Varley universal arm, 32/6; Harlie wave trap, 4/6; Watmel tuner, 7/6; Marconi universal output transformer, 10/6; Ferranti O.P.3c, 12/6; R.I. Hypernu, 13/-; Cossor transformers, 8/8; C.A.V. jellacid accumulator, 2 and 7, perfect, 9/-.

HYDRA Condensers, 4 mfd., 700v. working, 6/6; ditto, 500v. working, 5/-; Hydra 2 mfd., 700v. working, 3/6; ditto, 1 mfd., 2/9; ditto, 1,000v. working, 4/-; two only unused T.C.C., 4 mfd., 800v. working, 10/- each; ditto, one S.H., 8/-.

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MULLARD Permacore L.F. Transformers, 10/6; Cossor, 9/6; Ferranti push-pull A.F.3C, can be used as ordinary, 16/6; Ferranti O.P.4C 25-1, 12/6; all goods sent, satisfaction, or cash refunded.

DUBILIER R.C.C. Units, 3/6; Polar Ideal slow motion condensers, 0.0005, 7/-, or pair 13/-; Hydra condensers, fixed, 2 mfd., 650v. test, 2/2; Hydra 4 mfd., 500v. test, 3/3; Hydra 4 mfd., 375v. working (500v. A.C. test), 4/6; Hydra 0.01, 6d.

GRAHAM Farish Resistances, guaranteed carry 10 m.a., in values, 2, 3, 4, 5, 100, 150, 250, 350, 400, 500, thousand ohms; prices 1/6 each up to 150,000 and 1/- each others; all posted per return.—G. A. Ryall, 182, Kennington Rd., London, S.E.11. [1890

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Miscellaneous.—Contd.

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

E. C. WIRELESS.—Are you considering "The Wireless World" Four? Please write us.—Premier Place, High St., Putney, S.W.15. [1914

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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. [000]

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

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

GUARANTEED Repairs by Experts.—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

YOUR Transformer Repaired or Rewound and Returned Promptly; 3/6 post free.—James, 190, Bitterne Rd., Southampton. [1921

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

WANTED.

WANTED, M-L D.C. to A.C. rotary transformer.—Harris, 67, Redlands Rd., Penarth. [1860

PANATROPES, cinema models, A.C. or D.C.—Box 7851, c/o *The Wireless World*. [1848

WANTED, good second-hand cheap converter, 230 D.C. to A.C. 50-60 cycles, maximum input watts 100, input volts 105-125.—Box 7850, c/o *The Wireless World*. [1849

ALL Types Wireless Goods in Part Exchange for New; high allowance made.—Pepper, Wake Green Rd., Birmingham. [1910

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MARCONI Valves, S625, D.E.5B, L610 and P625A, various fixed and variable resistances, 2 Colvern H.F. chokes, Cyldon Bebe, 0.0003, all as new; exchange for Cossor A.C. valves or sell half price.—22, Darby Crescent, Sunbury, Middlesex. [1923

WANTED, all mains set in exchange for 600 c.c. motor cycle combination, 1928.—Weller, 43, Divisional Train, Lambhay Hill, Plymouth. [1915

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PARTNERSHIP Offered in Established Wireless School to Single Young Man, capital £200 minimum; must be proficient to instruct students for Postmaster's second-class wireless certificate.—Write Box 7901, c/o *The Wireless World*. [1939

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YOUTHS Required, wiring and assembly, previous experience preferred but not essential.—Eastern Wireless Co., Ltd., 87a, Collingwood Rd., Sutton, Surrey. [1847

Situations Vacant.—Contd.

MANAGER Required for Old Well Established Wireless Manufacturers' Concern, must have had some years' experience in the trade, with knowledge of latest methods of production, tools, etc., and real organisation ability; only men with the highest references and abilities need apply.—State salary, experience, etc., to Box 7888, c/o *The Wireless World*. [1870

TEST Assistants Required, with previous factory experience essential.—Write, stating age, salary, and experience, to Box 7865, c/o *The Wireless World*. [1862

TEST Assistants Required, previous factory experience essential.—Write, stating age, experience, and salary required, to Box 7900, c/o *The Wireless World*. [1938

SITUATIONS WANTED.

ADVERTISER (29), P.M.G. certificate, 12 years' operating experience, good technical knowledge modern radio, seeks position broadcast receiver development, design or maintenance; London preferred. —Box 7897, c/o *The Wireless World*. [1935

ADVERTISER (26), diploma radio, requires situation South London, design, repairs, etc., experienced servicing; references.—Slater, 8, Whittam Av., Marton, Blackpool. [1902

BOOKS, INSTRUCTION, ETC.

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

1928 and 1929 "Wireless World" for sale; 7/6 per year.—Lejeune, 57, Great Portland St. [1861

"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

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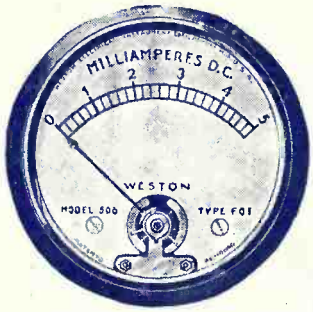

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,,	E	0 ,, 500,000 ,,	2·5 ,,	6/3	,,
,,	F	0 ,, 2,000 ,,	37·5 ,,	6/3	,,
,,	G	0 ,, 10,000 ,,	16·5 ,,	6/3	,,
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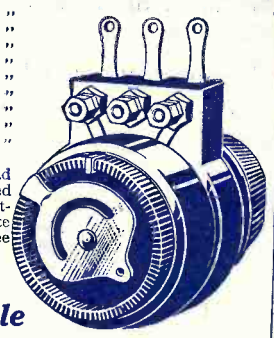

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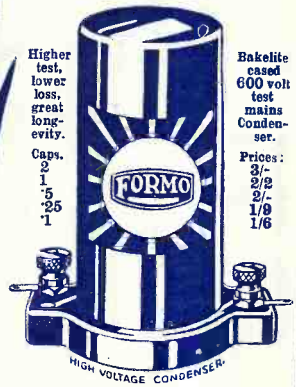

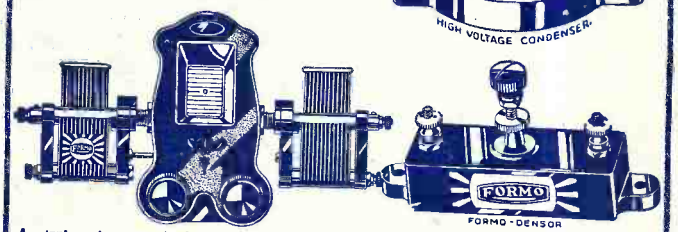

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